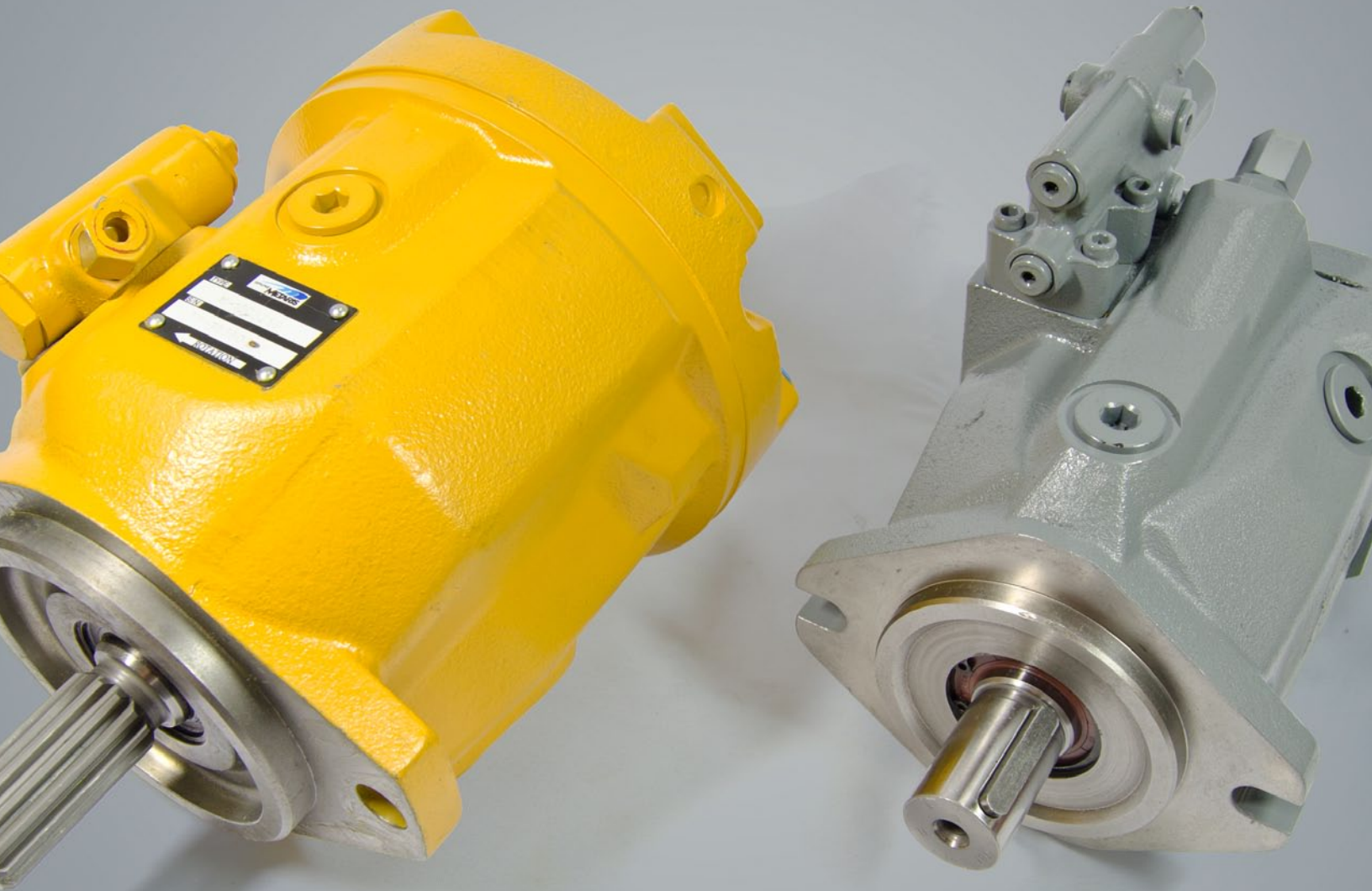


Genuine Metaris MA10V0/VSO Technical Catalog

Variable Displacement Piston Pump - A10V Series 31 & 52



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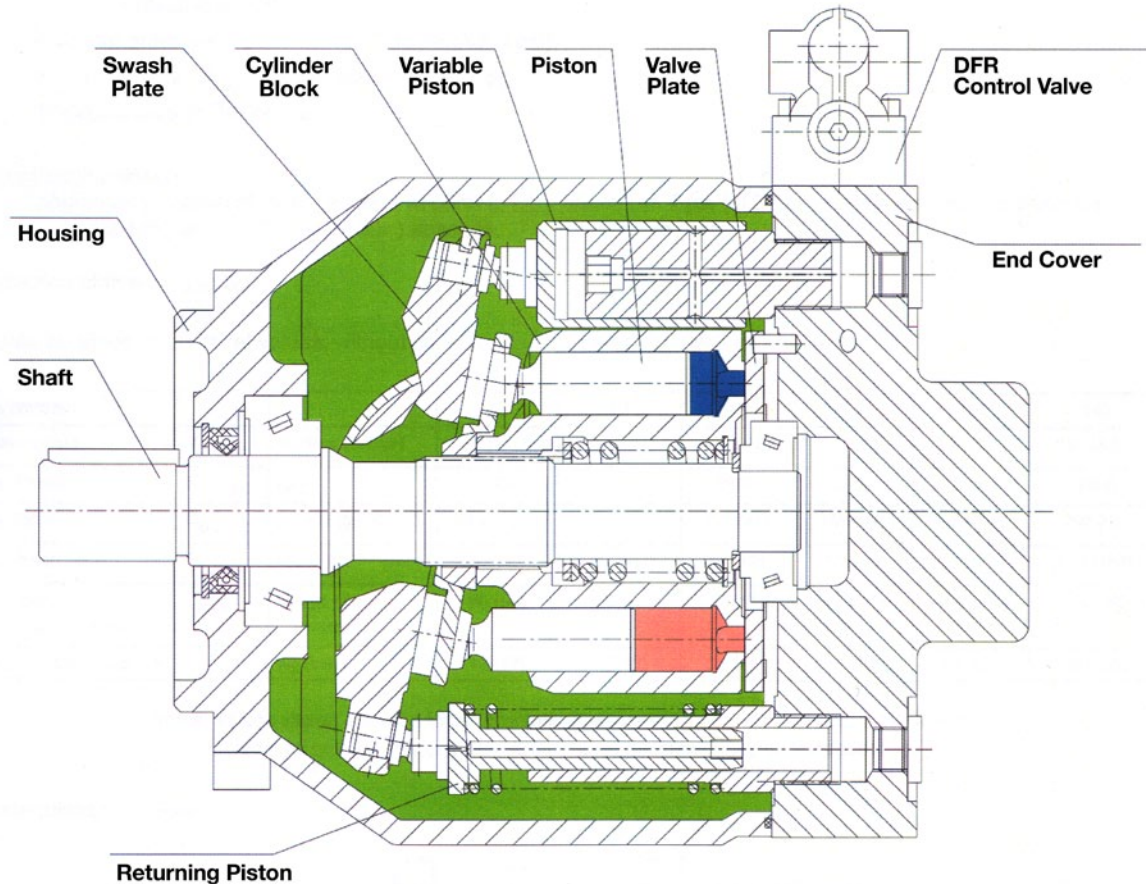
Cross-referenced parts from the Original Equipment Manufacturer "OEM" are listed for information purposes only. Trademarks identifying these parts for cross-reference are those of each OEM and are the property of their owners and are not used, or authorized for use, by Hydralex Global or its affiliates. Hydralex Global is not affiliated with the Original Equipment Manufacturer "OEM" or licensed or authorized to produce unit or parts for the OEM. All units and parts offered in this catalog are manufactured by Hydralex Global and not by the OEM.

MA10VO/VSO Series 31

Features

Axial piston pump MA10VO is a swashplate design and is used in open loop circuits. Flow is proportional to drive speed and displacement. By adjusting the position of the swashplate, it is possible to smoothly vary the output flow of the pump.

- Flange connections available in SAE or Metric
- Two case drain ports
- Operating pressure of 4000 psi (280 bar)
- Good suction characteristics
- Low noise level
- High power/weight ratio
- Long service life
- Quick response times
- Axial and radial loading of drive shaft is possible
- Wide range of controls
- Through-drive options available for multi-circuit systems



MA10VO/VSO Series 31

Technical Data

- Input operating pressure range
Absolute pressure at port S (A)
P_{abs} min.....11.6 psi (0.8 bar)
P_{abs} max.....435 psi (30 bar)
- Output operating pressure range
Pressure at port B
Nominal pressure P_N.....4000 psi (280 bar)
Peak pressure P_{max}.....5070 psi (350 bar)
- Case drain pressure
Maximum pressure of leakage fluid (at ports L, L1 is 7 psi (0.5 bar) higher than input pressure at port S, but not higher than 30 psi (2 bar) absolute.
- Direction of flow
("S" inlet port to "B" pressure port)
- Table of values (theoretical values, without considering η_{mh} and η_v ; values rounded)

Size		18	28	45	71	100	140
Displacement	V _{gmax} cm ³ /rev (in ³ /rev)	18 (1.10)	28 (1.71)	45 (2.75)	71 (4.33)	100 (6.10)	140 (8.54)
Max. Speed	N _{omax} rpm	3300	3000	2600	2200	2000	1800
Max. Flow	O _{omax} L/min (gpm)	59.4 (15.7)	84 (22)	117 (31)	156 (41)	200 (53)	252 (67)
Max. Power $\Delta p = 4000$ psi (280 bar)	P _{omax} kW (HP)	28 (36.6)	39 (51)	55 (72)	73 (96)	93 (124)	118 (156)
Max. Torque $\Delta p = 4000$ psi (280 bar)	T _{max} Nm (ft-lb)	80 (58)	125 (91)	200 (146)	316 (230)	445 (324)	623 (453)
Weight (w/o fluid)	Kg (lbs)	12 (27)	15 (33)	21 (46)	33 (73)	45 (99)	60 (132)

Note: Values shown are valid for an absolute pressure of 1 bar at suction port. If the flow is reduced or if the inlet pressure is increased, the speed may be increased.

6. Determination of size

$$\text{Flow } q_v = \frac{V_g \cdot n \cdot \eta_v}{231} \quad [\text{gpm}] \quad \left(q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad [\text{L/min}] \right)$$

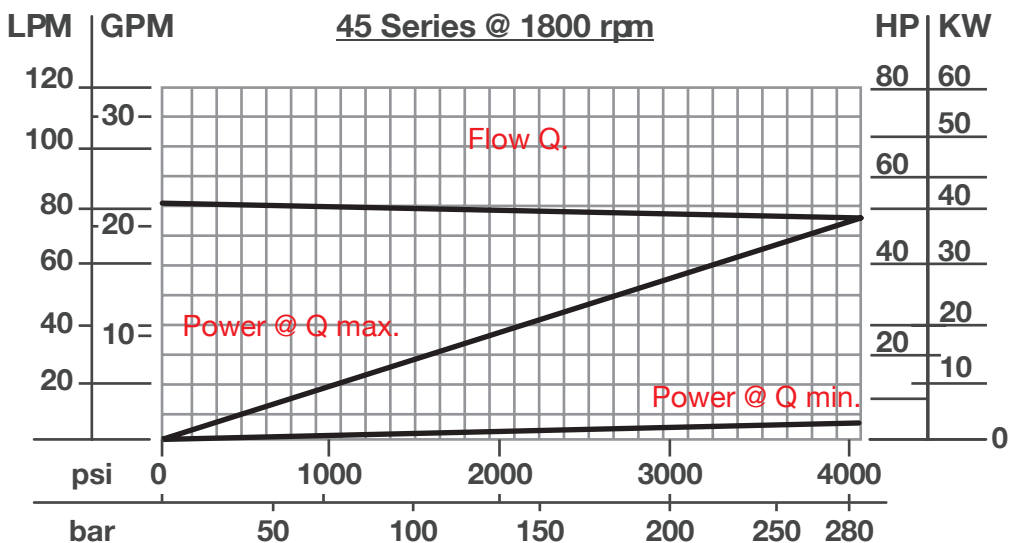
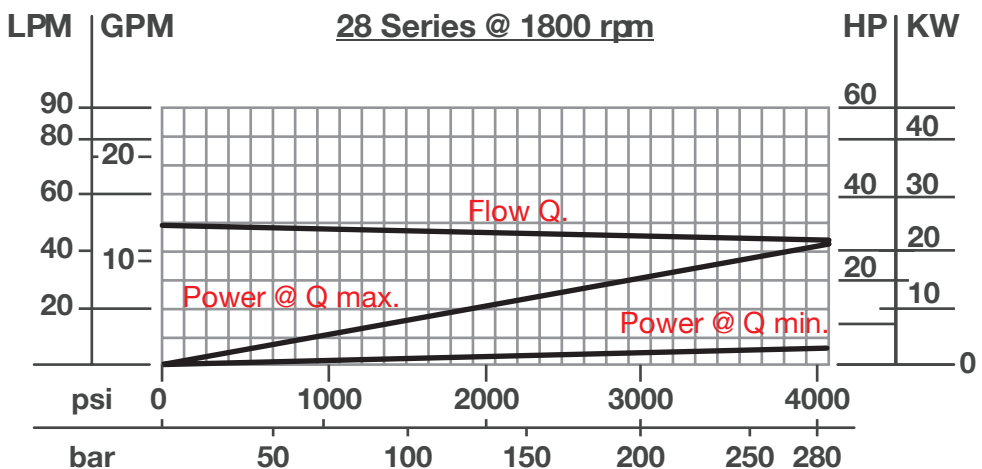
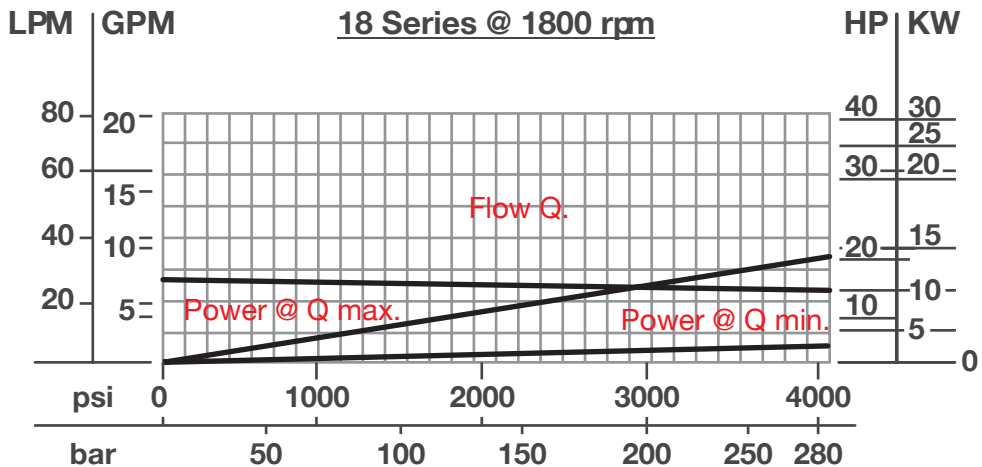
$$\text{Torque } T = \frac{V_g \cdot \Delta p}{24 \cdot \pi \cdot \eta_{mh}} \quad [\text{lb-ft}] \quad \left(T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad [\text{Nm}] \right)$$

$$\text{Power } P = \frac{q_v \cdot \Delta p}{1714 \cdot \eta_t} \quad [\text{HP}] \quad \left(P = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \quad [\text{kW}] \right)$$

V_g = Displacement per revolution in in³ (cm³)
 Δp = Differential pressure in psi (bar)
 n = Speed in rpm (min⁻¹)
 η_v = Volumetric efficiency
 η_{mh} = Mechanical-hydraulic efficiency
 η_t = Total efficiency

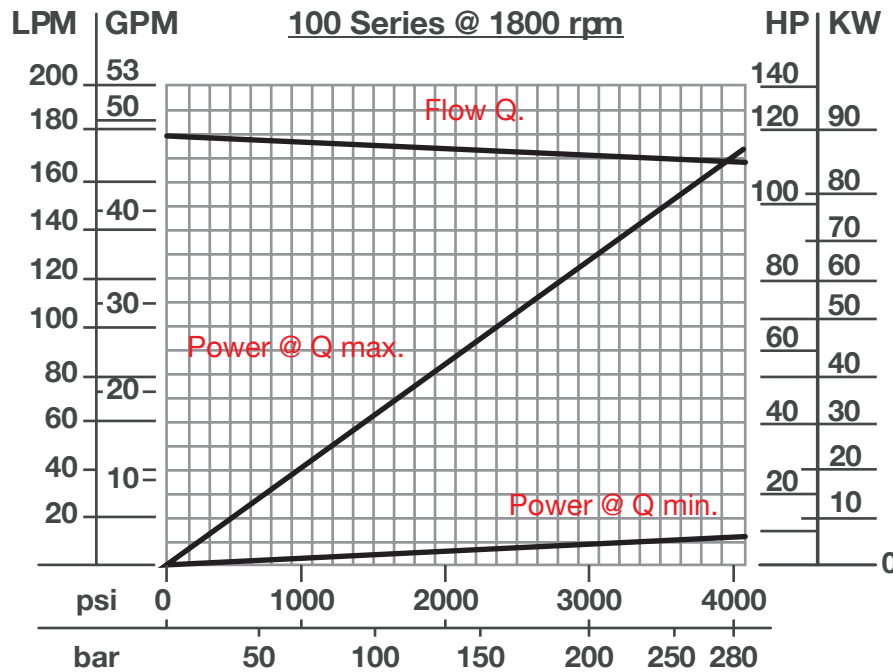
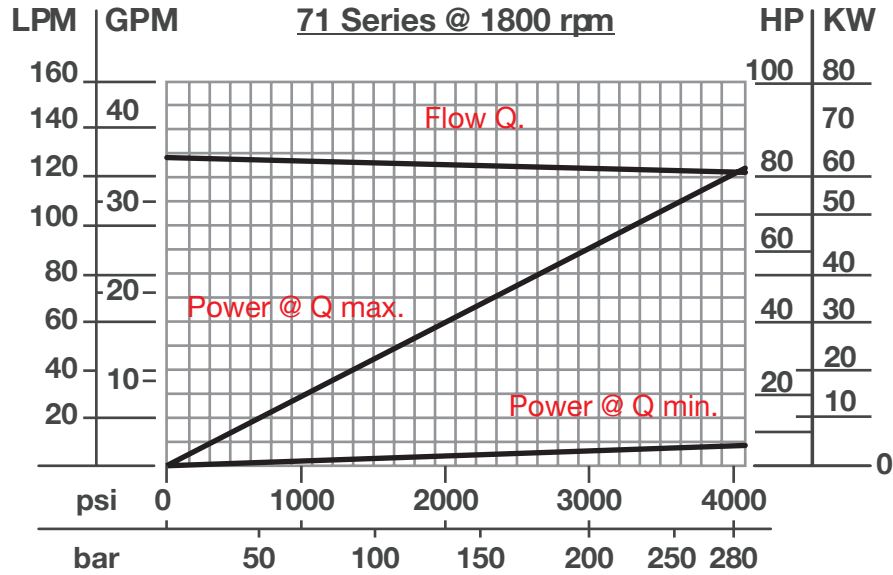
MA10VO/VSO Series 31

