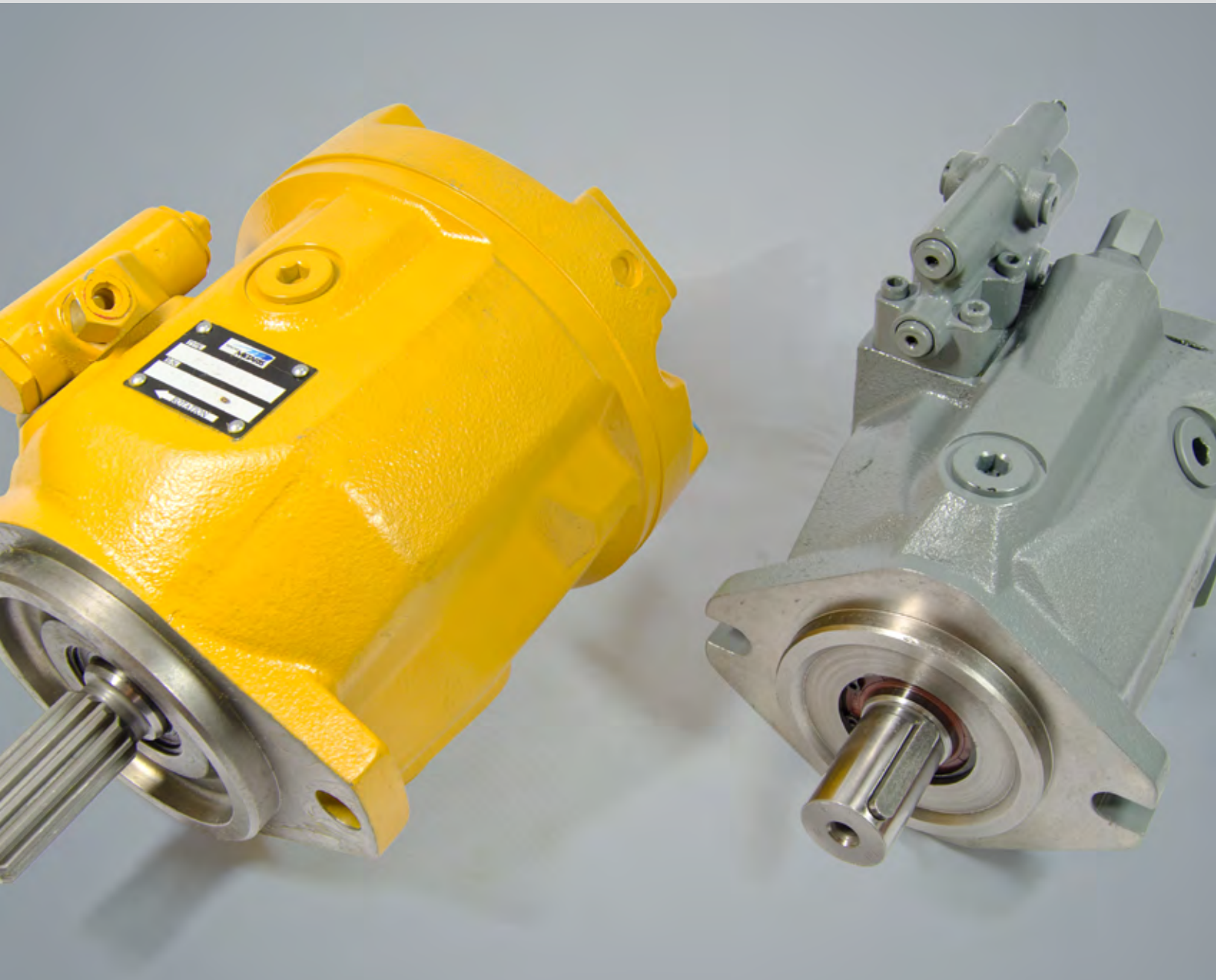
HYDRAULEX
The Right Replacement, Right Now®

Genuine Metaris MA10VO/VSO Technical Catalog

Variable Displacement Piston Pump - A10V Series 31 & 52



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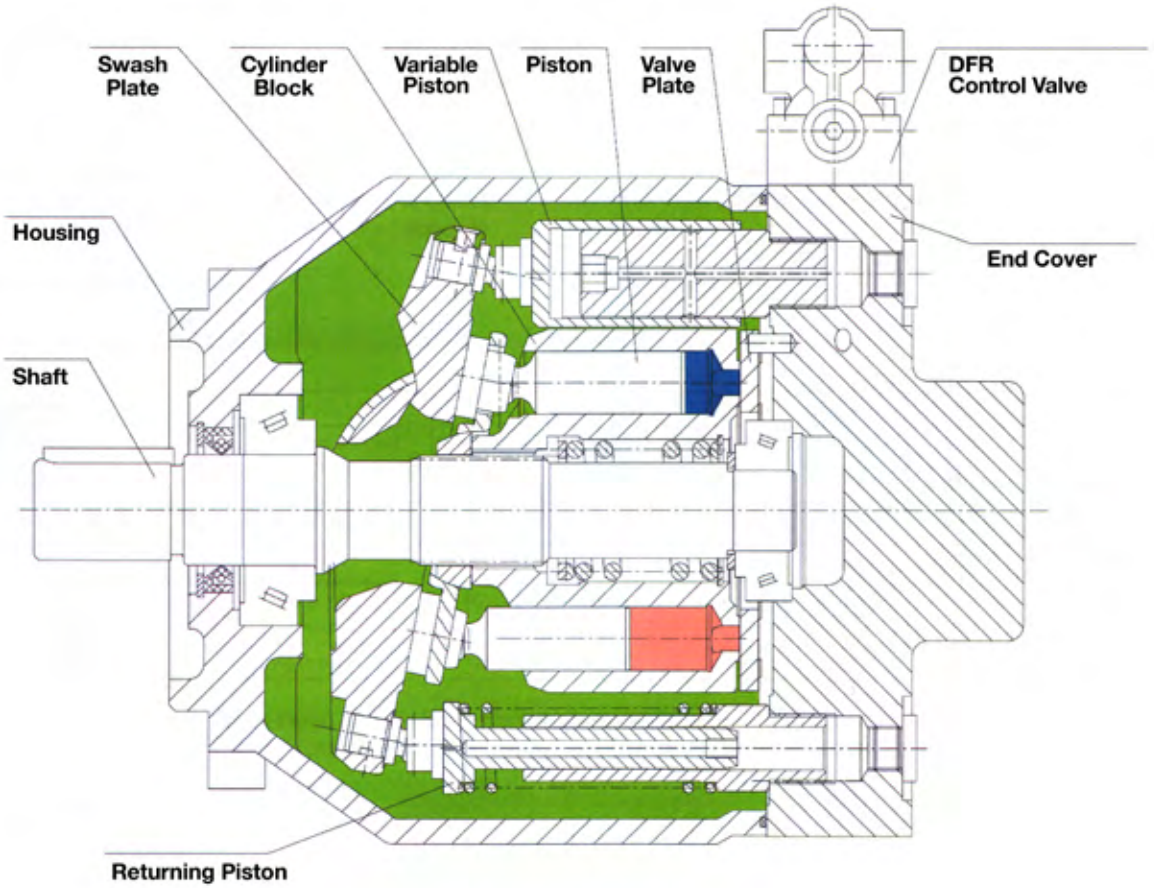
MA10VO/VSO Series 31

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

1. 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)

2. Output operating pressure range

   Pressure at port B

   Nominal pressure P_N.....4000 psi (280 bar)

   Peak pressure P_{max}.....5070 psi (350 bar)

3. 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.

4. Direction of flow

   ("S" inlet port to "B" pressure port)

5. Table of values (theoretical values, without considering η_{mh} and η_v ; values rounded)

Size			18	28	45	71	100	140
Displacement	V_{gmax}	cm³/rev (in³/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 Δp = 4000 psi (280 bar)	P_{omax}	kW (HP)	28 (36.6)	39 (51)	55 (72)	73 (96)	93 (124)	118 (156)
Max. Torque Δp = 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

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

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

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

V_g = Displacement per revolution in in³ (cm³)

Δp = Differential pressure in psi (bar)

n = Speed in rpm (min^{-1})

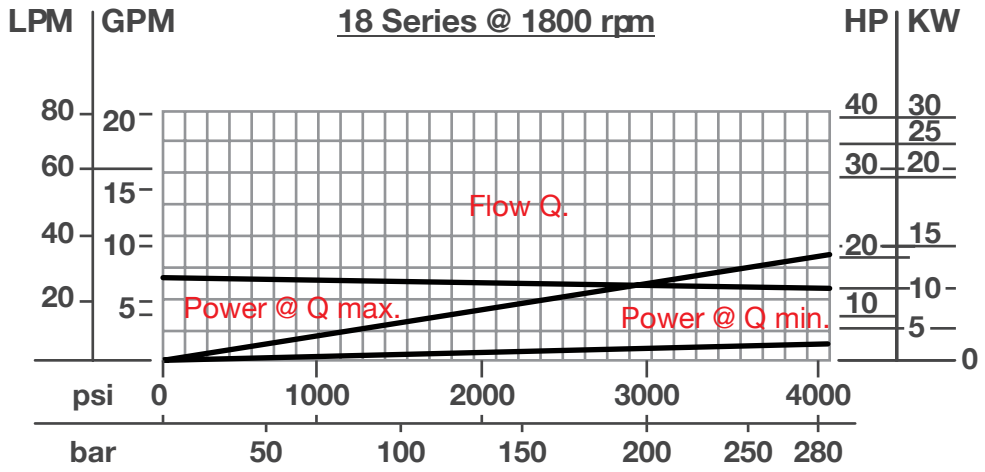
η_v = Volumetric efficiency

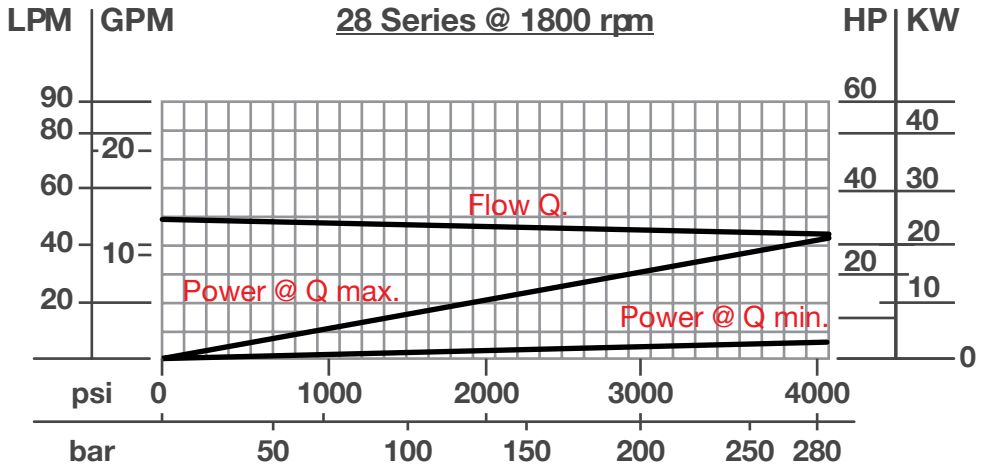
η_{mh} = Mechanical-hydraulic efficiency