Performance Information



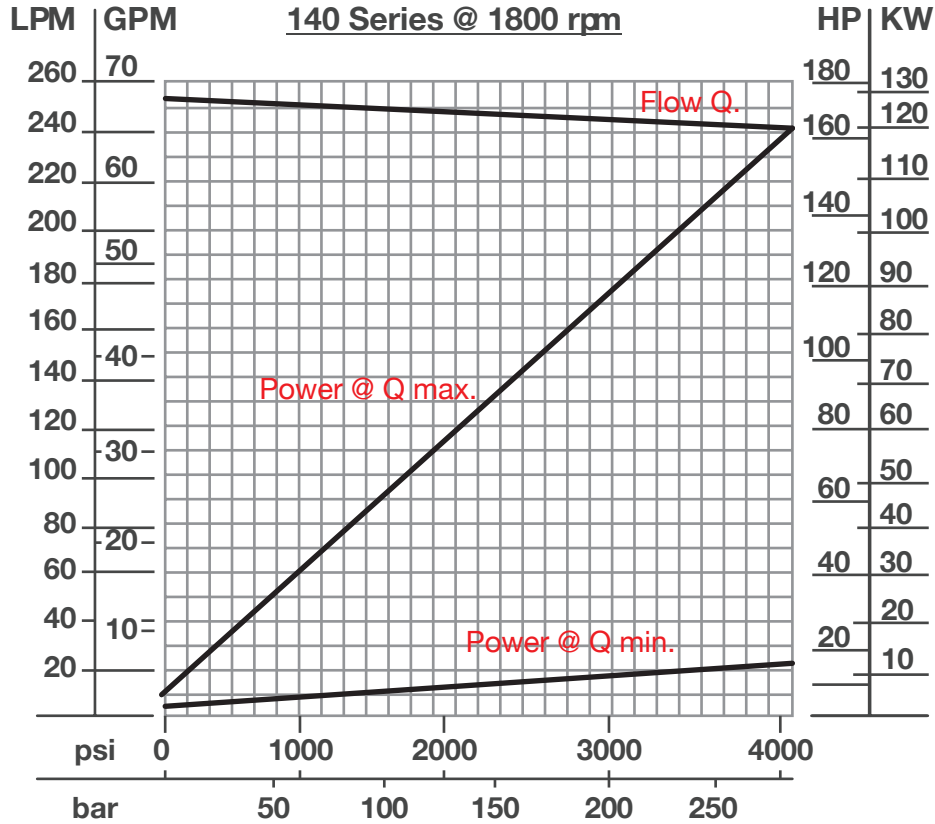
MA10V0/VSO Series 31

Performance Information



MA10V0/VSO Series 31

Performance Information



MA10VO/VSO Series 31

Model Code Breakdown

MA10V(S) - O - 71 - DR - 31 - R - P - S - C - 62 - N00

Axial Piston Unit

MA10V = Swash Plate Variable Pump

MA10VS = Swash Plate Variable Pump, for Industrial

Modes of Operation

O = Pump, Open Circuit

Displacement Size

cm³/r (in³/r)

18	28	45	71	100	140
(1.10)	(1.71)	(2.75)	(4.33)	(6.10)	(8.54)

Control Devices

	18	28	45	71	100	140
DR = Pressure Control	•	•	•	•	•	•
DRG = G - Remote Control	•	•	•	•	•	•
DFR = Pressure and Flow Control	•	•	•	•	•	•
DFR1 = X Channel Plugged	•	•	•	•	•	•
DFLR = Pressure, Flow and Power Control	-	•	•	•	•	•

Series

31 Series

Rotation

R = Clockwise CW

L = Counter-Clockwise CCW

Seals

P = Buna-N (NBR per DIN ISO 1629)

V = FPM (Fluorocarbon) Viton

Shafts

	18	28	45	71	100	140
S = SAE Splined Shaft	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"
R = SAE Splined Shaft, Reinforced (Higher Through-drive Torques)	3/4"	7/8"	1"	1 1/4"	1 1/2"	-
U = SAE Splined Shaft, Smaller Size (not for pumps w/Through-drive)	5/8"	-	7/8"	-	1 1/4"	-
W = SAE Splined Shaft, Reinforced U-type Shaft	-	-	7/8"	-	1 1/4"	-
K = SAE Keyed Shaft	3/4"	7/8"	1"	1 1/4"	1 1/2"	1 3/4"
P = Parallel w/Key DIN 6885	18mm	22mm	25mm	32mm	40mm	45mm

Mounting Flange

	18	28	45	71	100	140
C = SAE 2-Bolt	3 1/4"	4"	4"	5"	5"	-
A = ISO 2-Bolt	80mm	100mm	100mm	125mm	125mm	-
D = SAE 4-Bolt	-	-	-	-	-	6"
B = ISO 4-Bolt	-	-	-	-	-	180mm

Through-drive

	18	28	45	71	100	140
N00 = Without Through-drive	•	•	•	•	•	•

With through-drive to accept axial piston or gear pump

Mtg. Flange Shaft/Coupling	18	28	45	71	100	140
K04 = 101-2 (B) 1" 15T (B-B) A10V45(S,R), 60(U,W)	-	•	•	•	•	•
K01 = 82-2 (A) 5/8" 9T (A) A10V18(U,W)	•	•	•	•	•	•
K02/K68 = 101-2 (B) 7/8" 13T (B) A10V28(S,R), 45(U,W)	-	•	•	•	•	•
K07 = 127-2 (C) 1 1/4" 14T (C) A10V71(S,R), 100(U,W)	-	-	-	•	•	•
K24 = 127-2 (C) 1 1/2" 17T (C-C) A10V100(S,R), 85(S)	-	-	-	-	•	•
K17 = 152-4 (D) 1 3/4" 13T (D) A10V140(S,R)	-	-	-	-	-	•
KB7 = ISO 3019-2 1 3/4" 13T (D) A10V140(S,R)	-	-	-	-	-	•

Service Ports

Pressure Port B & Suction Port S	18	28	45	71	100	140
61 = Rear Ports, UNC Mounting Screws 1 2	-	•	•	•	•	•
62 = Opposite Side Ports, UNC Mounting Screws 2	•	•	•	•	•	•
11 = Rear Ports, Metric Mounting Screws 1	-	•	•	•	•	•
12 = Opposite Side Ports, Metric Mounting Screws	•	•	•	•	•	•
91 = Rear Ports, UNC Mounting Screws 1	-	-	-	•	-	-
92 = Opposite Side Ports, UNC Mounting Screws	-	-	-	•	-	-
41 = Rear Ports, Metric Mounting Screws 1	-	-	-	•	-	-
42 = Opposite Side Ports, Metric Mounting Screws	-	-	-	•	-	-

Port pos. 61, 11 only for version without Through-drive

¹ All rear porting, non Through-drive only

² MA10V071 = 8 threaded holes on pressure port code 11, 61, 12 & 62

MA10VO/VSO Series 31

Fluid

1. Hydraulic fluid

The MA10V open loop pump in the standard design should be used with a good quality, petroleum based anti-wear hydraulic fluid.

2. Operating viscosity range

$V_{opt} = 16 \text{ mm}^2 / \text{s} \sim 36 \text{ mm}^2 / \text{s}$ (80-170 sus)

For optimum efficiency and service life we recommend that the operating viscosity (at operating temperature) be selected from within the range:

$V_{opt} = \text{opt. operating viscosity } 16 \sim 36 \text{ mm}^2 / \text{s}$

Referred to tank temperature (open loop circuit).

Limits of viscosity range

(The following values are valid for extreme operating conditions):

$V_{min} = 10 \text{ mm}^2 / \text{s}$ (60 sus)

For short periods ($t \leq 1$ minute) at max. leakage oil temperature of 80°C (176°F)

$V_{max} = 1000 \text{ mm}^2 / \text{s}$

For short periods upon cold start

3. Temperature range

$T_{min} = -20^\circ\text{C}$ (-13°F); $T_{max} = +80^\circ\text{C}$ ($+176^\circ\text{F}$)

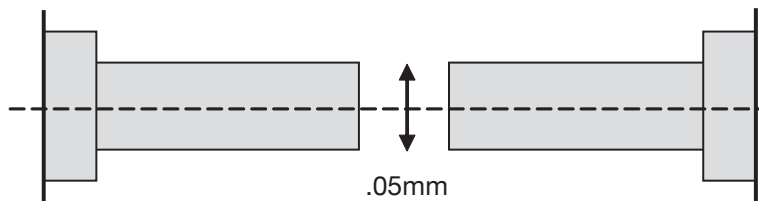
4. Filtration

In order to ensure reliable operation of the axial piston unit, the operating fluid must be maintained to a cleanliness ISO class of at least 16/19 to ISO4406. This may be achieved with filter elements with a cleanliness code of $10\mu\text{m}$.

Installation Note

The pump housing must be filled with clean hydraulic fluid prior to pump start up and remain full during operation.

The concentricity between the prime mover drive shaft and the pump shaft must be less than 0.05 mm (0.002 in).



MA10V0/VSO Series 31

Pump Installation Notes

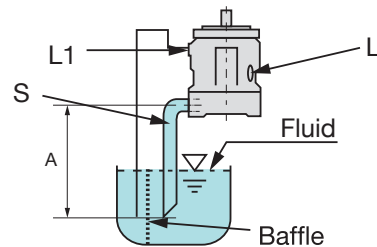
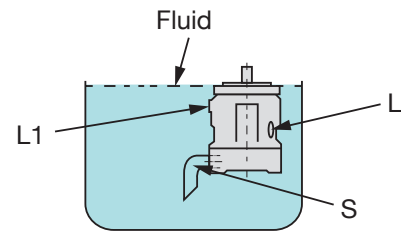
The installation position of the pump is optional.

The pump housing must be filled with fluid both when commissioning and in operation. In order to achieve low noise levels, all connecting lines (inlet, case drain) should be isolated from the tank by flexible lines.

Vertical Installation (Shaft end upwards)

The following conditions should be noted:

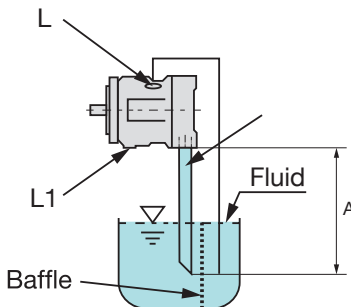
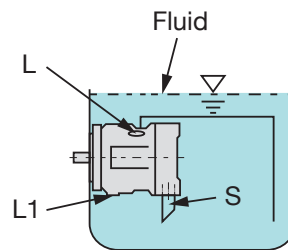
- Before installing the pump inside a tank, fill the pump case with fluid
- Make sure the ports are below the oil level (L), (L1) & S
- Avoid mounting above the tank whenever possible in order to maintain a low noise level
- The permissible inlet height is a result of the overall pressure loss "A" may not be greater than 32 inches (800 mm)



Horizontal Installation

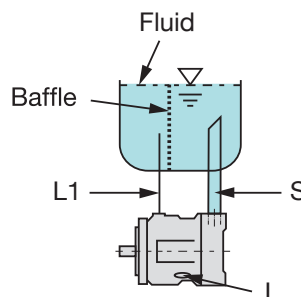
The following conditions should be noted:

- The pump must be installed in such a manner, that either (L) or (L1) (case drain) is at the top
- If the minimum fluid level is below the ports of the pump, pipe the ports (L) or (L1) & S below the minimum oil level
- Avoid mounting above the tank whenever possible in order to maintain a low noise level
- The permissible inlet height (h) is a result of the overall pressure loss, "A" may not be greater than 32 inches (800 mm)



Horizontal Installation (Below the reservoir tank)

- Pipe (L), (L1) and S must be mounted below the oil level



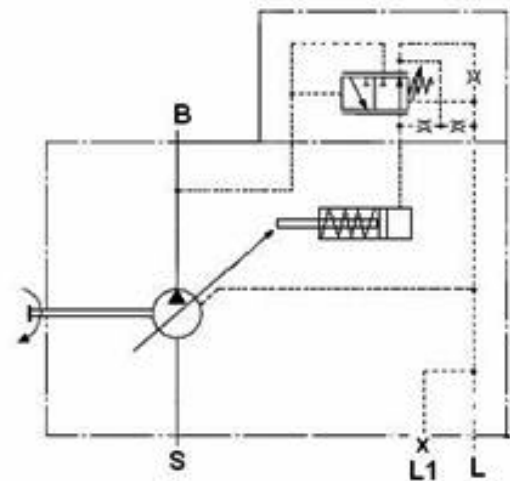
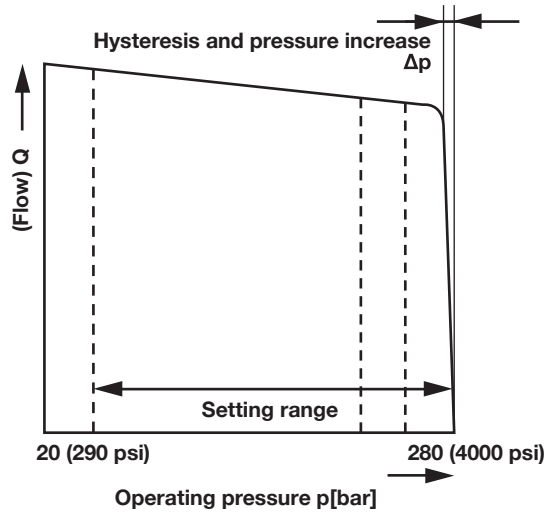
MA10VO/VSO Series 31

DR Pressure Control

The pressure control serves to maintain a constant pressure in the hydraulic system within the control range of the pump. The pump therefore supplies only the amount of hydraulic fluid required by the actuators. Pressure may be smoothly set at the pilot valve.

Static characteristic

(at $n_1 = 1500$ rpm; oil temp. = 125°F / 51°C)



B	Pressure Port
S	Suction Port
L, L1	Case Drain Ports (L1 sealed)

Control Data

Hysteresis and repetition accuracy Δpmax. 3 bar (45 psi)

Size	18	28	45	71	100	140
Δp	4 (58)	4 (58)	6 (87)	8 (116)	10 (145)	12 (174)

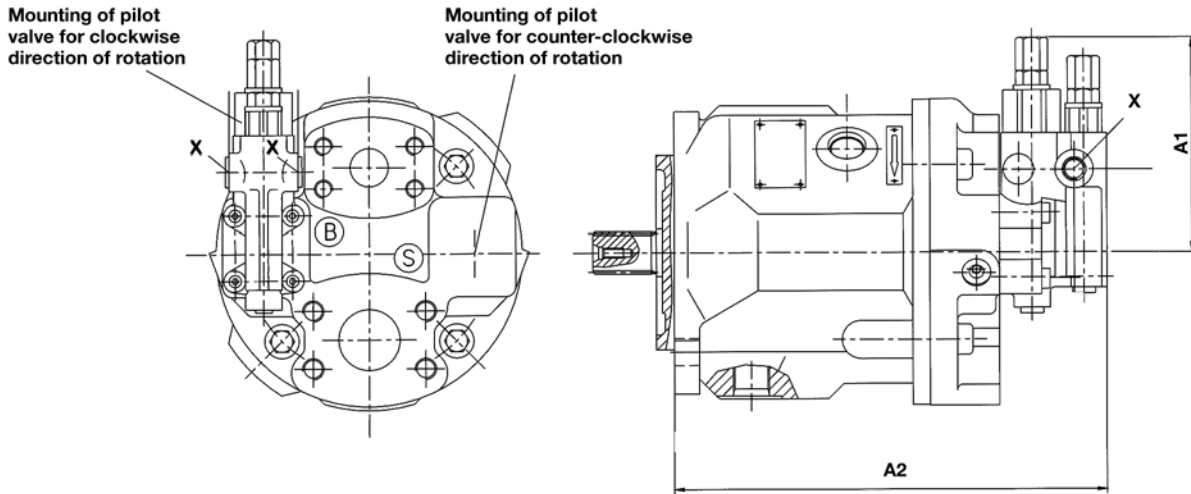
Pilot oil consumption.....max. approx. 3 L/min (0.8 gpm)

MA10V0/VSO Series 31

Unit Dimensions DR

Service Ports at Rear: Models 61N00 and 11N00

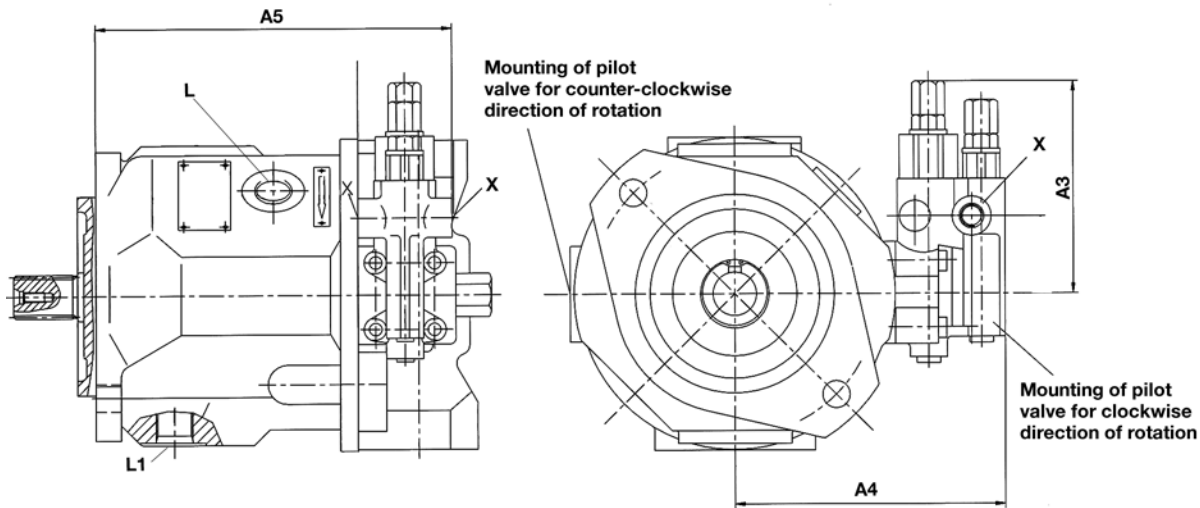
Sizes 18 - 140



Unit Dimensions DR

Service Ports on Side: Models 62N00 and 12N00

Sizes 18 - 140



Size	A1	A2	A3	A4	A5	Adapter L & L1 (ORB/Metric)	X
18	-	-	121	126	167	#6 ORB / M16 x 1.5	7/16-20UNF-2B
28	74	36	121	136	179	#8 ORB / M18 x 1.5	7/16-20UNF-2B
45	81	36	121	146	189	#10 ORB / M22 x 1.5	7/16-20UNF-2B
71	92	36	121	160	215	#10 ORB / M22 x 1.5	7/16-20UNF-2B
100	98	36	121	158	285	#12 ORB / M27 x 2	7/16-20UNF-2B
140	-	-	120	209	292	#12 ORB / M27 x 2	9/16-18UNF-2B

Measurements are in millimeters (mm)

MA10VO/VSO Series 31

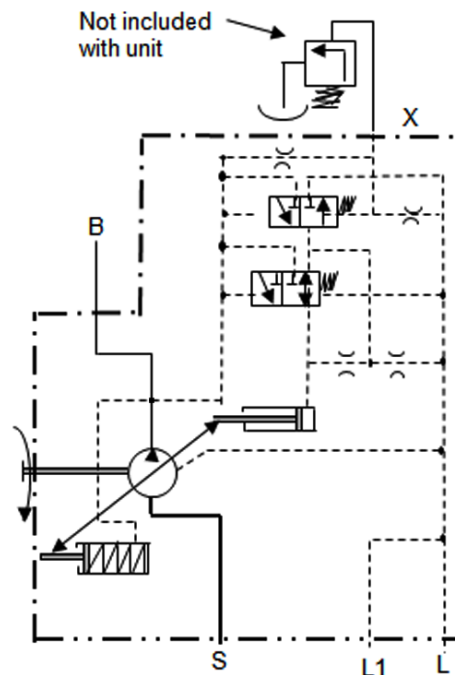
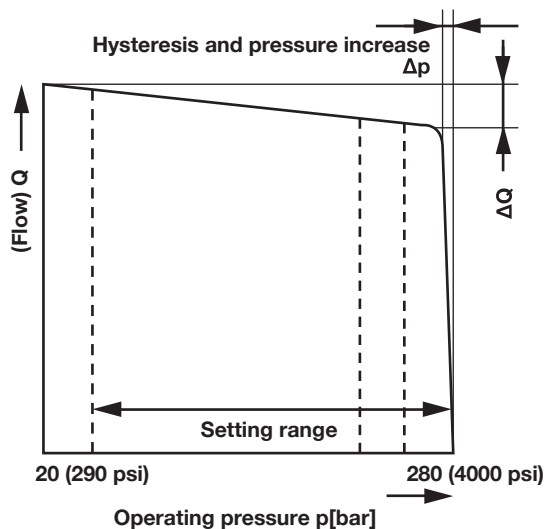
DRG Pressure Control, Remote Control

A pressure relief valve may be externally piped to port X for remote control purposes. It is not, however, included with the DRG control.