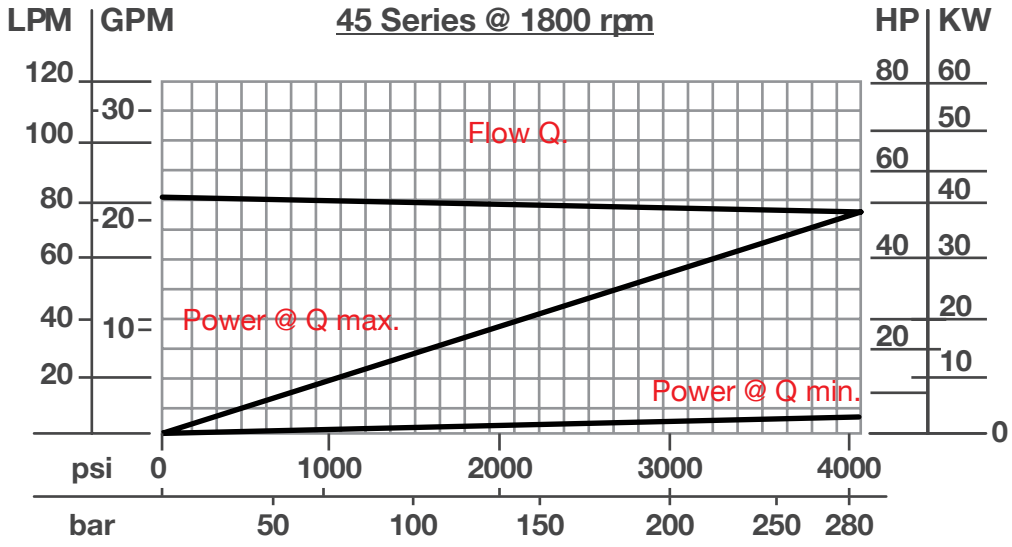
η_t = Total efficiency

MA10VO/VSO Series 31

Performance Information

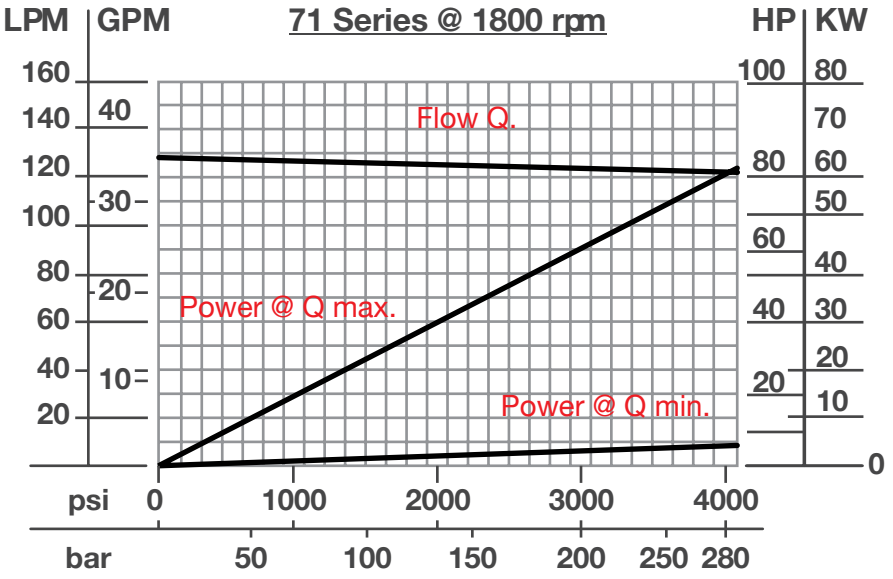


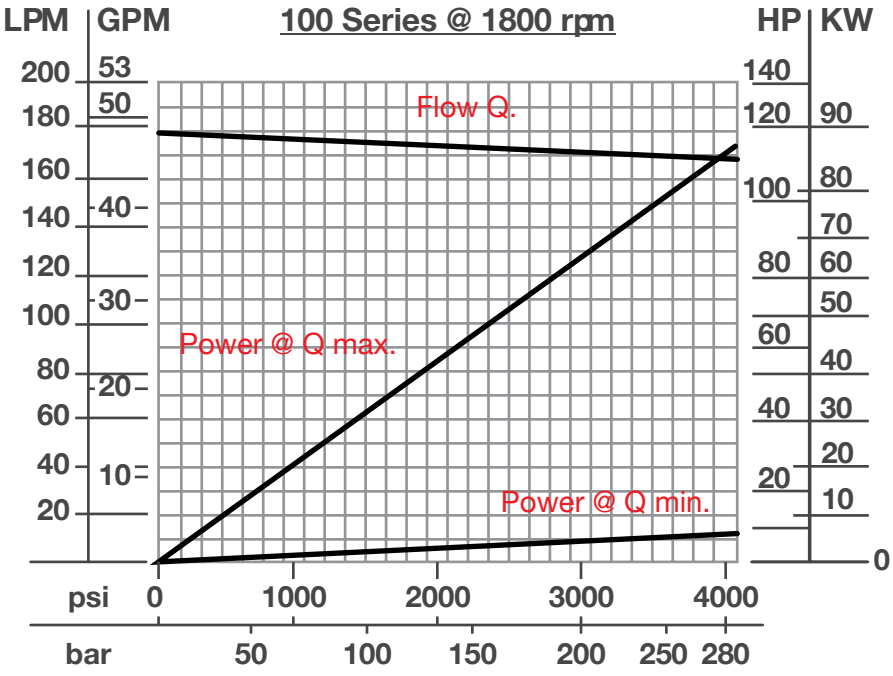




MA10VO/VSO Series 31

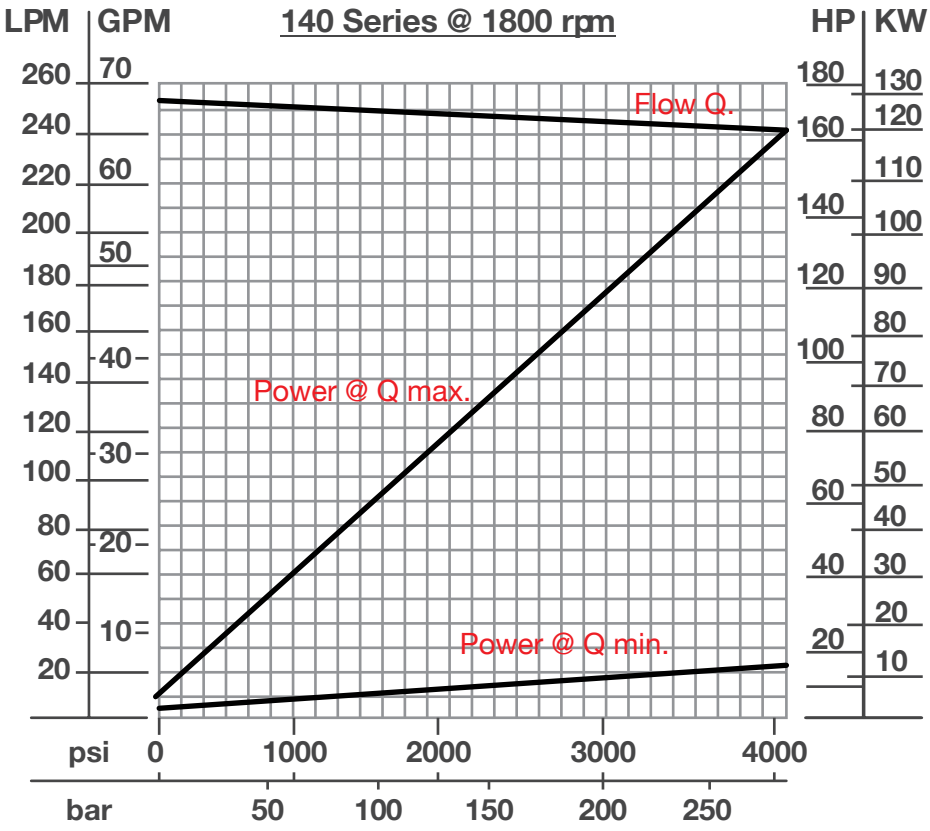
Performance Information





MA10VO/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 (1.10)	28 (1.71)	45 (2.75)	71 (4.33)	100 (6.10)	140 (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	¾"	⅞"	1"	1¼"	1½"	1¾"
R = SAE Splined Shaft, Reinforced (Higher Through-drive Torques)	¾"	⅞"	1"	1¼"	1½"	-
U = SAE Splined Shaft, Smaller Size (not for pumps w/Through-drive)	⅝"	-	⅞"	-	1¼"	-
W = SAE Splined Shaft, Reinforced U-type Shaft	-	-	⅞"	-	1¼"	-
K = SAE Keyed Shaft	¾"	⅞"	1"	1¼"	1½"	1¾"
P = Parallel w/Key DIN 6885	18mm	22mm	25mm	32mm	40mm	45mm

Mounting Flange

	18	28	45	71	100	140
C = SAE 2-Bolt	3¼"	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) ⅝" 9T (A) A10V18(U,W)	•	•	•	•	•	•
K02/K68 = 101-2 (B) ⅞" 13T (B) A10V28(S,R), 45(U,W)	-	•	•	•	•	•
K07 = 127-2 (C) 1¼" 14T (C) A10V71(S,R), 100(U,W)	-	-	-	•	•	•
K24 = 127-2 (C) 1½" 17T (C-C) A10V100(S,R), 85(S)	-	-	-	-	•	•
K17 = 152-4 (D) 1¾" 13T (D) A10V140(S,R)	-	-	-	-	-	•
KB7 = ISO 3019-2 1¾" 13T (D) A10V140(S,R)	-	-	-	-	-	•