The differential pressure at the pilot valve is set as standard to 20 bar (290 psi) and this results in a pilot flow of 1.5 L/min (0.4 gpm). If another setting is required (in the range 10-22 bar), please indicate that specifically and clearly.

The remote pilot valve should be mounted no more than 78in (2 meters) from the pump.

Static characteristic
 (at $n_1 = 1500$ rpm; oil temp. = 125°F / 51°C)



B	Pressure Port
S	Suction Port
L, L1	Case Drain Ports (L1 sealed)
X	Pilot Pressure Port

Control Data

Hysteresis and repetition accuracy Δpmax. 3 bar (45 psi)

Size		18	28	45	71	100	140
Δp	Bar (psi)	4 (58)	4 (58)	6 (87)	8 (116)	10 (145)	12 (174)

Pilot oil consumption.....max. approx. 4.5 L/min (1.19 gpm)

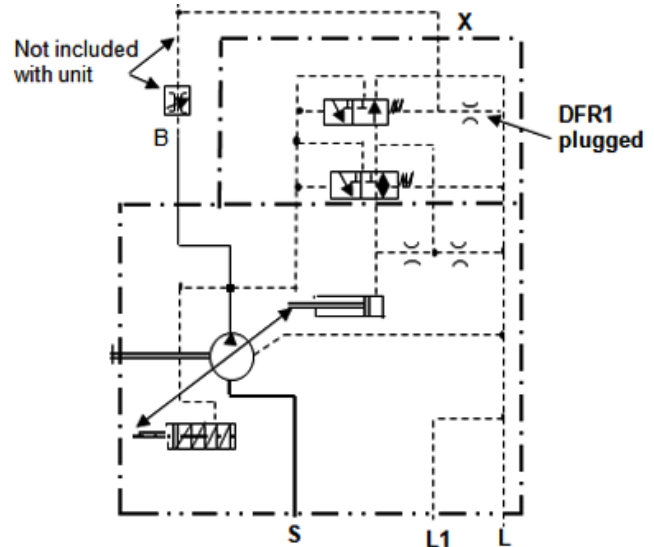
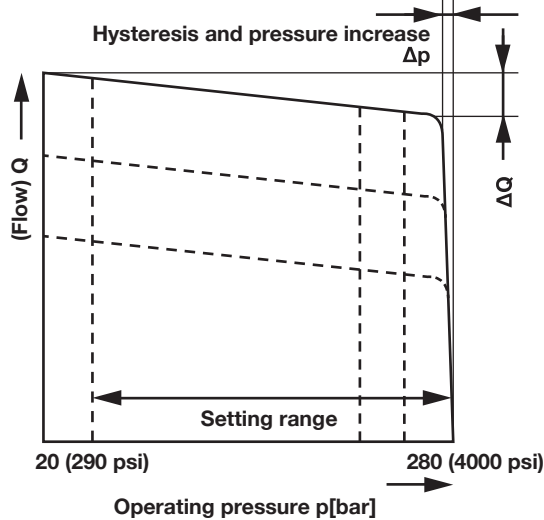
MA10V0/VSO Series 31

DFR/DFR1 Pressure/Flow Control

In addition to the pressure control function, the pump flow may be varied by means of a differential pressure at the actuator (e.g. an orifice).

In model DFR1, the X orifice is plugged.

Static characteristic
(at $n_1 = 1500$ rpm; oil temp. = 125°F / 51°C)



B	Pressure Port
S	Suction Port
L, L1	Case Drain Ports (L1 sealed)
X	Pilot Pressure Port

Flow Control/Differential Pressure Δp

Adjustable between 10 and 22 bar (higher values on request).

Standard setting: 14 bar. If a different setting is required, please specify clearly.

When port X is unloaded to tank, a zero stroke pressure ('stand by') of $p = 18 \pm 2$ bar (260 ± 30 psi) results.

Control Data

For pressure control technical data see DR pressure control.

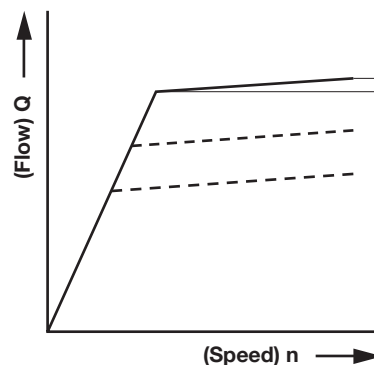
Max. flow deviation (hysteresis and increase) measured at drive speed $n = 1450$ rpm.

Size	18	28	45	71	100	140
ΔQ_{max} L/min (gpm)	0.5 (0.13)	1.0 (0.26)	1.8 (0.48)	2.8 (0.74)	4.0 (1.06)	6.0 (1.6)

Pilot oil consumption DFR.....max. approx. 3-4.5 L/min (0.70-1.19 gpm)

Pilot oil consumption DFR1.....max. approx. 3 L/min (0.70 gpm)

Static characteristic at variable speed

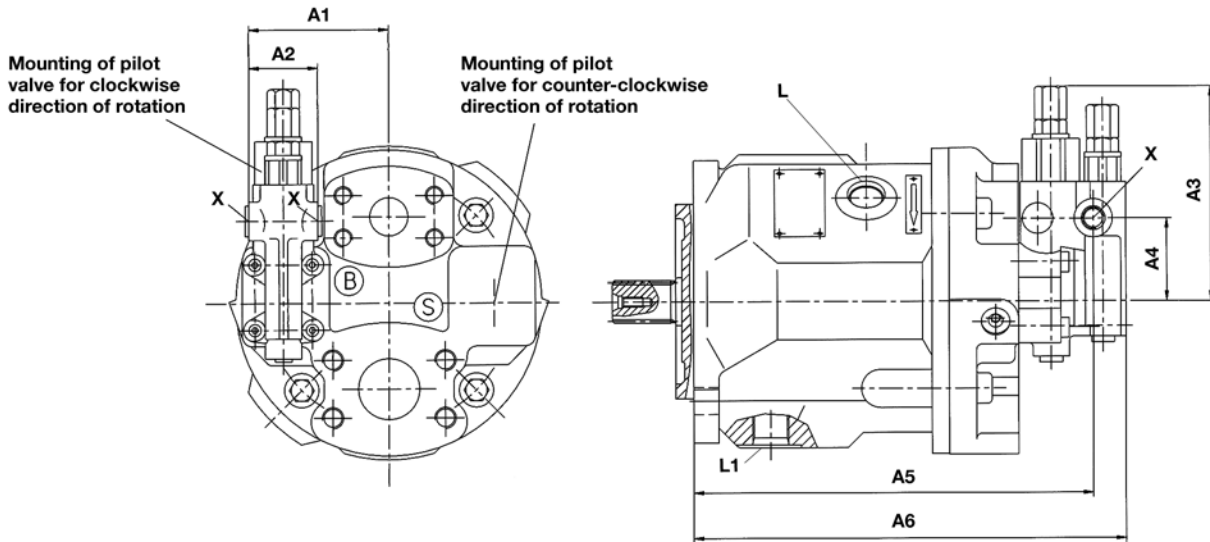


MA10VO/VSO Series 31

Unit Dimensions DFR/DFR1/DRG

Service Ports at Rear: Models 61N00 and 11N00

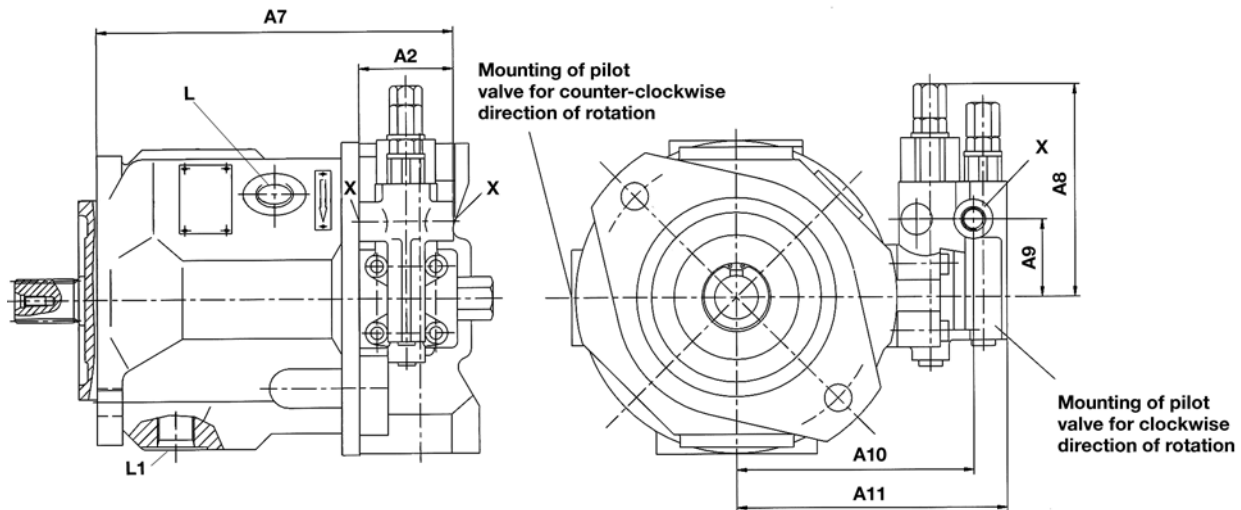
Sizes 18 - 140



Unit Dimensions DFR/DFR1/DRG

Service Ports on Side: Models 62N00 and 12N00

Sizes 18 - 140



Size	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	Adapter L & L1 (ORB/Metric)	X
18	-	36	-	-	-	-	167	121	41	112	126	#6 ORB / M16 x 1.5	7/16-20UNF-2B
28	74	36	121	40	211	228	179	121	41	116	135	#8 ORB / M18 x 1.5	7/16-20UNF-2B
45	81	36	121	40	231	248	189	118	40	122	140	#10 ORB / M22 x 1.5	7/16-20UNF-2B
71	92	36	121	40	264	281	215	119	40	145	163	#10 ORB / M22 x 1.5	7/16-20UNF-2B
100	98	36	121	40	328	346	286	119	40	145	164	#12 ORB / M27 x 2	7/16-20UNF-2B
140	-	50	-	-	-	-	292	120	26	186	210	#12 ORB / M27 x 2	9/16-18UNF-2B

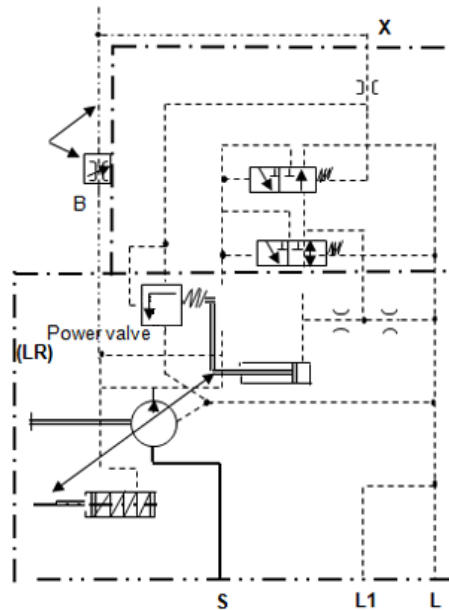
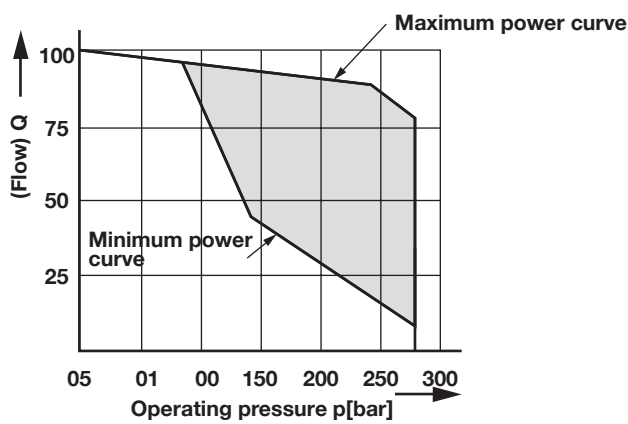
Measurements are in millimeters (mm)

MA10V0/VSO Series 31

DFLR Pressure/Flow/Power Control

In order to achieve a constant drive torque with a varying operating pressure, the swivel angle, and with it the output flow from the axial piston unit is varied, so that the product of flow and pressure remain constant.

Flow control is possible below the limit of the power curve.



B	Pressure Port
S	Suction Port
L, L1	Case Drain Ports (L1 sealed)
X	Pilot Pressure Port

The power characteristic is factory-set, so please specify clearly in detail; e.g. 20 kW at 1450 rpm (5 HP, 1800 rpm).

- Spring group Ato 90 bar (1,300 psi)
- Spring group Bto 160 bar (2,320 psi)
- Spring group Cto 240 bar (3,480 psi)
- Spring group Dover 240 bar (3,480 psi)

**Please contact us for 'Spring' part numbers.*

Control Data

For pressure control technical data see DR pressure control.

For flow control technical data see DFR control.

Start of control.....from 80 bar (1,160 psi)

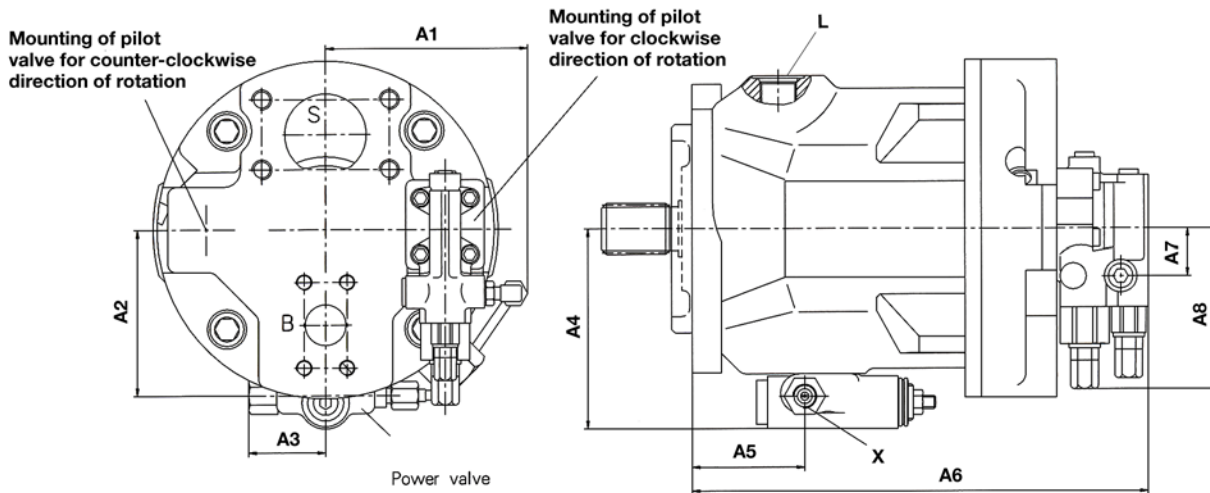
Pilot oil consumption.....max. approx. 5.5 L/min (1.45 gpm)

MA10VO/VSO Series 31

Unit Dimensions DFLR

Service Ports at Rear: Models 61N00 and 11N00

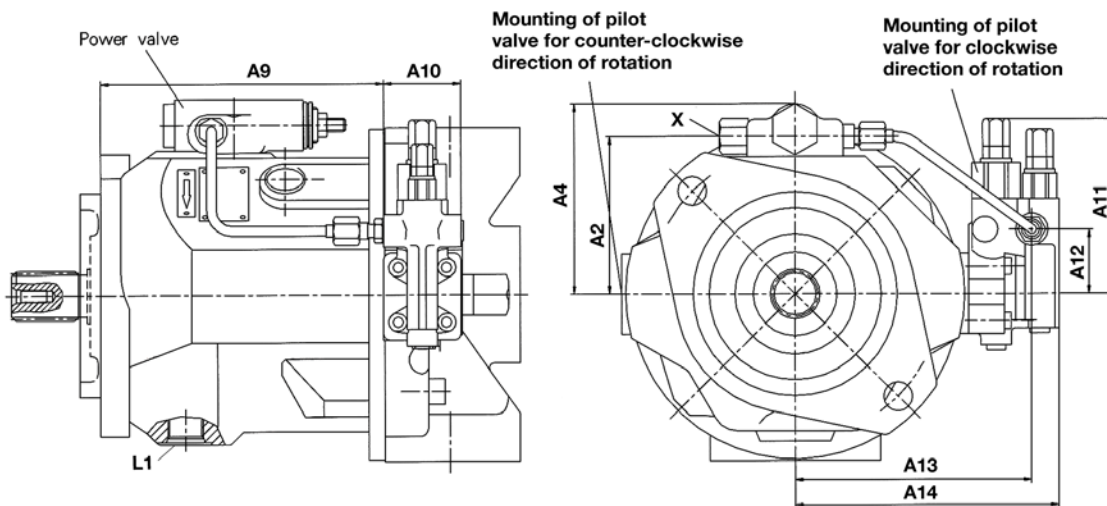
Sizes 18 - 140



Unit Dimensions DFLR

Service Ports on Side: Models 62N00 and 12N00

Sizes 18 - 140

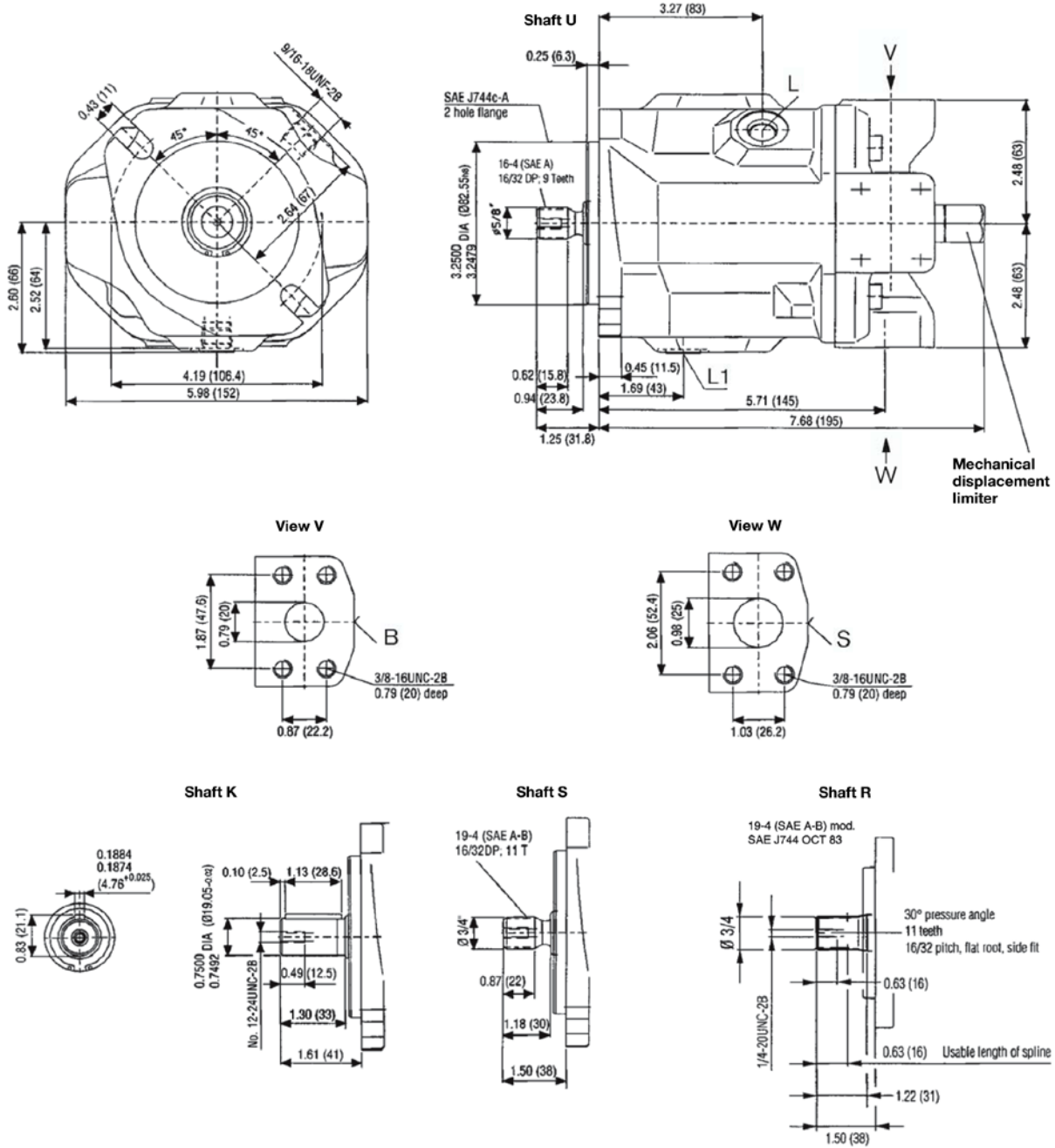


Size	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	Adapter L & L1 (ORB/Metric)	X
18	-	-	-	-	-	-	40	121	130	36	121	40	109	126	#6 ORB / M16 x 1.5	7/16-20UNF-2B
28	102	88	57	109	48	228	40	121	143	36	121	40	116	135	#8 ORB / M18 x 1.5	7/16-20UNF-2B
45	109	90	57	111	54	248	40	121	153	36	118	40	122	140	#10 ORB / M22 x 1.5	7/16-20UNF-2B
71	120	103	57	124	70	281	40	121	180	36	119	40	145	163	#10 ORB / M22 x 1.5	7/16-20UNF-2B
100	126	112	57	133	112	345	40	121	249	36	119	40	146	164	#12 ORB / M27 x 2	7/16-20UNF-2B
140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Measurements are in millimeters (mm)

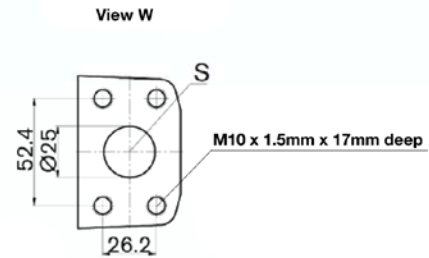
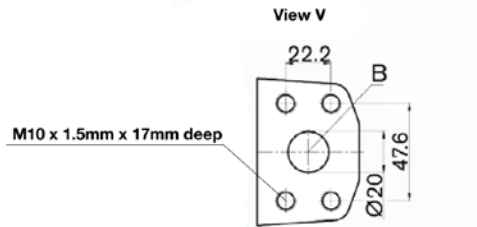
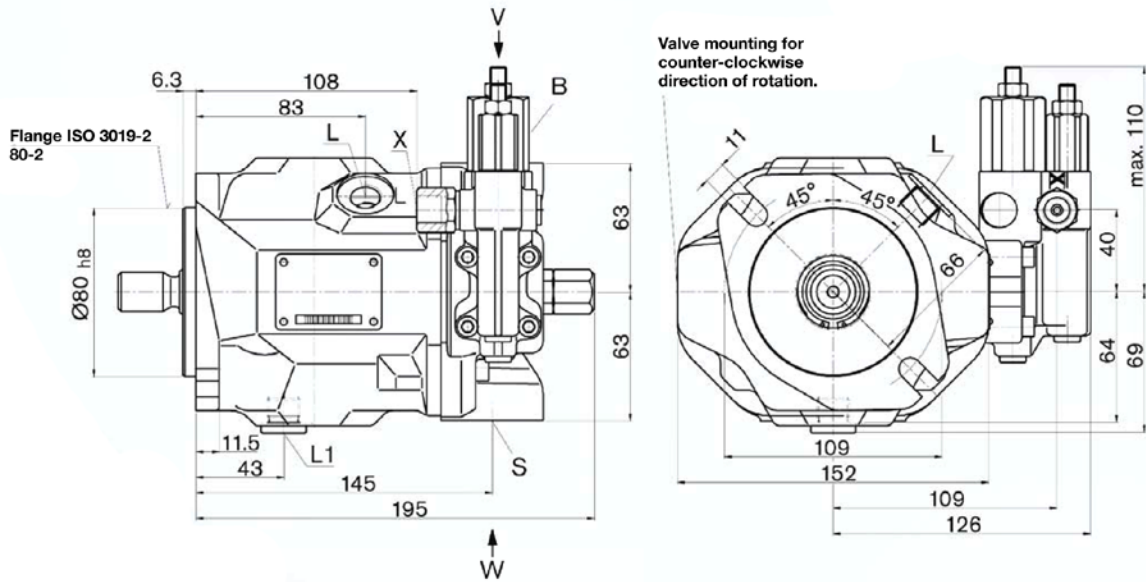
MA10V0/VSO Series 31

Mounting Dimension, Sizes 18, SAE
Service Ports at Side: No Through-drive, Model 62N00

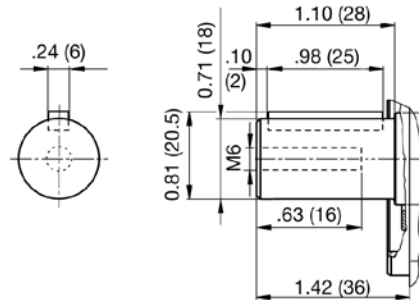


MA10VO/VSO Series 31

Mounting Dimension, Sizes 18, ISO
 Service Ports at Side: No Through-drive, Model 12N00



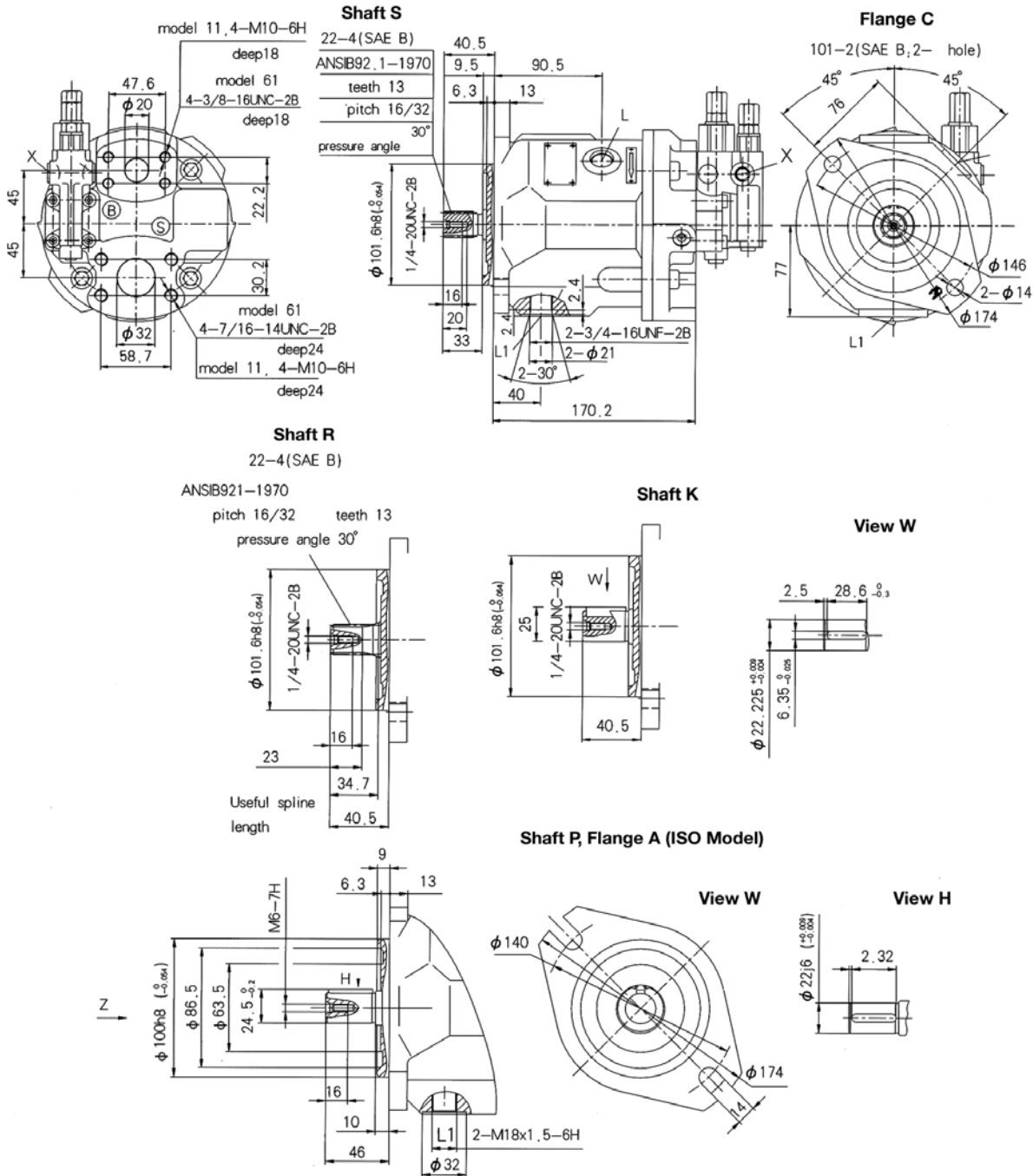
Shaft P (ISO Model)



MA10VO/VSO Series 31

Mounting Dimension, Sizes 28, SAE & ISO

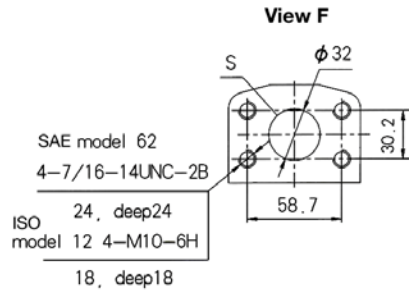
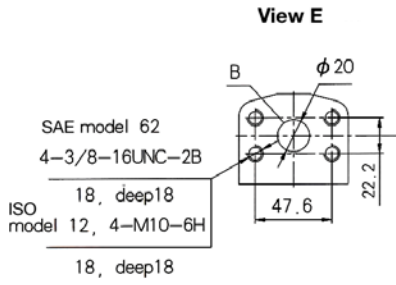
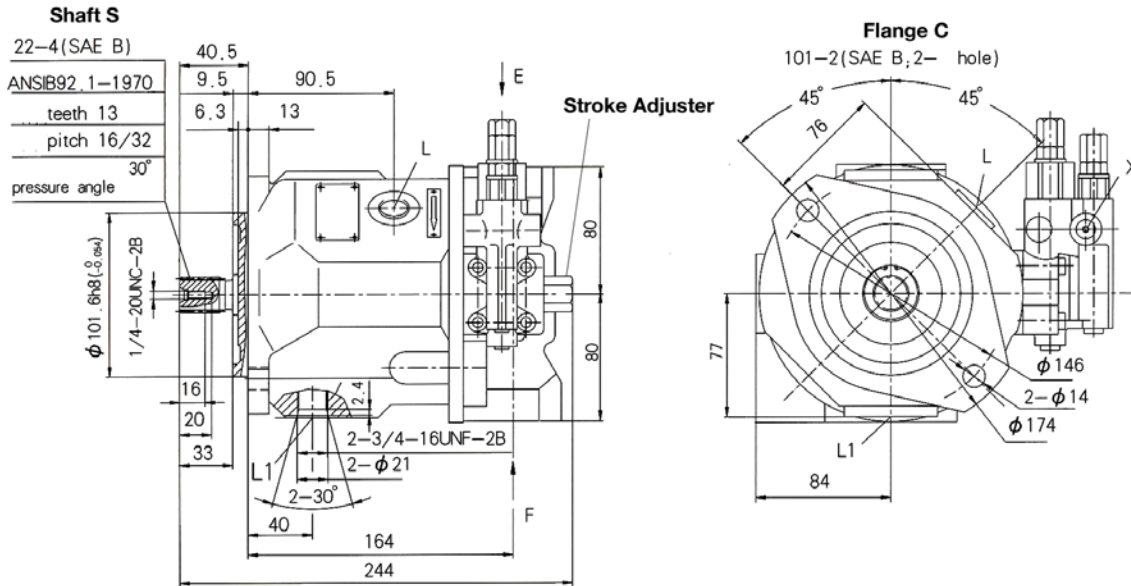
Service Ports at Rear: No Through-drive, Models 61N00 and 11N00



MA10VO/VSO Series 31

Mounting Dimension, Sizes 28

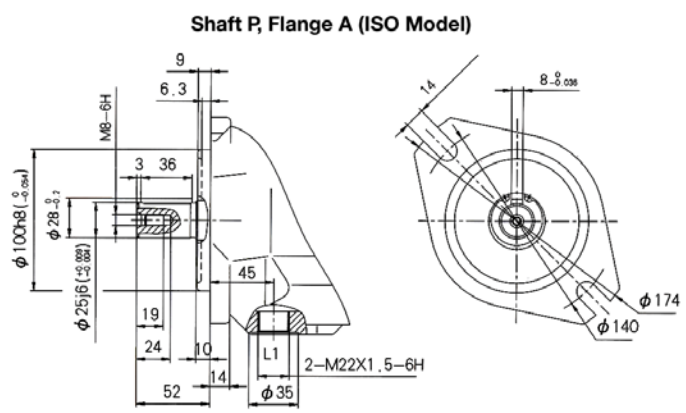
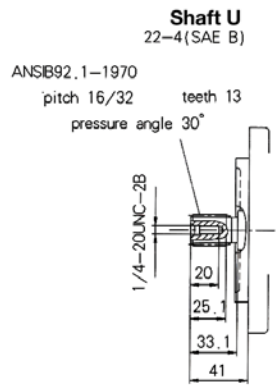
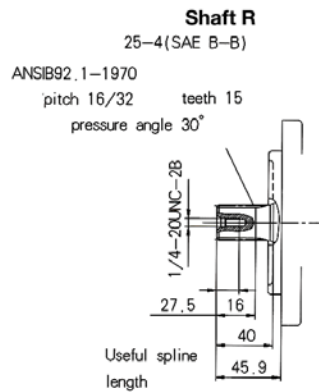
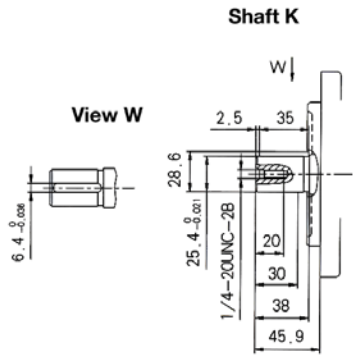
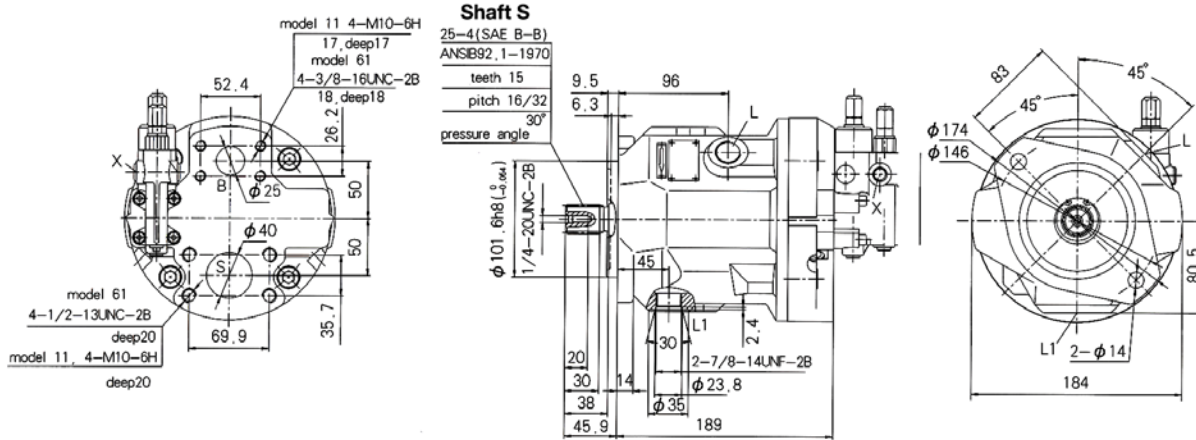
Service Ports at Side: No Through-drive, Models 62N00 and 12N00



MA10VO/VSO Series 31

Mounting Dimension, Sizes 45, SAE & ISO

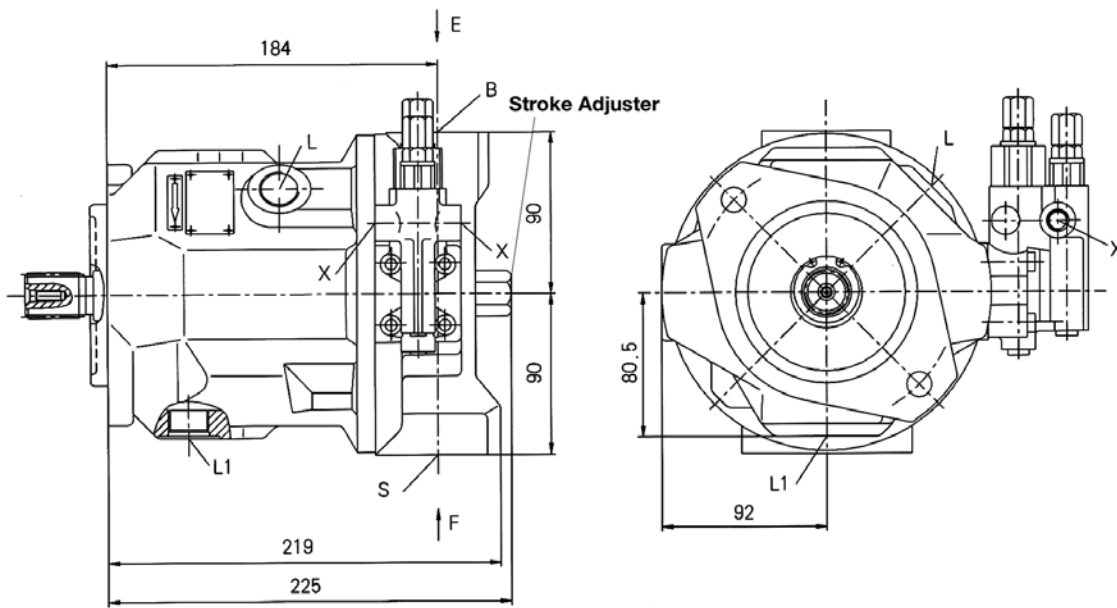
Service Ports at Rear: No Through-drive, Models 61N00 and 11N00