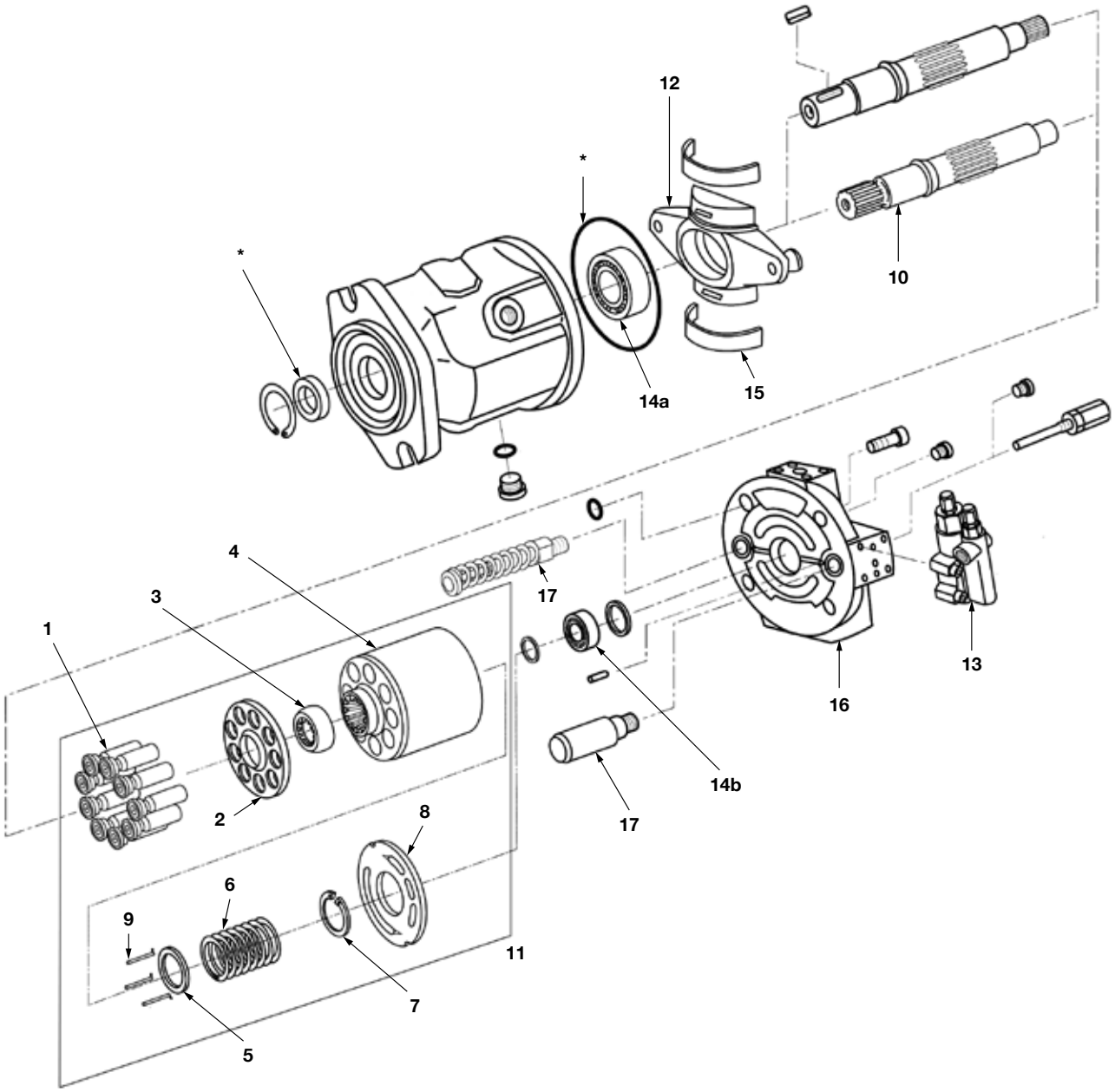
Service Ports

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] MA10VO71 = 8 threaded holes on pressure port code 11, 61, 12 & 62

MA10VO/VSO Series 31

Parts Breakdown



MA10VO/VSO, Size 18, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
1	PISTON (EACH)	9 REQ.	B18-72-110	M925458
2	RETAINER PLATE	1	B18-75-300	M946784
3	BALL GUIDE	1	B18-75-300	M944741
4	BARREL	1	B18-73-000	M940734
5	SPRING - SEAT	1	B18-78-000	M934827
6	SPRING	1	B18-76-100	M933409
7	RETAINER	1	X05-02-25120	M934832
8a	LENS PLATE - LEFT	1	B18-74-200	M940732
8b	LENS PLATE - RIGHT	1	B18-74-100	M941477
9	PIN (EACH)	3 REQ.	B18-77-500	M934826
10a	SHAFT (METRIC) - CODE P	1	B18-50-291	M948585
10b	SHAFT (SPLINED) - CODE S	1	B18-50-361	M948588
10c	SHAFT (KEYED) - CODE K	1	B18-50-161	M948587
10d	SHAFT (SPLINED) - CODE U	1	B18-50-311	M932607
10e	SHAFT SPLINED (THRU DRV-CODE S)	1	B18-50-362	M413740
10f	SHAFT KEYED (THRU DRV-CODE P)	1	B18-50-292	M937405
10g	SHAFT METRIC (THRU DRV-CODE K)	1	B18-50-162	M413734
10h	SHAFT METRIC (THRU DRV-CODE R)	1	B18-50-862	M962289
11a	ROTARY GROUP L.H.	1	B18-70-200	M944801
11b	ROTARY GROUP R.H.	1	B18-70-100	M940435
12a	YOKE L.H.	1	B18-43-210	M960983/ M960809
12b	YOKE R.H.	1	B18-43-110	M948592
13a	CONTROLLER (DFR)***	1	B00-30-100	M907094/ M942581
13b	CONTROLLER (DFR1)***		B00-30-200	M907096
13c	CONTROLLER (DRG)***	1	B00-30-400	M916069
13d	CONTROLLER (DR)***	1	B00-30-300	M907095
13e	CONTROLLER (DG)***	1	B00-30-600	M910921874
14a	SHAFT BEARING - CUP/CONE	1	X03-33-12245	M70109-005
14b	REAR BEARING - CUP/CONE	1	MPN101572	M772968
15	SADDLE BEARING (EACH)	2 REQ.	B18-03-602	M925255
16a	THRU DRIVE COVER K01 (RH)	1	B18-23-123	M945500
16b	THRU DRIVE COVER K01 (LH)	1	B18-23-223	M937407
16c	THRU DRIVE COVER K01 (RH) metric ported	1	B18-23-323	
16d	THRU DRIVE COVER K01 (LH) metric ported	1	B18-23-423	
17	CONTROL PISTON ASSY	1	B18-40-502	M940417
	COUPLING K01	1	B18-50-512	M937150
	KEY FOR SHAFT (CODE K) SAE	1	X01-01-50629	

*** *Controller included with pump*

MA10VO/VSO, Size 18, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
	KEY FOR SHAFT (CODE P) METRIC	1	X01-01-60625	
	SHIM KIT	1	B18-92-000	
*	SEAL KIT	1	B18-80-100	M937565
*	SEAL KIT - VITON	1	B18-80-200	M941171

MA10VO/VSO, Size 28, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
1	PISTON (EACH)	9 REQ.	B28-72-110	M925459 / M967658
2	RETAINER PLATE	1	B28-75-300	M942514
3	BALL GUIDE	1	B28-75-300	M944743
4	BARREL	1	B28-73-000	M907125 / M2407325
5	SPRING - SEAT	1	X05-04-33150	M2400717 / M918933
6	SPRING	1	B28-76-100	M924891
7	RETAINER	1	B28-78-000	M939048 / M2400716
8a	LENS PLATE - LEFT	1	B28-74-200	M936647
8b	LENS PLATE - RIGHT	1	B28-74-100	M936648
9	PIN (EACH)	3 REQ.	B28-77-500	M785407
10a	SHAFT METRIC (CODE P)	1	B28-50-291	M923797 / M2415569
10b	SHAFT SPLINED (CODE S)	1	B28-50-321	M947780 / M923789
10c	SHAFT KEYED (CODE K)	1	B28-50-121	M926330
10d	SHAFT KEYED (CODE T)	1	B28-50-731	M989033
10e	SHAFT SPLINED (THRU DRIVE CODE S)	1	B28-50-322	M926327 / M2417371
10f	SHAFT METRIC (THRU DRIVE CODE P)	1	B28-50-292	M925275 / M2415913
10g	SHAFT KEYED (THRU DRIVE CODE K)	1	B28-50-122	M926328
10h	SHAFT SPLINED (THRU DRIVE CODE R)	1	B28-50-822	M962290
11a	ROTARY GROUP L.H.	1	B28-70-200	M947782 / M958654
11b	ROTARY GROUP R.H.	1	B28-70-100	M947781
12a	YOKE L.H.	1	B28-43-210	M960999/ M947785
12b	YOKE R.H.	1	B28-43-110	M960813 /M903859
12c	YOKE LH DFLR	1	B28-43-220	M947785
12d	YOKE RH DFLR	1	B28-43-120	M947783
13a	CONTROLLER (DFR)***	1	B00-30-100	M907094/ M942581
13b	CONTROLLER (DFR1)***	1	B00-30-200	M907096
13c	CONTROLLER (DRG)***	1	B00-30-400	M916069
13d	CONTROLLER (DR)***	1	B00-30-300	M907095
13e	CONTROLLER (DG)***	1	B00-30-600	M910921874
14a	SHAFT BEARING - CUP/CONE	1	X03-33-12556	M70109-001
14b	REAR BEARING - CUP/CONE	1	X03-33-11740	M70109-002
15	SADDLE BEARING (EACH)	2 REQ	B28-03-602	M902778 / M942158
16a	THRU DRIVE COVER K01 (RH)	1	B28-23-124	M5120-542-005
16b	THRU DRIVE COVER K02 / K03 (RH)	1	B28-24-124	M5120-542-006
16c	THRU DRIVE COVER K01 (LH)*	1	B28-23-224	M5120-542-002
16d	THRU DRIVE COVER K02 / K03 (LH)	1	B28-24-224	M5120-542-003
17	CONTROL PISTON ASSY	1	B28-40-502	MBH00911164