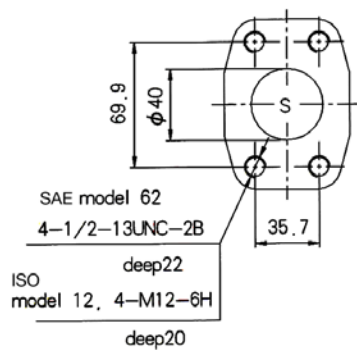
MA10VO/VSO Series 31

Mounting Dimension, Sizes 45

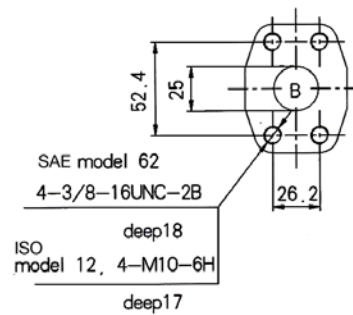
Service Ports at Side: No Through-drive, Models 62N00 and 12N00



View F



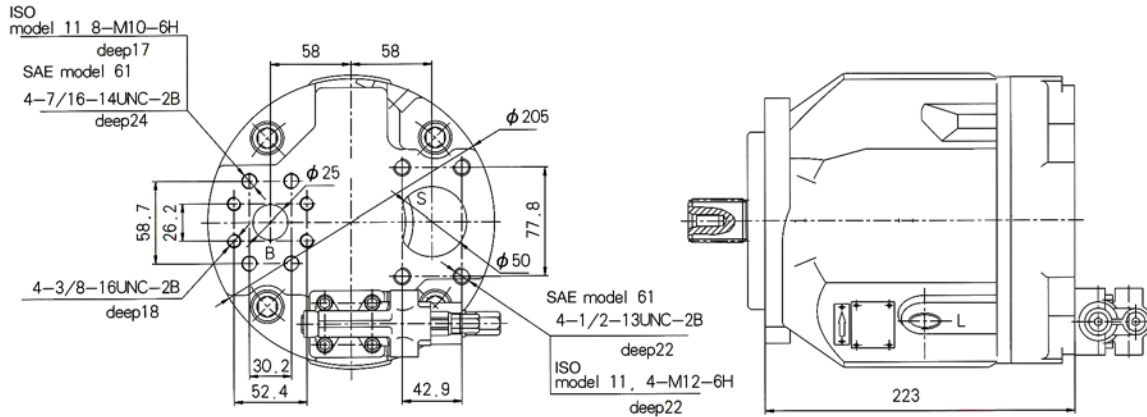
View E



MA10VO/VSO Series 31

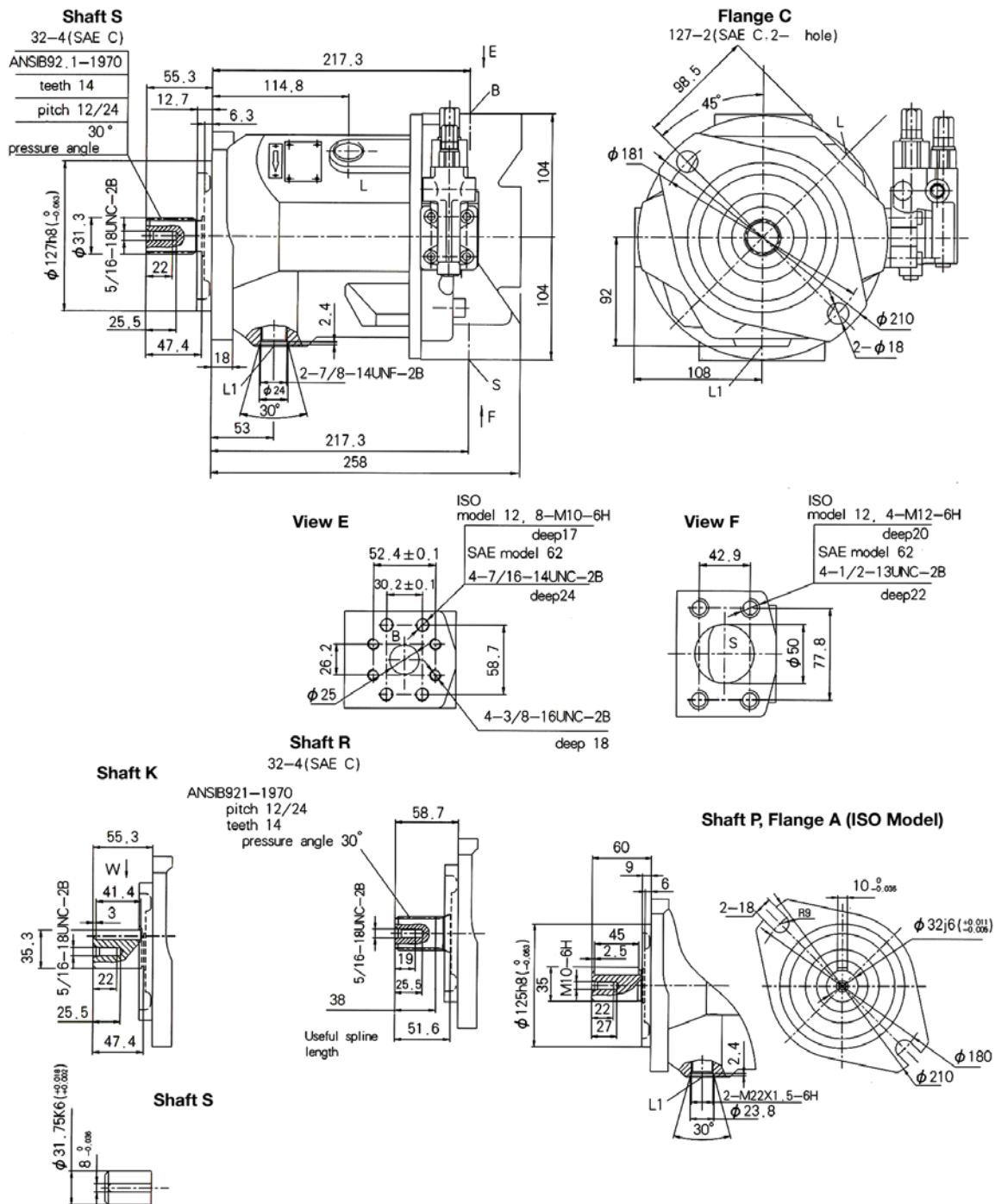
Mounting Dimension, Sizes 71

Service Ports at Rear: No Through-drive, Models 61N00 and 11N00



MA10VO/VSO Series 31

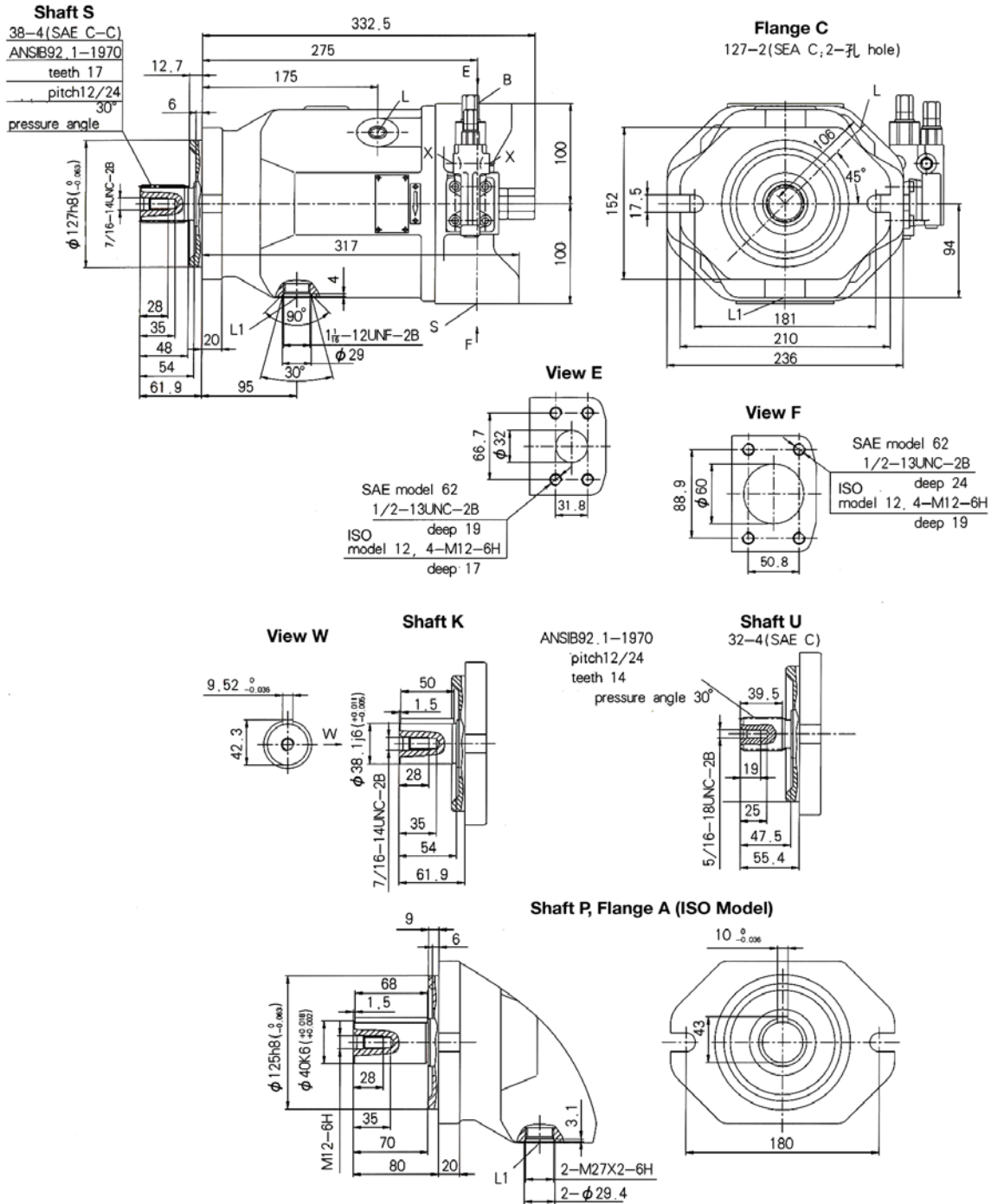
Mounting Dimension, Sizes 71, SAE & ISO
 Service Ports at Side: No Through-drive, Models 62N00 and 12N00



MA10VO/VSO Series 31

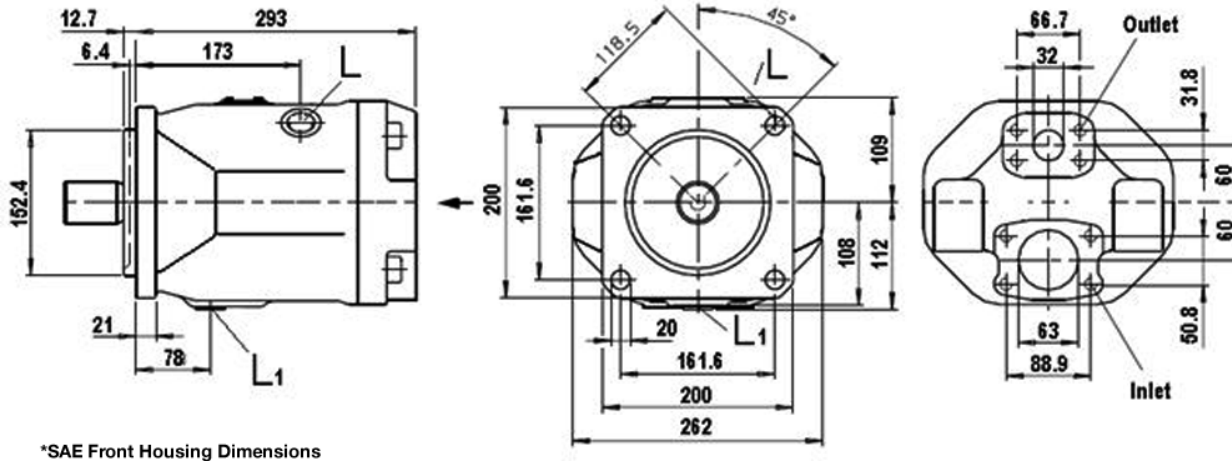
Mounting Dimension, Sizes 100

Service Ports at Side: No Through-drive, Models 62N00 and 12N00

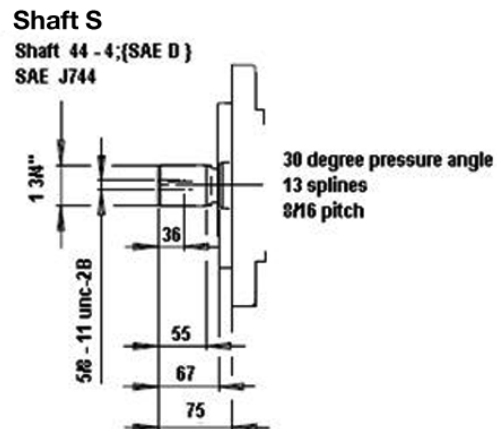
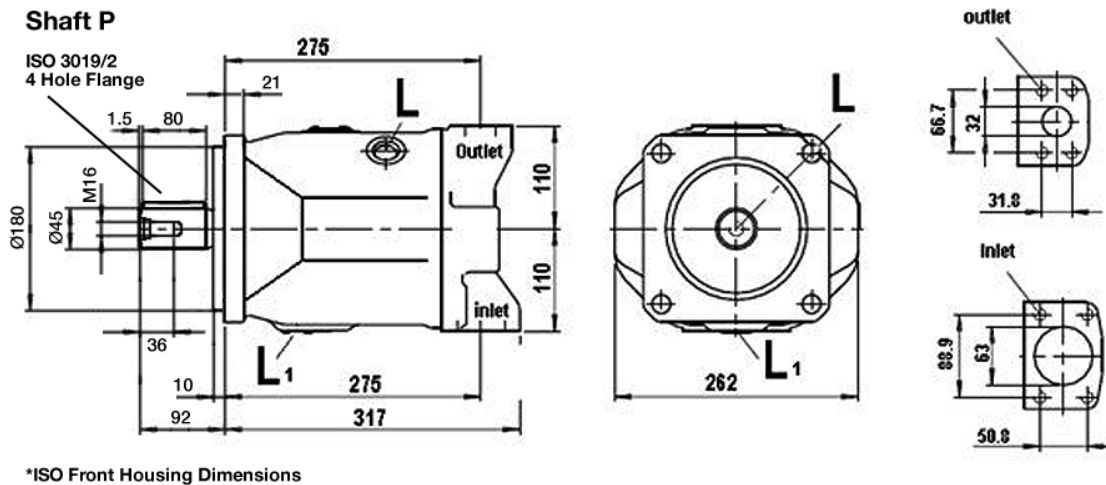


MA10VO/VSO Series 31

Mounting Dimension, Sizes 140
 Service Ports at Rear: Models 61N00 and 11N00

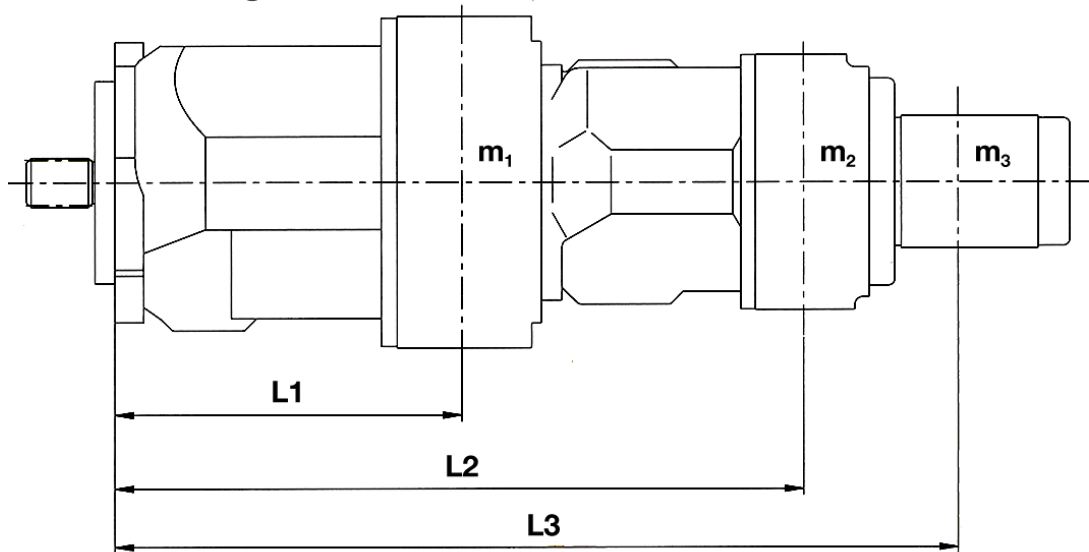


Mounting Dimension, Sizes 140
 Service Ports at Side: Models 62N00 and 12N00



MA10VO/VSO Series 31

Permissible Bending



m_1, m_2, m_3 Weight of pump lbs (kg)

l_1, l_2, l_3 Distance to center of gravity in (mm)

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{12} \text{ lb-ft}$$

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102} \text{ (Nm)}$$

Size			28	45	71	100	140
Permissible bending moment	T_m	lb-ft	65	101	159	221	332
		Nm	88	137	216	300	450
Weight	m_1	lbs	33	46	73	99	132
		kg	15	21	33	45	60
Distance to center of gravity	l_1	in	4.33	5.11	5.91	6.30	6.30
		mm	110	130	150	160	160

Combination Pumps

By mounting combination pumps, circuits independent of each other are available for use.

- If the combination pump consists of 2 MA10VO pumps and if these are to be delivered ready-assembled, then the two type codes are to be combined with a "+", when ordering.

Ordering example: MA10VO71DR/31R-PSC62K02 + MA10VO28DR/31R-PSC62N00

- If a gear pump, vane or other type pump is to be mounted in the factory as a second or third pump, please consult the factory for available mounting information.
- If the second pump is an MA10V unit, the spigot will be to SAE dimensions.

MA10VO/VSO Series 31 Through Drives

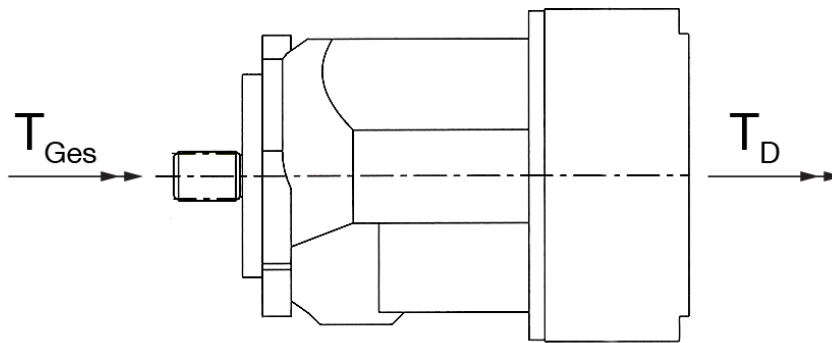
Maximum Permissible Input and Through Drive Torques

Through-drive

The MA10VO axial piston pump can be supplied with a through-drive.

The type of through-drive is determined by codes (K01-K17). If the combination pump is not mounted in the factory, the simple type code is sufficient.

Included with the pump unit are: Coupling sleeve, seals and necessary hardware.



The drive torques for pump 1 and pump 2 can be split up as required. However, the max. permissible input torque T_{tot} as well as the max. permissible through drive torque T_{thr} may not be exceeded.

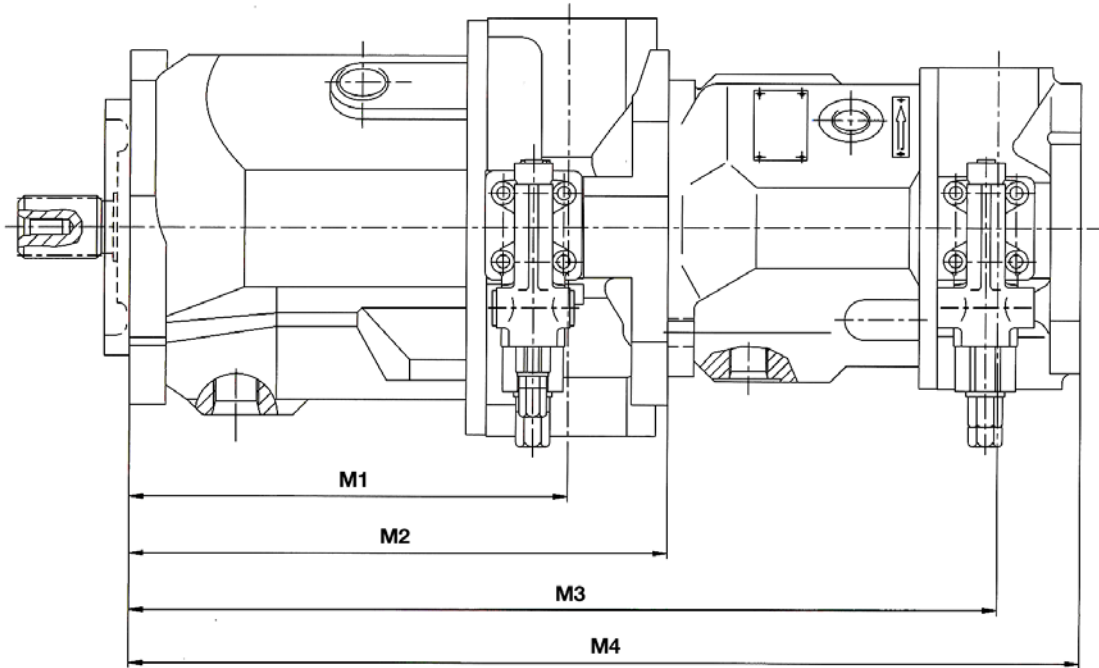
Size			18	28	45	71	100	140
Max. Permissible Input Torque T_{tot}								
With Shaft S	T_{tot}	Nm	124	198	319	626	1104	1620
With Shaft R	T_{tot}	Nm	150	225	400	644	-	-
Max. Perm. Through Drive Torque T_{thr}								
With Shaft S	T_{thr}	Nm	108	160	319	492	778	1266
With Shaft R	T_{thr}	Nm	120	176	365	548	-	-

T_{tot} = Max. permissible input torque pump 1

T_{thr} = Max. permissible through drive torque at 2nd shaft end of pump 1

MA10VO/VSO Series 31

Unit Dimensions of Combination Pumps

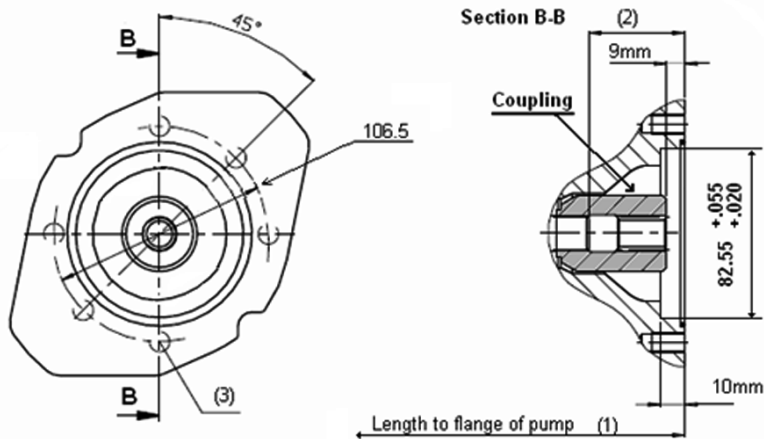


Pump 1	MA10VO28				MA10VO45				MA10VO71				MA10VO100				MA10VO140				
	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4	
Pump 2																					
MA10VO18	in.	6.5	8.03	13.74	15.71	7.24	9.02	14.72	16.69	8.54	10.51	16.21	18.19	10.83	13.31	19.02	20.98	10.83	13.78	19.49	21.46
	mm	165	204	349	399	184	229	373	424	217	267	412	462	275	338	483	533	275	350	495	545
MA10VO28	in.	6.5	8.03	14.53	15.67	7.24	9.02	15.51	16.65	8.54	10.51	17.01	18.15	10.83	13.31	19.8	20.94	10.83	13.78	20.28	21.42
	mm	165	204	369	398	184	229	394	423	217	267	432	461	275	338	503	532	275	350	515	544
MA10VO45	in.					7.24	9.02	16.3	17.64	8.54	10.51	17.76	19.36	10.83	13.31	20.55	21.93	10.83	13.78	21.02	22.4
	mm					184	229	413	448	217	267	451	486	275	338	522	557	275	350	534	569
MA10VO71	in.									8.54	10.51	19.06	20.63	10.83	13.31	21.85	23.43	10.83	13.78	22.32	23.9
	mm									217	267	484	524	275	338	555	585	275	350	567	607
MA10VO100	in.													10.83	14.02	24.84	26.5	10.83	14.49	24.31	29.97
	mm													275	356	631	673	275	368	643	685
MA10VO140	in.																	10.83	14.49	24.31	29.97
	mm																	275	368	643	685

MA10VO/VSO Series 31

Dimensions of Through-drive Covers:
 Mounting Flange for SAE A, 2-bolt 3.250" (82.55) Pilot

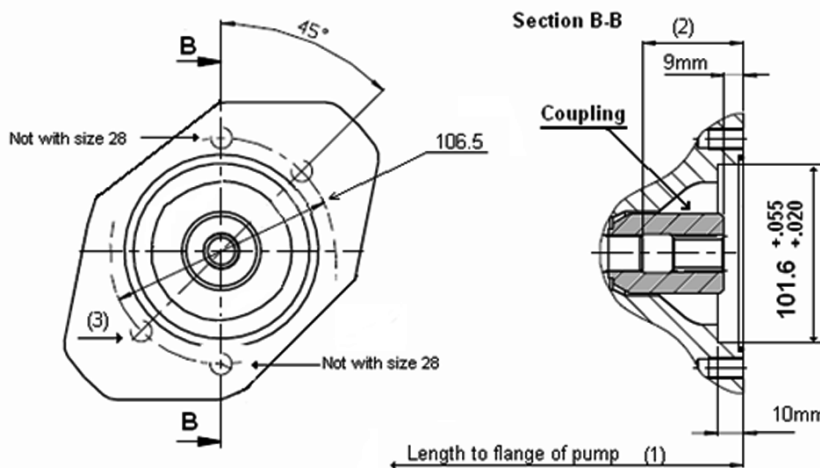
Ordering code with 5/8" 9T spline coupling - K01
 Ordering code with 3/4" 11T spline coupling - K52



Size	1	2	3
28	204mm	47mm	M10-16mm deep
45	229mm	53mm	M10-16mm deep
71	267mm	60mm	M10-20mm deep
100	338mm	65mm	M10-20mm deep
140	350mm	77mm	M10-20mm deep

Dimensions of Through-drive Covers:
 Mounting Flange for SAE B, 2-bolt 4" (101.6) Pilot

Ordering code with 7/8" 13T spline coupling - K02 & K68
 Ordering code with 1" 15T spline coupling - K04
 Ordering code with 7/8" keyed coupling - K03
 Ordering code with 1" keyed coupling - K05



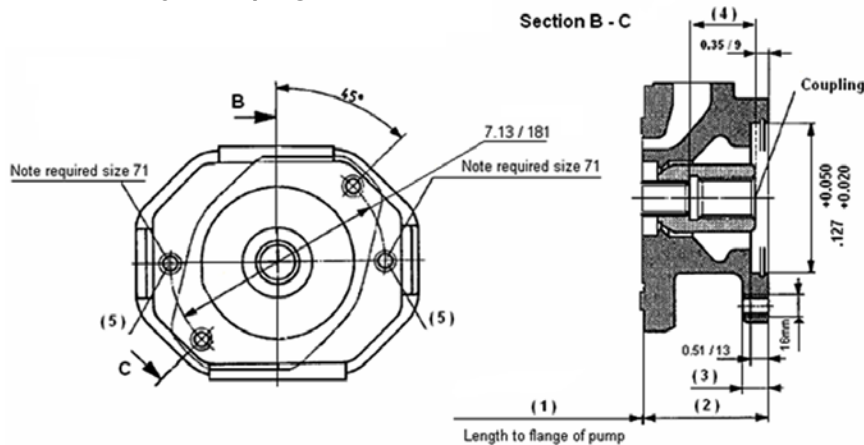
Size	1	2	3
28	204mm	47mm	M12-15mm deep
45	229mm	53mm	M12-18mm deep
71	267mm	60mm	M12-20mm deep
100	338mm	65mm	M12-20mm deep
140	350mm	77mm	M12-20mm deep

MA10V0/VSO Series 31

Dimensions of Through-drive Covers:
Mounting Flange for SAE C, 2-bolt 5" (127) Pilot

Ordering code with 1-1/4" 14T spline coupling - K07

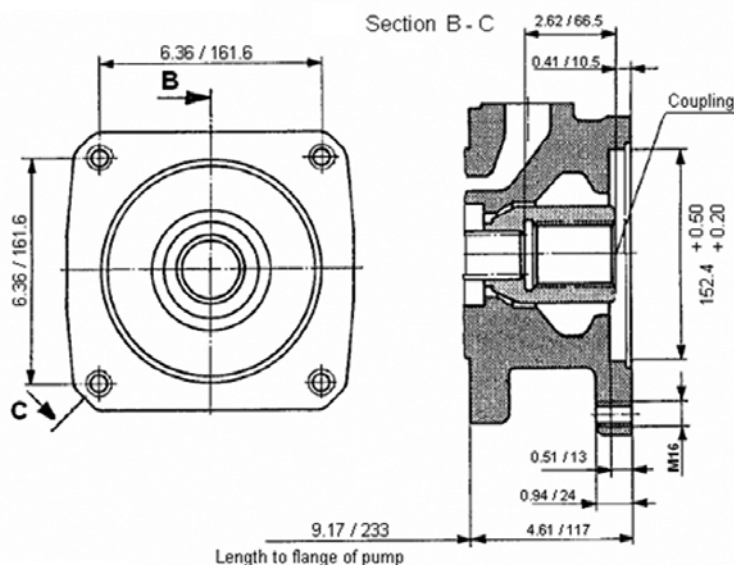
Ordering code with 1-1/4" keyed coupling - K08



Size	1	2	3	4	5
71	177mm	90mm	18mm	52mm	M16-18mm deep
100	233mm	105mm	20mm	57mm	M16-25mm deep
140	233mm	117mm	24mm	68mm	M16-25mm deep

Dimensions of Through-drive Covers:
Mounting Flange for SAE D, 4-bolt 5.98" (152) Pilot (MA10V140)

Ordering code with 1-3/4" coupling - K17

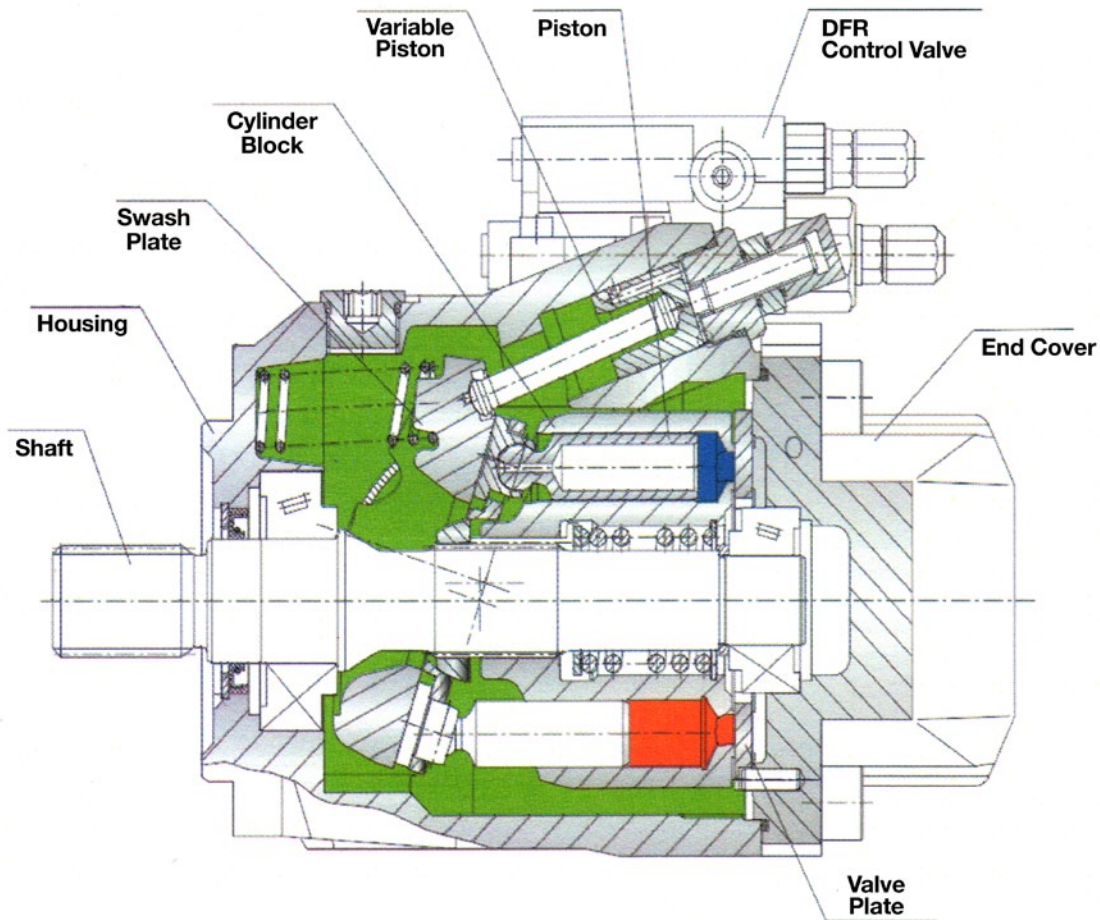
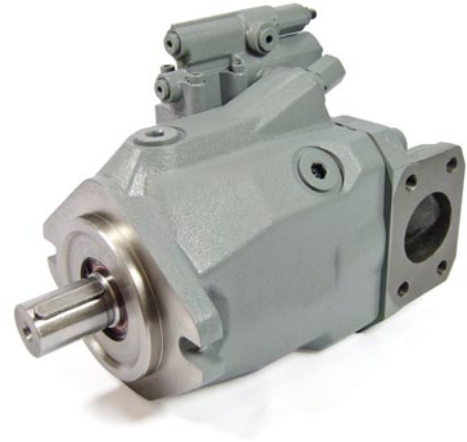


MA10VO/VSO Series 52

Features

Axial piston pump MA10VO is a swashplate design and is used in open loop circuits. Flow is proportional to drive speed and displacement. By adjusting the position of the swashplate, it is possible to smoothly vary the output flow of the pump.

- Flange connections available in SAE or Metric
- Two case drain ports
- Operating pressure of 3625 psi (250 bar)
- Good suction characteristics
- Low noise level
- High power/weight ratio
- Long service life
- Quick response times
- Axial and radial loading of drive shaft is possible
- Wide range of controls
- Through-drive options available for multi-circuit systems



MA10V0/VSO Series 52

Technical Data

- Input operating pressure range
Absolute pressure at port S (A)
P_{abs} min.....11.6 psi (0.8 bar)
P_{abs} max.....435 psi (30 bar)
- Output operating pressure range
Pressure at port B
Nominal pressure P_N.....3625 psi (250 bar)
Peak pressure P_{max}.....4500 psi (315 bar)
- Case drain pressure
Maximum pressure of leakage fluid (at ports L, L1 is 7 psi (0.5 bar) higher than input pressure at port S, but not higher than 30 psi (2 bar) absolute.
- Direction of flow
("S" inlet port to "B" pressure port)
- Table of values (theoretical values, without considering η_{mh} and η_v ; values rounded)

Size		45	60
Displacement	V _{gmax}	cm ³ /rev (in ³ /rev)	45 (2.75) 60 (3.66)
Max. Speed	N _{omax}	rpm	2600 2600
Max. Flow	O _{omax}	L/min (gpm)	117 (31) 162 (43)
Max. Power $\Delta p = 4000$ psi (280 bar)	P _{omax}	kW (HP)	49 (65) 68 (90)
Max. Torque $\Delta p = 4000$ psi (280 bar)	T _{max}	Nm (ft-lb)	179 (132) 250 (184)
Weight (w/o fluid)		Kg (lbs)	18 (40) 22 (48.5)

Note: Values shown are valid for an absolute pressure of 1 bar at suction port. If the flow is reduced or if the inlet pressure is increased, the speed may be increased.