*** *Controller included with pump*

MA10VO/VSO, Size 28, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
	FEEDBACK CONTROL PISTON	1	B00-30-520	
	COUPLING K01	1	B28-50-512	MBH00943539
	COUPLING K02	1	B28-50-522	MBH00943542
	COUPLING K03	1	B28-50-622	M764981
	KEY FOR SHAFT (CODE K) SAE	1	X01-01-60629	
	KEY FOR SHAFT (CODE P) METRIC	1	X01-01-60630	
	SHIM KIT	1	B28-92-000	
*	SEAL KIT	1	B28-80-100	M915845
*	SEAL KIT - VITON	1	B28-80-200	M915845V

MA10VO/VSO, Size 45, Series 31 & 52

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
1	PISTON (EACH)	9 REQ.	B45-72-110	M925460 / M963893
2	RETAINER PLATE	1	B45-75-300	M943627 / M978872
3	BALL GUIDE	1	B45-75-300	M941318
4	BARREL	1	B45-73-000	M907001
5	SPRING - SEAT	1	B45-78-000	M2400727 / M939056
6	SPRING	1	B45-76-100	M2400724 / M071072
7	RETAINER	1	X05-04-38150	M2400726 / M912520
8a	LENS PLATE - LEFT	1	B45-74-200	M936644
8b	LENS PLATE - RIGHT	1	B45-74-100	M936645
9	PIN (EACH)	3 REQ.	B45-77-500	M941277
10a	SHAFT SPLINED (CODE U)	1	B45-50-321	M987649 / M926325
10b	SHAFT SPLINED (CODE S)	1	B45-50-331	M923309 / M947729
10c	SHAFT KEYED (CODE K)	1	B45-50-131	M923308 / M947788
10d	SHAFT METRIC (CODE P)	1	B45-50-291	M923742 / M947820
10e	SHAFT KEYED (CODE T)	1	B45-50-731	M2417384
10f	SHAFT SPLINED (THRU DRIVE CODE R)	1	B45-50-832	M962291/ M2417400
10g	SHAFT SPLINED (THRU DRIVE CODE U)	1	B45-50-322	M926326 / M2417398
10h	SHAFT KEYED (THRU DRIVE CODE K)	1	B45-50-132	M926335
10j	SHAFT SPLINED (THRU DRIVE CODE S)	1	B45-50-332	M923743
10k	SHAFT SPLINED (THRU DRV-CODE W)	1	B45-50-822	M902417398
10l	SHAFT KEYED (THRU DRIVE METRIC CODE P)	1	B45-50-292	M923310
11a	ROTARY GROUP L.H.	1	B45-70-200	M947789 / M914154
11b	ROTARY GROUP R.H.	1	B45-70-100	M947730 / M900510
12a	YOKE L.H. (52 Design)	1	B46-43-210	M929316
12b	YOKE R.H. (52 Design)	1	B46-43-110	M928665
12c	YOKE L.H. (31 Design)	1	B45-43-210	M947791
12d	YOKE R.H. (31 Design)	1	B45-43-110	M904992
12e	YOKE L.H. (31 Design) -DFLR	1	B45-43-220	M961026
12f	YOKE R.H. (31 Design) - DFLR	1	B45-43-120	M947790
13a	CONTROLLER (DFR)***	1	B00-30-100	M907094/ M942581
13b	CONTROLLER (DFR1)***	1	B00-30-200	M907096
13c	CONTROLLER (DRG)***	1	B00-30-400	M916069
13d	CONTROLLER (DR)***	1	B00-30-300	M907095
13e	CONTROLLER (DG)***	1	B00-30-600	M910921874
14a	SHAFT BEARING - CUP/CONE	1	X03-33-12957	M70109-004
14b	REAR BEARING - CUP/CONE	1	X03-33-12245	M70109-005
15a	SADDLE BEARING - 31 design (EACH)	2 REQ	B45-03-602	M900198

*** *Controller included with pump*

MA10VO/VSO, Size 45, Series 31 & 52

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
15b	SADDLE BEARING - 52 design (EACH)	2 REQ	B46-03-602	M933793
16a	THRU DRIVE COVER K01 (RH)	1	B45-23-135	M5130-542-006
16b	THRU DRIVE COVER K02 / K03 / K04 (RH)	1	B45-24-135	M5130-542-007
16c	THRU DRIVE COVER K01 (LH)	1	B45-23-235	M5130-542-002
16d	THRU DRIVE COVER K02 / K03 / K04 (LH)	1	B45-24-235	M5130-542-003
16e	THRU DRIVE COVER (45/52) KP1 ISO (RH)	1	B46-23-335	
16f	THRU DRIVE COVER (45/52) KP1 ISO (LH)	1	B46-23-435	
16g	THRU DRIVE COVER (45/52) K02 (LH)	1	B46-24-435	
16h	THRU DRIVE COVER (45/52) K02 (BI)	1	B46-24-735	
17	CONTROL PISTON ASSY - 31 design	1	B45-40-501	MBH00910852
	FEEDBACK CONTROL PISTON	1	B00-30-520	B00-30-520
	COUPLING K01	1	B45-50-512	MBH00943529
	COUPLING K02	1	B45-50-522	MBH00943531
	COUPLING K03	1	B45-50-622	M763764
	COUPLING K04	1	B45-50-532	MBH00738476
	COUPLING K05	1	B45-50-632	M766933
	KEY FOR SHAFT (CODE K) SAE	1	X01-01-60635	M751137
	KEY FOR SHAFT (CODE P) METRIC	1	X01-01-70836	
	SHIM KIT	1	B45-92-000	
*	SEAL KIT - 31 Design	1	B45-80-100	M925885
*	SEAL KIT - VITON - 31 Design	1	B45-80-200	M925885V
*	SEAL KIT - 52 Design	1	B46-80-100	M963478
*	SEAL KIT - VITON - 52 Design	1	B46-80-200	M963478V