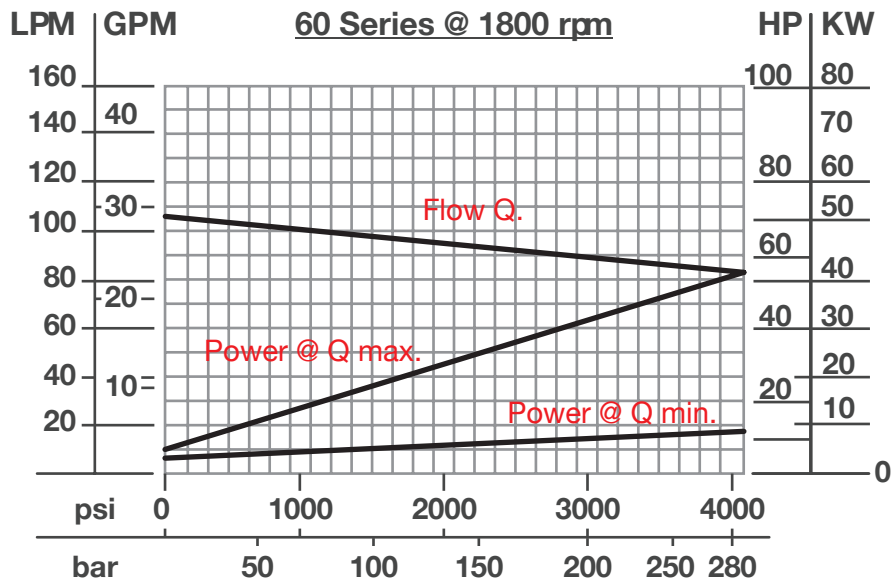
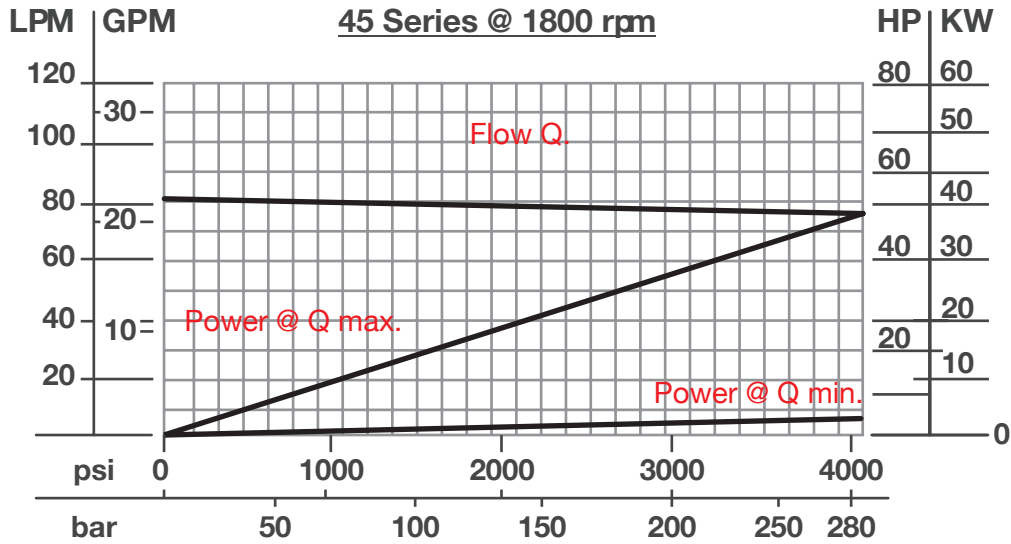
6. Determination of size

$$\begin{array}{l}
 \text{Flow } q_v = \frac{V_g \cdot n \cdot \eta_v}{231} \quad [\text{gpm}] \quad \left(q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad [\text{L/min}] \right) \\
 \text{Torque } T = \frac{V_g \cdot \Delta p}{24 \cdot \pi \cdot \eta_{mh}} \quad [\text{lb-ft}] \quad \left(T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad [\text{Nm}] \right) \\
 \text{Power } P = \frac{q_v \cdot \Delta p}{1714 \cdot \eta_t} \quad [\text{HP}] \quad \left(P = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \quad [\text{kW}] \right)
 \end{array}$$

V_g = Displacement per revolution in in³ (cm³)
 Δp = Differential pressure in psi (bar)
 n = Speed in rpm (min⁻¹)
 η_v = Volumetric efficiency
 η_{mh} = Mechanical-hydraulic efficiency
 η_t = Total efficiency

MA10V0/VSO Series 52

Performance Information



MA10V0/VSO Series 52

Model Code Breakdown

MA10V(S) - O - 45 - DR - 52 - R - P - S - C - 62 - N00

Axial Piston Unit

MA10VS = Swash Plate Variable Pump, for Industrial

Modes of Operation

O = Pump, Open Circuit

Displacement Size

cm³/r (in³/r)

45	60
(2.75)	(3.66)

Control Devices

	45	60
DR = Pressure Control	•	•
DRG = G - Remote Control	•	•
DFR = Pressure and Flow Control	•	•
DFR1 = X Channel Plugged	•	•

Series

52 Series

Rotation

R = Clockwise CW

L = Counter-Clockwise CCW

Seals

P = Buna-N (NBR per DIN ISO 1629)

V = FPM (Fluorocarbon) Viton

Shafts

	45	60
S = SAE Splined Shaft	1"	1¼"
U = SAE Splined Shaft, Smaller Size (not for pumps w/Through-drive)	¾"	1"
W = SAE Splined Shaft, Reinforced U-type Shaft	¾"	1"
K = SAE Keyed Shaft	1"	1¼"
P = Parallel w/Key DIN 6885	25mm	32mm

Through-drive

	45	60
N00 = Without Through-drive	•	•

With through-drive to accept axial piston or gear pump

Mtg. Flange / Shaft/Coupling	45	60
K04 = 101-2 (B) 1" 15T (B-B) A10V45(S,R), 60(U,W)	•	•
K01 = 82-2 (A) 5/8" 9T (A) A10V18(U,W)	•	•
K02 = 101-2 (B) 7/8" 13T (B) A10V28(S,R), 45(U,W)	•	•

Service Ports

Pressure Port B & Suction Port S	45	60
61 = Rear Ports, UNC Mounting Screws	•	•
62 = Opposite Side Ports, UNC Mounting Screws	•	•
11 = Rear Ports, Metric Mounting Screws	•	•
12 = Opposite Side Ports, Metric Mounting Screws	•	•
64 = Rear Ports, UNC Mounting Screws	•	-

Port pos. 61, 11 and 64 only for version without Through-drive

Mounting Flange

	45	60
C = SAE 2-Bolt	4"	4"
A = ISO 2-Bolt	100mm	-
D = SAE 4-Bolt	-	5"

MA10VO/VSO Series 52

Fluid

1. Hydraulic fluid

The MA10V open loop pump in the standard design should be used with a good quality, petroleum based anti-wear hydraulic fluid.

2. Operating viscosity range

$V_{opt} = 16 \text{ mm}^2 / \text{s} \sim 36 \text{ mm}^2 / \text{s}$ (80-170 sus)

For optimum efficiency and service life we recommend that the operating viscosity (at operating temperature) be selected from within the range:

$V_{opt} = \text{opt. operating viscosity } 16 \sim 36 \text{ mm}^2 / \text{s}$

Referred to tank temperature (open loop circuit).

Limits of viscosity range

(The following values are valid for extreme operating conditions):

$V_{min} = 10 \text{ mm}^2 / \text{s}$ (60 sus)

For short periods ($t \leq 1$ minute) at max. leakage oil temperature of 80°C (176°F)

$V_{max} = 1000 \text{ mm}^2 / \text{s}$

For short periods upon cold start

3. Temperature range

$T_{min} = -20^\circ\text{C}$ (-13°F); $T_{max} = +80^\circ\text{C}$ ($+176^\circ\text{F}$)

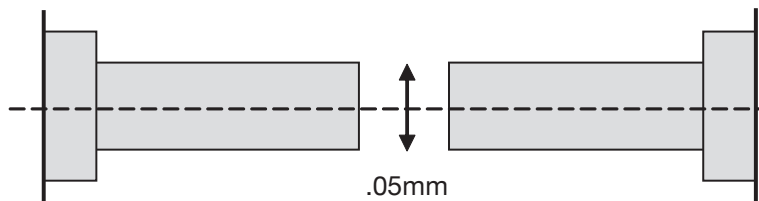
4. Filtration

In order to ensure reliable operation of the axial piston unit, the operating fluid must be maintained to a cleanliness ISO class of at least 16/19 to ISO4406. This may be achieved with filter elements with a cleanliness code of $10\mu\text{m}$.

Installation Note

The pump housing must be filled with clean hydraulic fluid prior to pump start up and remain full during operation.

The concentricity between the prime mover drive shaft and the pump shaft must be less than 0.05 mm (0.002 in).



MA10V0/VSO Series 52

Pump Installation Notes

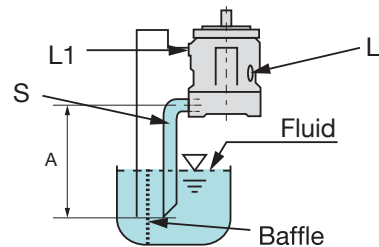
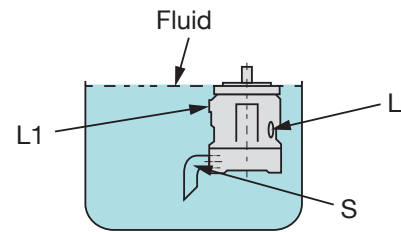
The installation position of the pump is optional.

The pump housing must be filled with fluid both when commissioning and in operation. In order to achieve low noise levels, all connecting lines (inlet, case drain) should be isolated from the tank by flexible lines.

Vertical Installation (Shaft end upwards)

The following conditions should be noted:

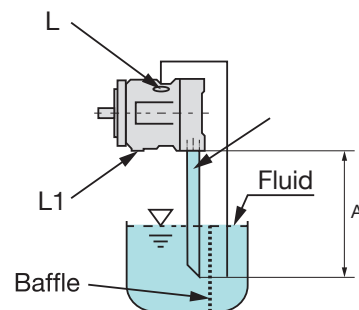
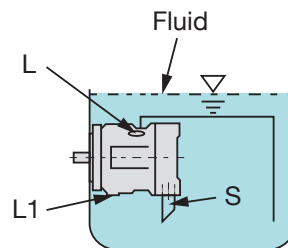
- Before installing the pump inside a tank, fill the pump case with fluid
- Make sure the ports are below the oil level (L), (L1) & S
- Avoid mounting above the tank whenever possible in order to maintain a low noise level
- The permissible inlet height is a result of the overall pressure loss "A" may not be greater than 32 inches (800 mm)



Horizontal Installation

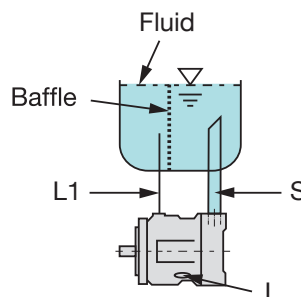
The following conditions should be noted:

- The pump must be installed in such a manner, that either (L) or (L1) (case drain) is at the top
- If the minimum fluid level is below the ports of the pump, pipe the ports (L) or (L1) & S below the minimum oil level
- Avoid mounting above the tank whenever possible in order to maintain a low noise level
- The permissible inlet height (h) is a result of the overall pressure loss, "A" may not be greater than 32 inches (800 mm)



Horizontal Installation (Below the reservoir tank)

- Pipe (L), (L1) and S must be mounted below the oil level



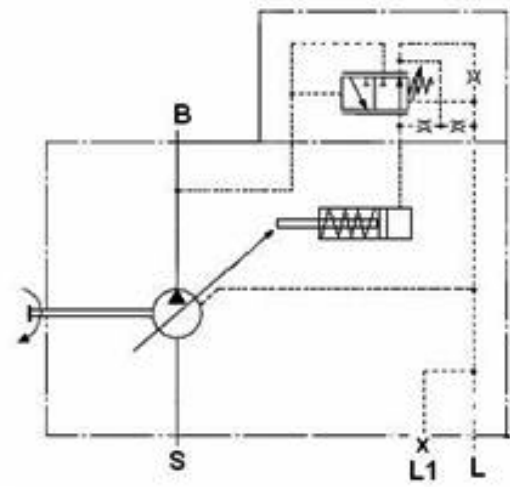
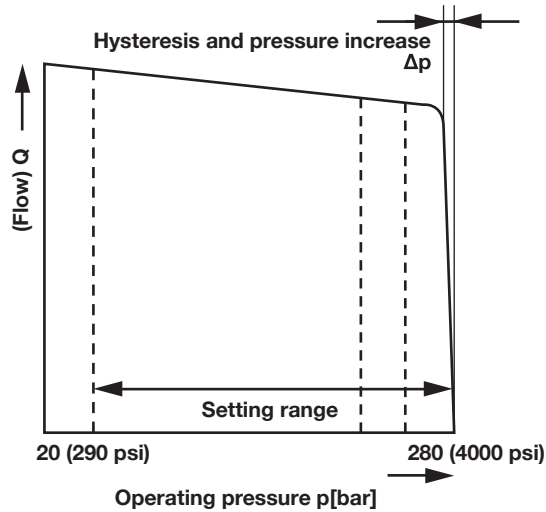
MA10VO/VSO Series 52

DR Pressure Control

The pressure control serves to maintain a constant pressure in the hydraulic system within the control range of the pump. The pump therefore supplies only the amount of hydraulic fluid required by the actuators. Pressure may be smoothly set at the pilot valve.

Static characteristic

(at $n_1 = 1500 \text{ rpm}$; oil temp. = $125^\circ\text{F} / 51^\circ\text{C}$)



B	Pressure Port
S	Suction Port
L, L1	Case Drain Ports (L1 sealed)

Control Data

Hysteresis and repetition accuracy Δpmax. 3 bar (45 psi)

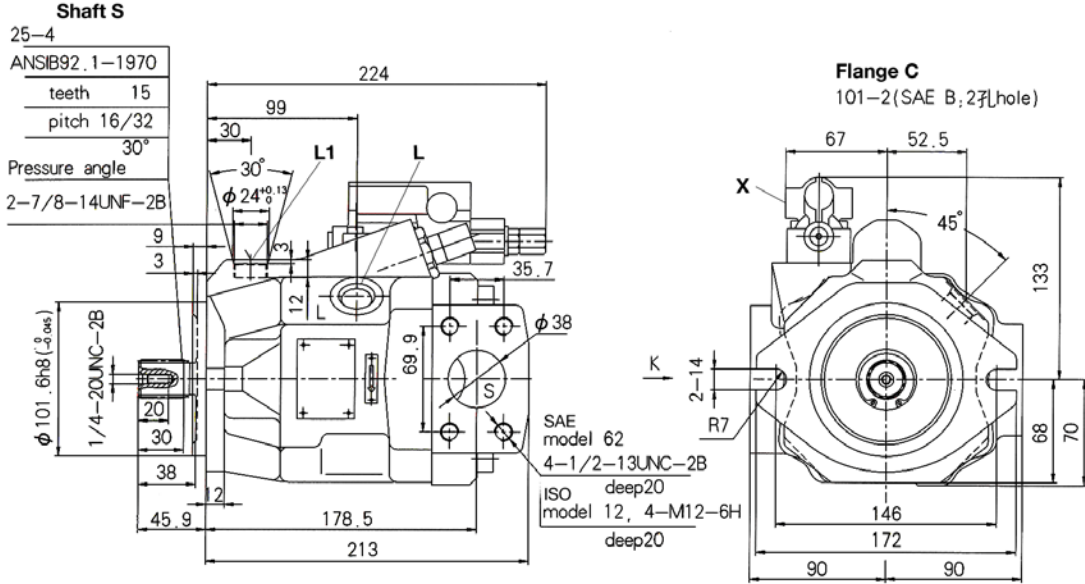
Size	45	60
Δp	6 (87)	8 (116)

Pilot oil consumption.....max. approx. 3 L/min (0.8 gpm)

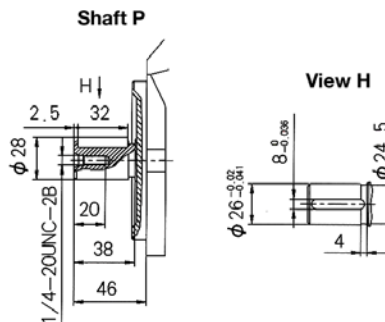
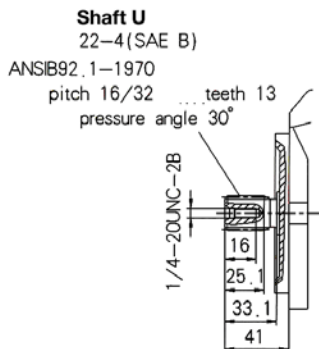
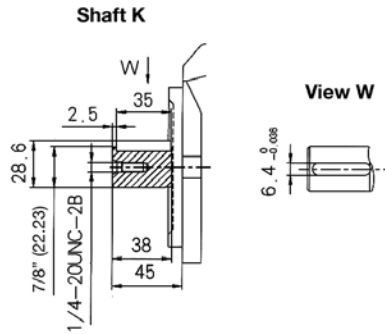
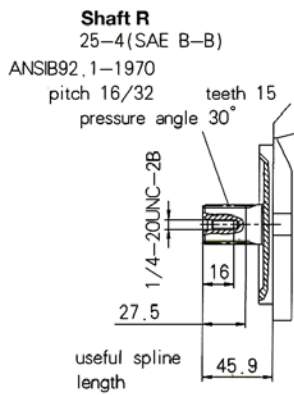
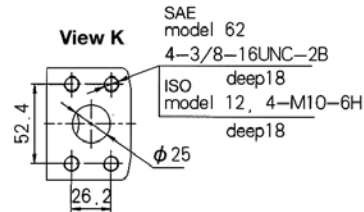
MA10VO/VSO Series 52

Mounting Dimension, Sizes 45

DR Pressure Control (Version: MA10VSO45DR/52R-XXC62/12N00)



Standard Size	
L & L1	X
7/8-14UNF	7/16-30UNF



MA10VO/VSO Series 52

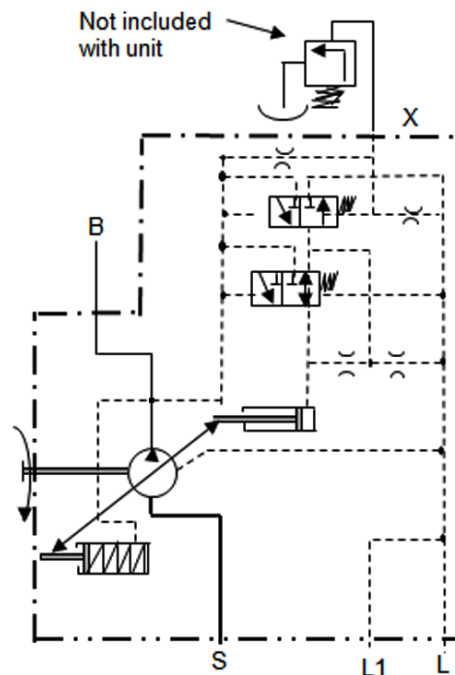
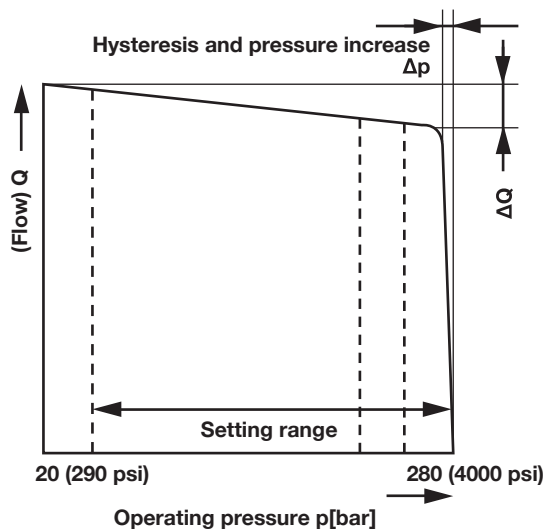
DRG Pressure Control, Remote Control

A pressure relief valve may be externally piped to port X for remote control purposes. It is not, however, included with the DRG control.

The differential pressure at the pilot valve is set as standard to 20 bar (290 psi) and this results in a pilot flow of 1.5 L/min (0.4 gpm). If another setting is required (in the range 10-22 bar), please indicate that specifically and clearly.

The remote pilot valve should be mounted no more than 78in (2 meters) from the pump.

Static characteristic
 (at $n_1 = 1500$ rpm; oil temp. = 125°F / 51°C)



B	Pressure Port
S	Suction Port
L, L1	Case Drain Ports (L1 sealed)
X	Pilot Pressure Port

Control Data

Hysteresis and repetition accuracy Δpmax. 3 bar (45 psi)

Size		45	60
Δp	Bar (psi)	6 (87)	8 (116)

Pilot oil consumption.....max. approx. 4.5 L/min (1.19 gpm)

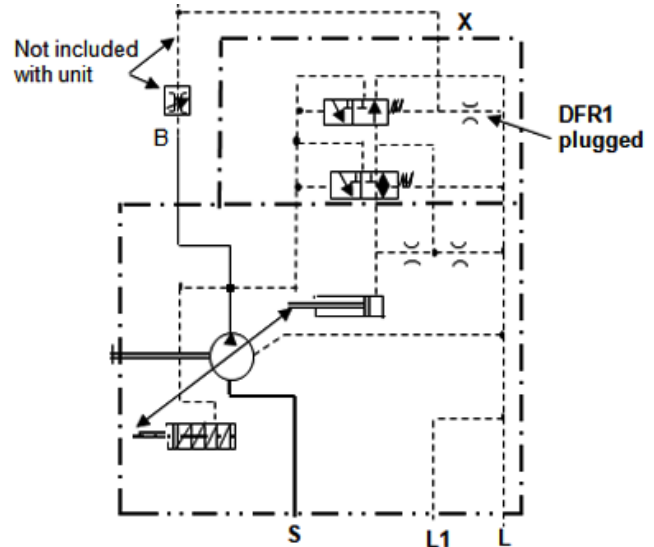
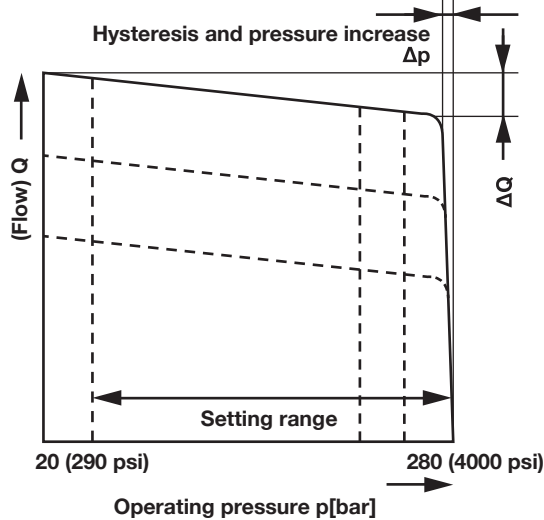
MA10V0/VSO Series 52

DFR/DFR1 Pressure/Flow Control

In addition to the pressure control function, the pump flow may be varied by means of a differential pressure at the actuator (e.g. an orifice).