MA10VO/VSO, Size 60, Series 52

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
1	PISTON (EACH)	9 REQ.	B60-72-110	M2418043
2	RETAINER PLATE	1	B60-75-300	M2413087
3	BALL GUIDE	1	B60-75-300	M973533
4	BARREL	1	B60-73-000	M973540
5	SPRING - SEAT	1	B60-78-000	M2400742
6	SPRING	1	B60-76-100	M975251
7	RETAINER	1	MPN107182	M9156218
8a	LENS PLATE - LEFT	1	B60-74-200	M2451807
8b	LENS PLATE - RIGHT	1	B60-74-100	M978570
9	PIN (EACH)	3 REQ.	B60-77-500	M2400741
10a	SHAFT SPLINED (CODE S)	1	B60-50-341	M2413417
10b	SHAFT SPLINED (CODE U)	1	B60-50-331	M987666
10c	SHAFT KEYED (CODE K)	1	B60-50-141	M2413414
10d	SHAFT SPLINED (THRU DRIVE CODE S)	1	B60-50-342	M994407
10e	SHAFT SPLINED (THRU DRIVE CODE W)	1	B60-50-832	M987665
11a	ROTARY GROUP L.H.	1	B60-70-200	M926276
11b	ROTARY GROUP R.H.	1	B60-70-100	M973744
12a	YOKE L.H (52 Design)	1	B60-43-210	M975095
12b	YOKE R.H (52 Design)	1	B60-43-110	M973545
13a	CONTROLLER (DFR)***	1	B00-30-100	M907094/ M942581
13b	CONTROLLER (DFR1)***	1	B00-30-200	M907096
13c	CONTROLLER (DRG)***	1	B00-30-400	M916069
13d	CONTROLLER (DR)***	1	B00-30-300	M907095
13e	CONTROLLER (DG)***	1	B00-30-600	M910921874
14a	SHAFT BEARING - CUP/CONE	1	X03-33-13573	M70109-007
14b	REAR BEARING - CUP/CONE	1	X03-33-12552	M33205
15a	SADDLE BEARING -R	1	B60-03-612	M2413837
15b	SADDLE BEARING - L	1	B60-03-622	M2413836
17	CONTROL PISTON ASSY	1	B60-40-500	M993694
*	SEAL KIT	1	B60-80-100	M408523
*	SEAL KIT - VITON	1	B60-80-200	M408523V

*** *Controller included with pump*

MA10VO/VSO, Size 71, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
1	PISTON (EACH)	9 REQ.	B71-72-110	M720011 / M924554
2	RETAINER PLATE	1	B71-75-300	M919813
3	BALL GUIDE	1	B71-75-300	M749745
4	BARREL	1	B71-73-000	M907126
5	SPRING - SEAT	1	B71-78-000	M720186
6	SPRING	1	B71-76-100	M720178
7	RETAINER	1	X05-04-45180	M919038
8a	LENS PLATE - LEFT	1	B71-74-200	M936640
8b	LENS PLATE - RIGHT	1	B71-74-100	M936641
9	PIN (EACH)	3 REQ.	B71-77-500	M785423
10a	SHAFT METRIC (CODE P)	1	B71-50-291	M947821 / M995064
10b	SHAFT SPLINED (CODE S)	1	B71-50-341	M923553 / M947796
10c	SHAFT KEYED (CODE K)	1	B71-50-141	M926333 / M2412021
10d	SHAFT SPLINED (THRU DRIVE CODE S)	1	B71-50-342	M923471
10e	SHAFT KEYED (THRU DRIVE CODE K)	1	B71-50-142	M926344 / M2412030
10f	SHAFT METRIC (THRU DRIVE CODE P)	1	B71-50-292	M925556 / M987680
10g	SHAFT SPLINED (THRU DRV-CODE R)	1	B71-50-842	9622292
11a	ROTARY GROUP L.H.	1	B71-70-200	M947802 / M911929
11b	ROTARY GROUP R.H.	1	B71-70-100	M947801 / M956007
12a	YOKE L.H.	1	B71-43-210	M904689
12b	YOKE R.H.	1	B71-43-110	M961017
12c	YOKE LH DFLR	1	B71-43-220	M904689
12d	YOKE RH DFLR	1	B71-43-120	M961017
13a	CONTROLLER (DFR)***	1	B00-30-100	M907094/ M942581
13b	CONTROLLER (DFR1)***	1	B00-30-200	M907096
13c	CONTROLLER (DRG)***	1	B00-30-400	M916069
13d	CONTROLLER (DR)***	1	B00-30-300	M907095
13e	CONTROLLER (DG)***	1	B00-30-600	M910921874
14a	SHAFT BEARING - CUP/CONE	1	X03-33-13573	M70109-007
14b	REAR BEARING - CUP/CONE	1	X03-33-12557	M70109-008
14b	SADDLE BEARING (EACH)	2 REQ	B71-03-602	M902777
**	BEARING KIT	1	B71-03-800	M5140-635-014
16a	THRU DRIVE COVER K07 / K08 (RH)	1	B71-25-196	M5140-542-021
16b	THRU DRIVE COVER K01 (RH)	1	B71-23-196	M5140-542-017
16c	THRU DRIVE COVER K02 / K04 (RH)	1	B71-24-196	M5140-542-019
16d	THRU DRIVE COVER K01 (LH)*	1	B71-23-296	M5140-542-018
16e	THRU DRIVE COVER K02 / K04 (LH)	1	B71-24-296	M5140-542-020

*** Controller included with pump ** Part available (not shown)

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MA10VO/VSO, Size 71, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
16f	THRU DRIVE COVER K07 / K08 (LH)	1	B71-25-296	M5140-542-022
17	CONTROL PISTON ASSY	1	B71-40-501	M910873 / 910870
	FEEDBACK CONTROL PISTON	1	B71-30-520	
	COUPLING K01	1	B71-50-512	MBH00943545
	COUPLING K02	1	B71-50-522	MBH00943547
	COUPLING K03	1	B71-50-622	M795682
	COUPLING K04	1	B71-50-532	MBH00943548
	COUPLING K05	1	B71-50-632	M764906
	COUPLING K07	1	B71-50-542	MBH00943549
	COUPLING K08	1	B71-50-642	M766895
	KEY FOR SHAFT (CODE K) SAE	1	X01-01-80841	
	KEY FOR SHAFT (CODE P) METRIC	1	X01-01-81045	
	SHIM KIT	1	B71-92-000	
*	SEAL KIT	1	B71-80-100	M915846 / M5140-635-005
*	SEAL KIT - VITON	1	B71-80-200	M915846V / M5140-635-007

MA10VO/VSO, Size 100, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
1	PISTON (EACH)	9 REQ.	B10-72-110	M925463 / M2418003
2	RETAINER PLATE	1	B10-75-300	M967136 / M996526
3	BALL GUIDE	1	B10-75-300	M906813 / M944744
4	BARREL	1	B10-73-000	M906882 / M2407207
5	SPRING - SEAT	1	B10-78-000	M906880
6	SPRING	1	B10-76-100	M906894
7	RETAINER	1	X05-02-62200	M791555
8a	LENS PLATE - LEFT	1	B10-74-200	M936639
8b	LENS PLATE - RIGHT	1	B10-74-100	M936661
9	PIN (EACH)	3 REQ.	B10-77-500	M906879
10a	SHAFT SPLINED (CODE U)	1	B10-50-341	M2410600 / M923312
10b	SHAFT SPLINED (CODE S)	1	B10-50-381	M924553 / M987698
10c	SHAFT KEYED (CODE K)	1	B10-50-181	M923317 / M2410595
10d	SHAFT METRIC (CODE P)	1	B10-50-291	M925162 / M987699
10e	SHAFT SPLINED (THRU DRIVE CODE R)	1	B10-50-882	M993523
10f	SHAFT SPLINED (THRU DRIVE CODE W)	1	B10-50-842	M987686
10g	SHAFT METRIC (THRU DRIVE CODE P)	1	B10-50-292	M923709 / M987697
10h	SHAFT KEYED (THRU DRIVE CODE K)	1	B10-50-182	M924552 / M2410605
10j	SHAFT SPLINED (THRU DRIVE CODE S)	1	B10-50-382	M923316
11a	ROTARY GROUP L.H.	1	B10-70-200	M907681 / M948604
11b	ROTARY GROUP R.H.	1	B10-70-100	M948603 / M906871
12a	YOKE L.H.	1	B10-43-210	M948606
12b	YOKE R.H.	1	B10-43-110	M961050
12c	YOKE LH DFLR	1	B10-43-220	M948606
12d	YOKE RH DFLR	1	B10-43-120	M093881
13a	CONTROLLER (DFR)***	1	B00-30-100	M907094/ M942581
13b	CONTROLLER (DFR1)***	1	B00-30-200	M907096
13c	CONTROLLER (DRG)***	1	B00-30-400	M916069
13d	CONTROLLER (DR)***	1	B00-30-300	M907095
13e	CONTROLLER (DG)***	1	B00-30-600	M910921874
14a	SHAFT BEARING - CUP/CONE	1	X03-33-14587	M906908
14b	REAR BEARING - CUP/CONE	1	X03-33-13062	M906909
15	SADDLE BEARING (EACH)	2 REQ	B10-03-602	M906881
17	CONTROL PISTON ASSY	1	B10-40-501	M913784
	FEEDBACK CONTROL PISTON	1	B00-30-520	
16a	THRU DRIVE COVER K01/ K52(RH)	1	B10-23-147	M910375
16b	THRU DRIVE COVER K01/ K52(LH)	1	B10-23-247	910729

**** Controller included with pump*

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MA10VO/VSO, Size 100, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
16c	THRU DRIVE COVER K02 / K04 (RH)	1	B10-24-147	910369
16d	THRU DRIVE COVER K02 / K04 (LH)	1	B10-24-247	
16e	THRU DRIVE COVER K71 / K24 / K08 (RH)	1	B10-25-147	
16f	THRU DRIVE COVER K71 / K24 / K08 (LH)	1	B10-25-247	
	COUPLING K01	1	B10-50-512	M943560
	COUPLING K02	1	B10-50-522	M943562
	COUPLING K04	1	B10-50-532	M943563
	COUPLING K07	1	B10-50-542	M943564
	COUPLING K08	1	B10-50-642	M943569
	COUPLING K24	1	B10-50-582	M943565
	COUPLING K52	1	B10-50-592	M943561
	KEY FOR SHAFT (CODE K) SAE	1	X01-01-90950	
	KEY FOR SHAFT (CODE P) METRIC	1	X01-01-81268	
	SHIM KIT	1	B10-92-000	
*	SEAL KIT	1	B10-80-100	M915847
*	SEAL KIT - VITON	1	B10-80-200	M915847V

MA10VO/VSO, Size 140, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
1	PISTON (EACH)	9 REQ.	B14-72-110	M925464
2	RETAINER PLATE	1	B14-75-300	M996527
3	BALL GUIDE	1	B14-75-300	M944745
4	BARREL	1	B14-73-000	M945341
5	SPRING - SEAT	1	B14-78-000	M917727
6	SPRING	1	B14-76-100	M918171
7	RETAINER	1	X05-02-58200	918189
8a	LENS PLATE - LEFT	1	B14-74-200	M975126
8b	LENS PLATE - RIGHT	1	B14-74-100	M973907 / M975125
9	PIN (EACH)	3 REQ.	B14-77-500	M917728
10a	SHAFT SPLINED (CODE S)	1	B14-50-351	M923593 / M948614
10b	SHAFT KEYED (CODE K)	1	B14-50-151	M923315 / M948513
10c	SHAFT METRIC (CODE P)	1	B14-50-291	M923594 / M948612
10d	SHAFT KEYED (THRU-DRIVE CODE K)	1	B14-50-152	M923314
10e	SHAFT SPLINED (THRU-DRIVE CODE S)	1	B14-50-352	M923595
10f	SHAFT METRIC (THRU-DRIVE CODE P)	1	B14-50-292	M923313
11a	ROTARY GROUP L.H.	1	B14-70-200	M948618
11b	ROTARY GROUP R.H.	1	B14-70-100	M948617
12a	YOKE L.H.	1	B14-43-210	M948620
12b	YOKE R.H.	1	B14-43-110	M948619
12c	YOKE L.H. DFLR	1	B14-43-220	M948620
12d	YOKE R.H. DFLR	1	B14-43-120	M948622
13a	CONTROLLER (DFR/DFR1)***	1	B14-30-100	M924993
13b	CONTROLLER (DRG)***	1	B14-30-400	M928528
13c	CONTROLLER (DR)***	1	B14-30-300	M920182
17	CONTROL PISTON ASSY	1	B14-40-502	M917597
	FEEDBACK CONTROL PISTON	1	B14-30-520	
14a	SHAFT BEARING - CUP/CONE	1	MPN101573	M918203
14b	REAR BEARING - CUP/CONE	1	MPN091749	M32207F
15	SADDLE BEARING (EACH)	2	B14-03-602	M918174
	COUPLING K02	1	B14-50-522	M943552
	COUPLING K04	1	B14-50-532	M938658
	COUPLING K07	1	B14-50-542	M921508
	COUPLING K17	1	B14-50-552	M932172
	KEY FOR SHAFT (CODE K) SAE	1	X01-02-01165	
	KEY FOR SHAFT (CODE P) METRIC	1	X01-01-90979	
	SHIM KIT	1	B14-92-000	

*** *Controller included with pump*

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MA10VO/VSO, Size 140, Series 31

Parts Breakdown

Item	Description	Qty	Metaris Part #	Alt. Part #
*	SEAL KIT	1	B14-80-100	M941169
*	SEAL KIT - VITON	1	B14-80-200	M941169V

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 mm² / s ~ 36 mm² / 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 = opt. operating viscosity 16 ~ 36 mm² / s

   Referred to tank temperature (open loop circuit).

   Limits of viscosity range
   (The following values are valid for extreme operating conditions):

   V min = 10 mm² / s (60 sus)
   For short periods (t ≤ 1 minute) at max. leakage oil temperature of 80°C (176°F)

   V max = 1000 mm² / s
   For short periods upon cold start

3. Temperature range

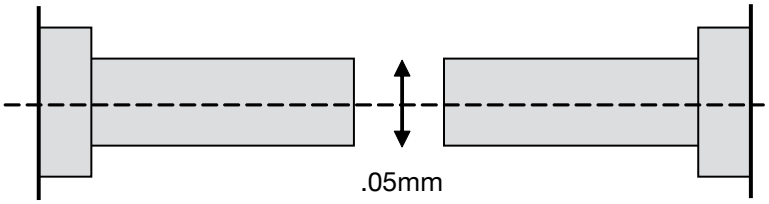
   T min = -20°C (-13°F); T max = +80°C (+176°F)

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 10µm.

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).



MA10VO/VSO Series 31

Pump Installation Notes

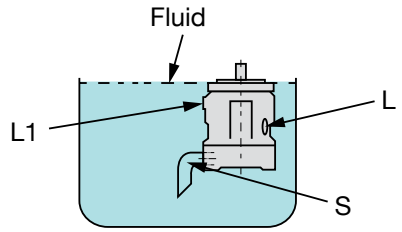
The installation position of the pump is optional.

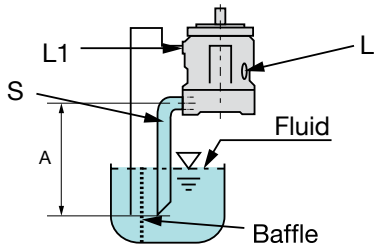
The pump housing must be filled with fluid both when commissioning and in operation. In order to achieve low noise levels, all connecting lines (inlet, case drain) should be isolated from the tank by flexible lines.