In model DFR1, the X orifice is plugged.

Static characteristic
(at $n_1 = 1500 \text{ rpm}$; oil temp. = $125^\circ\text{F} / 51^\circ\text{C}$)



B	Pressure Port
S	Suction Port
L, L1	Case Drain Ports (L1 sealed)
X	Pilot Pressure Port

Flow Control/Differential Pressure Δp

Adjustable between 10 and 22 bar (higher values on request).

Standard setting: 14 bar. If a different setting is required, please specify clearly.

When port X is unloaded to tank, a zero stroke pressure ('stand by') of $p = 18 \pm 2 \text{ bar}$ ($260 \pm 30 \text{ psi}$) results.

Control Data

For pressure control technical data see DR pressure control.

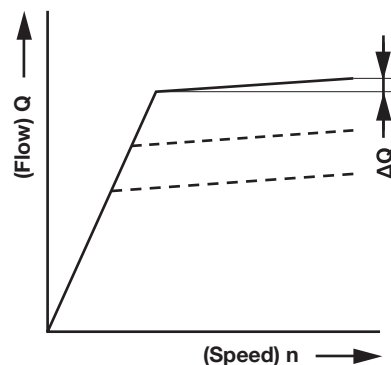
Max. flow deviation (hysteresis and increase) measured at drive speed $n = 1450 \text{ rpm}$.

Size	45	60
$\Delta Q_{\text{max}} \text{ L/min (gpm)}$	1.8 (0.48)	2.8 (0.74)

Pilot oil consumption DFR.....max. approx. 3-4.5 L/min (0.70-1.19 gpm)

Pilot oil consumption DFR1.....max. approx. 3 L/min (0.70 gpm)

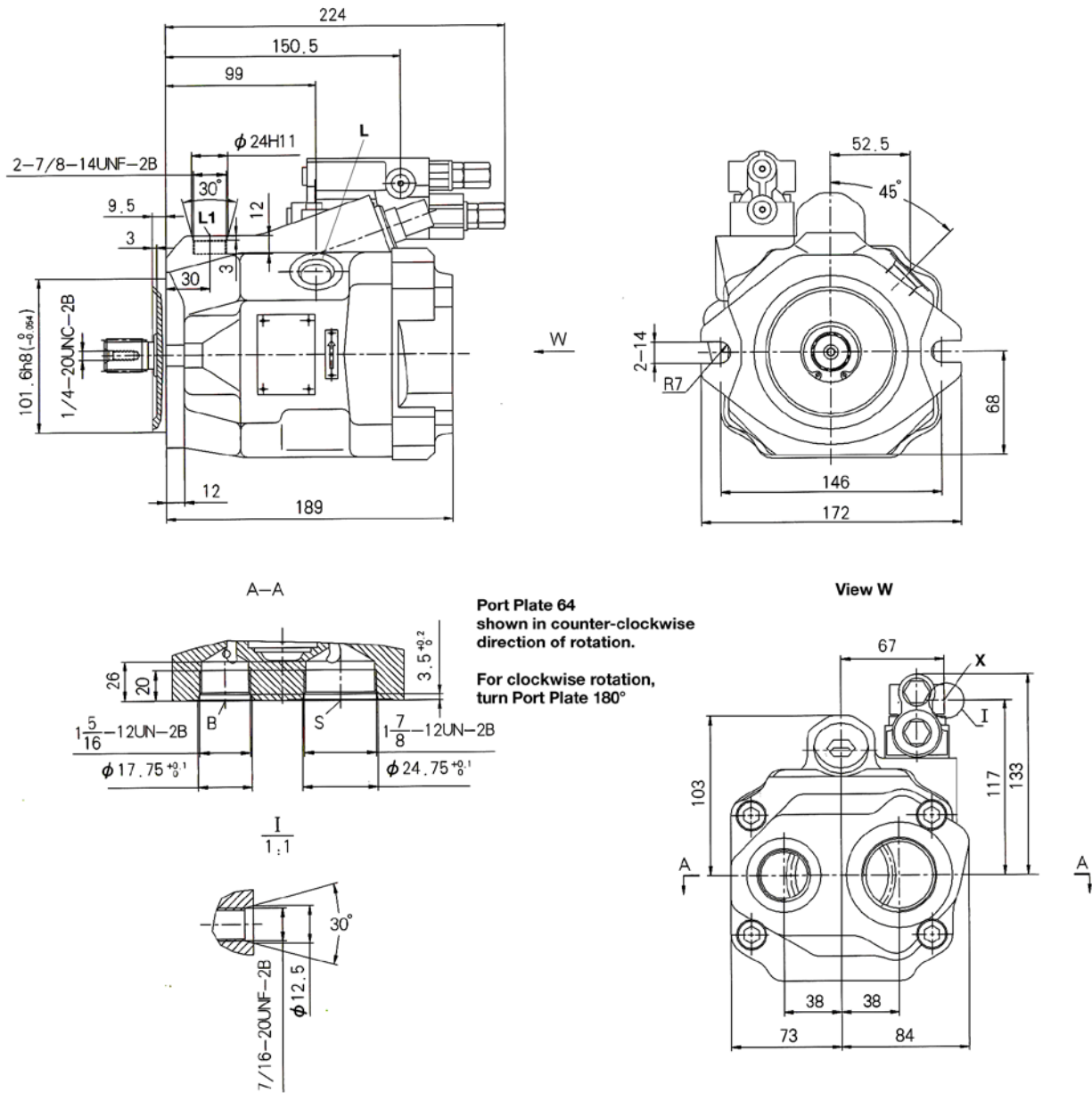
Static characteristic at variable speed



MA10VO/VSO Series 52

Mounting Dimension, Sizes 45

DFR, DFR1 & DRG Controls (Version: MA10VSO45^{***}/52L-XXC64N00)



Standard Size	
L & L1	X

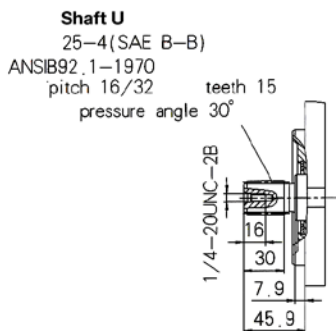
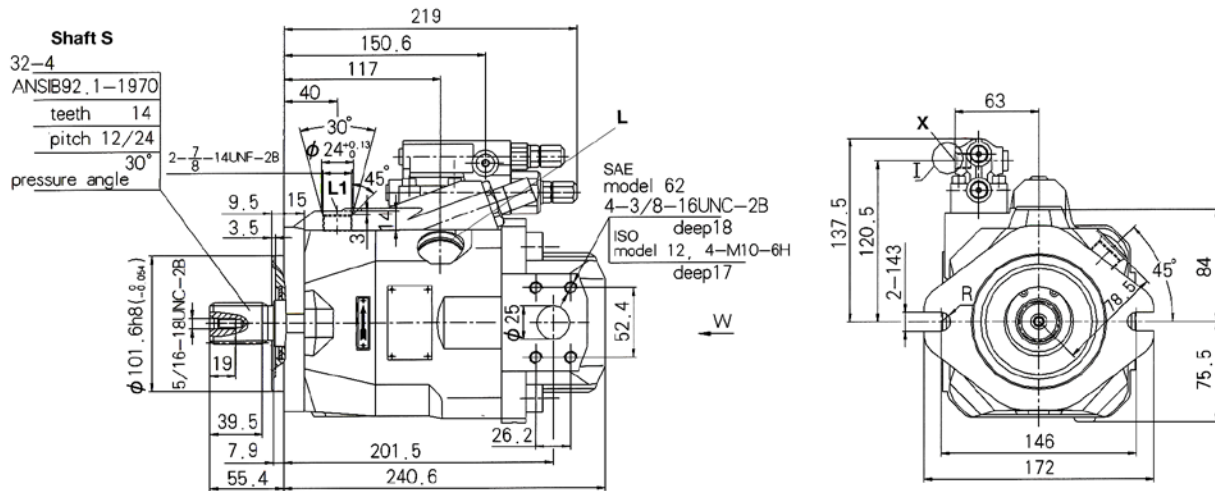
7/8-14UNF

7/16-30UNF

MA10VO/VSO Series 52

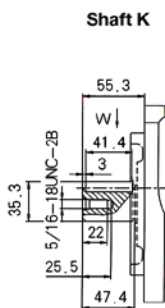
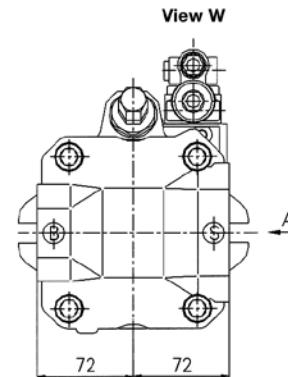
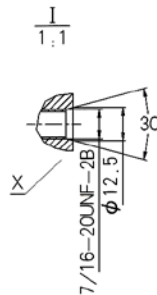
Mounting Dimension, Sizes 60

DFR, DFR1 & DRG Controls (Version: MA10VSO60***/52L-XXC62/12N00)

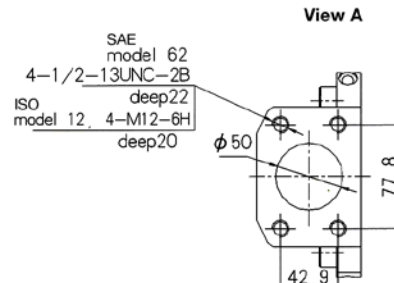
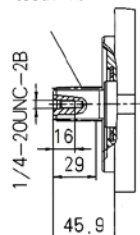


Port Plate 62/12
shown in counter-clockwise
direction of rotation.

For clockwise rotation,
turn Port Plate 180°



Shaft W
25-4 (SAE B-B)
ANSI B92.1-1970
pitch 16/32 teeth 15



Standard Size

L & L1

X

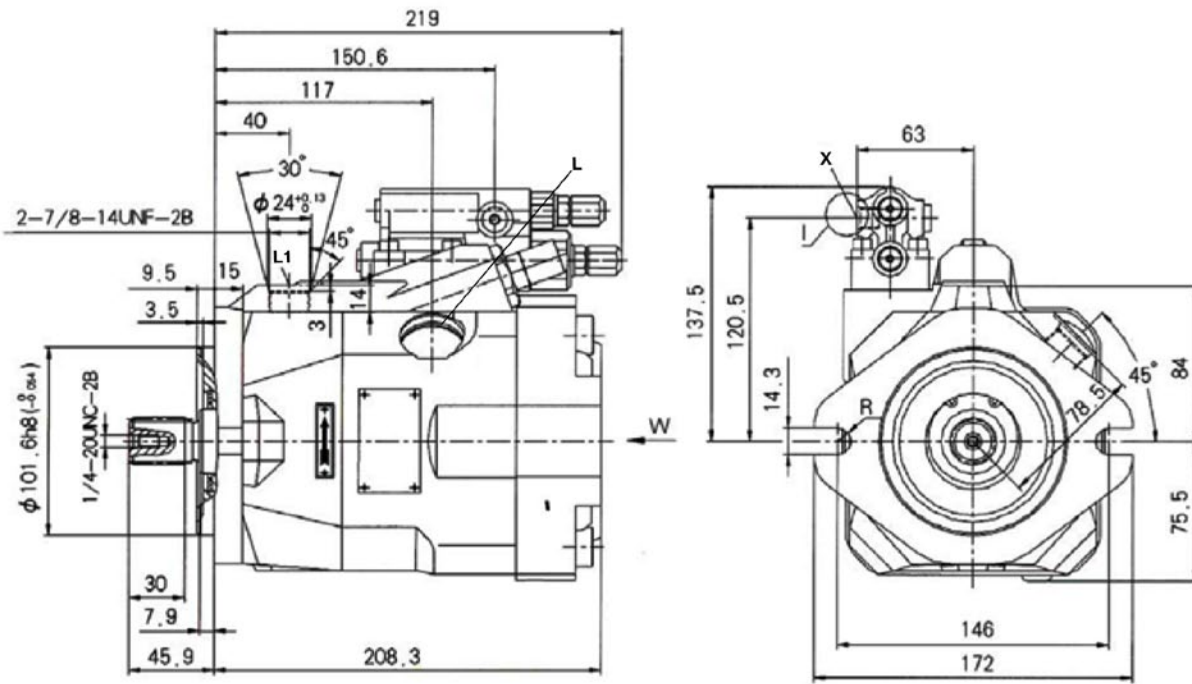
7/8-14UNF

7/16-30UNF

MA10VO/VSO Series 52

Mounting Dimension, Sizes 60

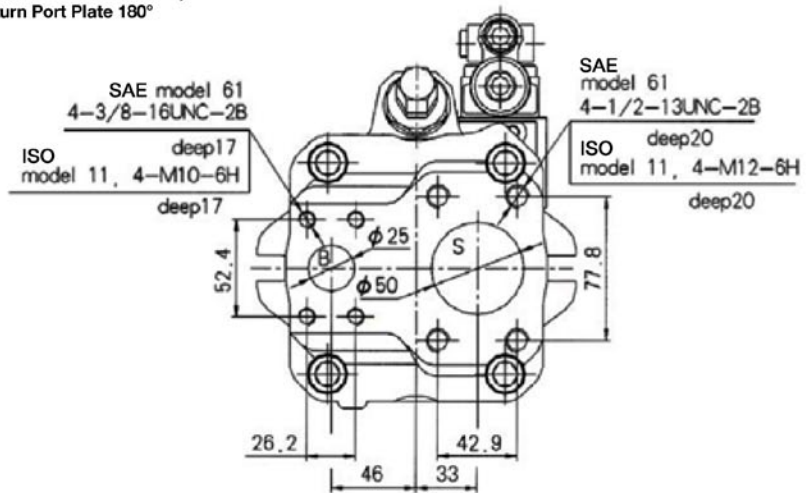
DFR, DFR1 & DRG Controls (Version: MA10VSO60***/52L-XXC61/11N00)



Port Plate 61/11
 shown in counter-clockwise
 direction of rotation.

For clockwise rotation,
 turn Port Plate 180°

View W



Standard Size	
L & L1	X

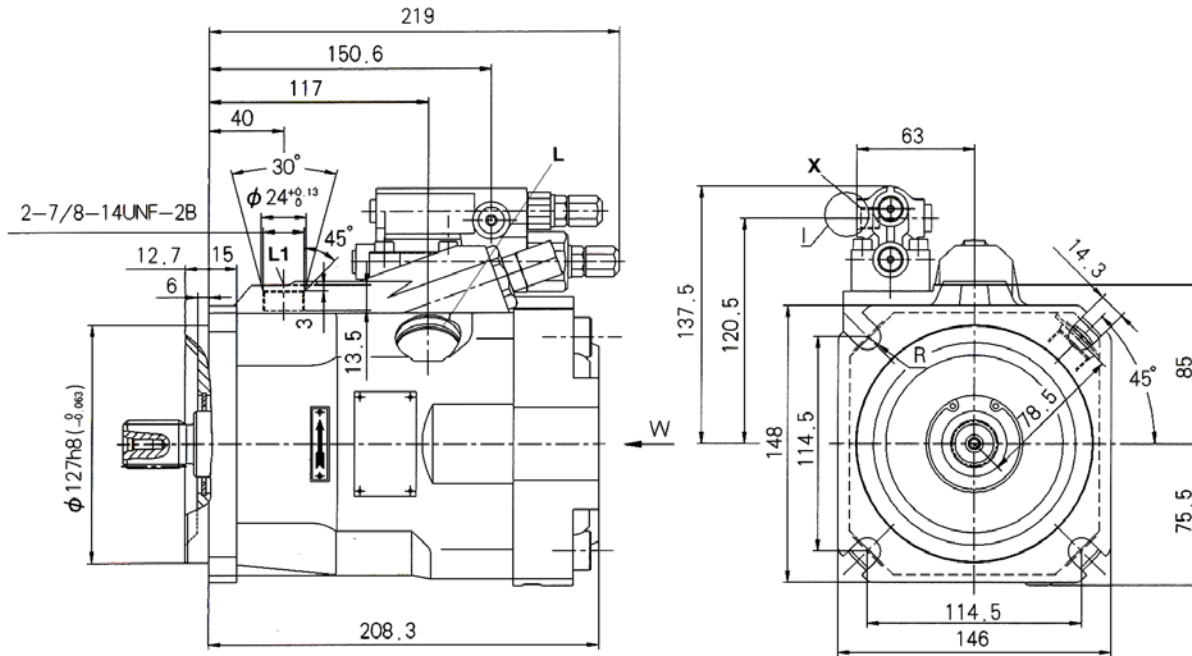
7/8-14UNF

7/16-30UNF

MA10V0/VSO Series 52

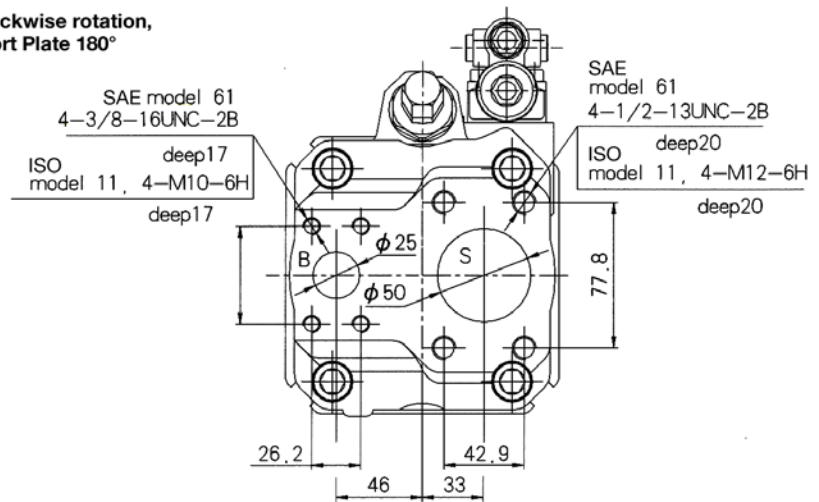
Mounting Dimension, Sizes 60

DFR, DFR1 & DRG Controls (Version: MA10VSO60***/52L-XXD61/11N00)



Port Plate 61/11
shown in counter-clockwise
direction of rotation.

For clockwise rotation,
turn Port Plate 180°



Standard Size	
L & L1	X

7/8-14UNF

7/16-30UNF

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