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)

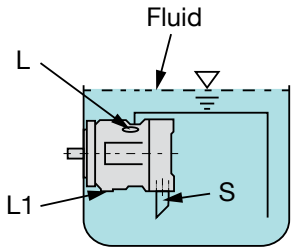


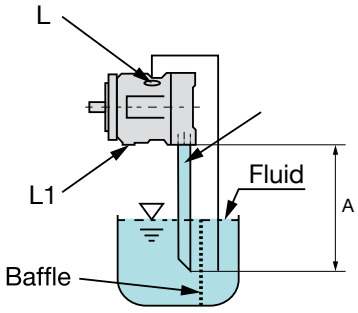


Horizontal Installation

The following conditions should be noted:

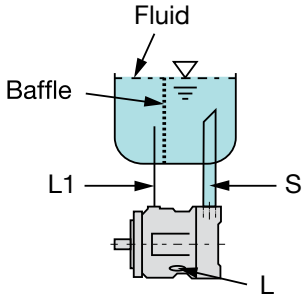
- The pump must be installed in such a manner, that either (L) or (L1) (case drain) is at the top
- If the minimum fluid level is below the ports of the pump, pipe the ports (L) or (L1) & S below the minimum oil level
- Avoid mounting above the tank whenever possible in order to maintain a low noise 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

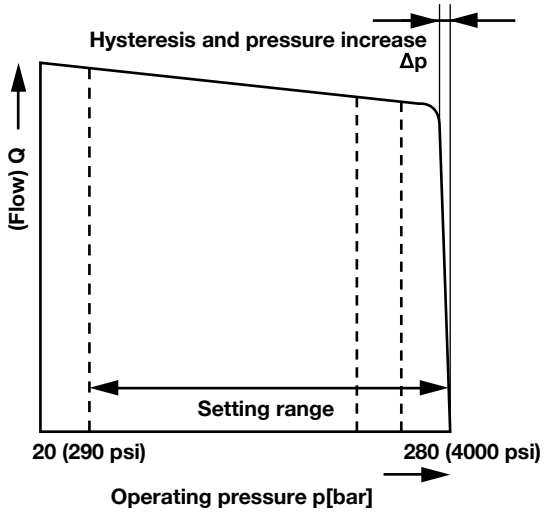


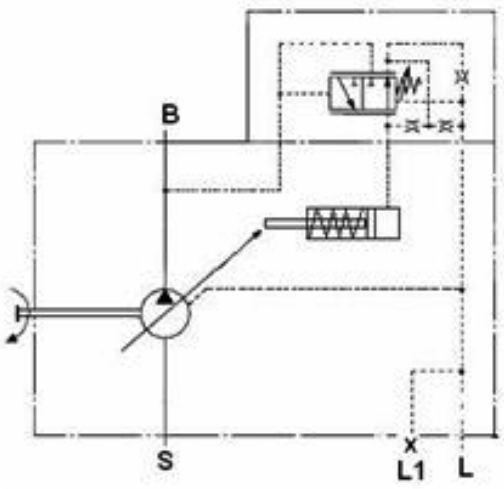
MA10VO/VSO Series 31

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 n1 = 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 Δp.....max. 3 bar (45 psi)

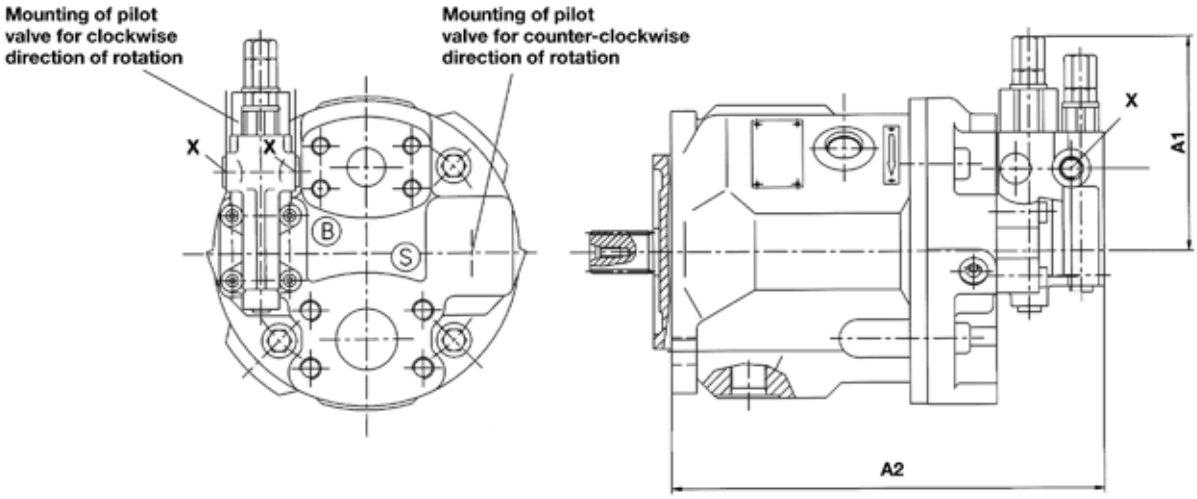
Size		18	28	45	71	100	140
Δp	Bar (psi)	4 (58)	4 (58)	6 (87)	8 (116)	10 (145)	12 (174)

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

MA10VO/VSO Series 31

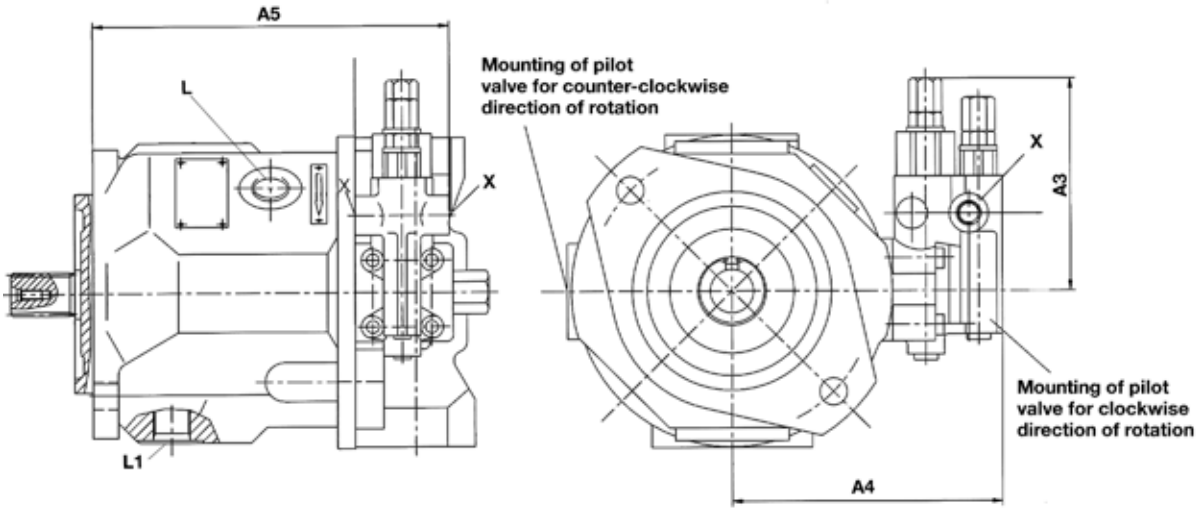
Unit Dimensions DR
Service Ports at Rear: Models 61N00 and 11N00

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

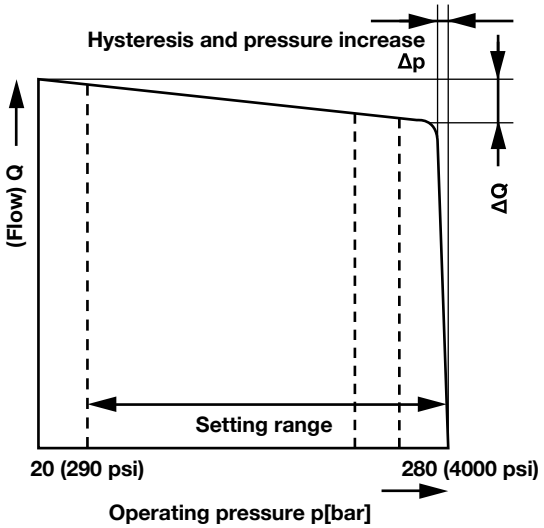
DRG Pressure Control, Remote Control

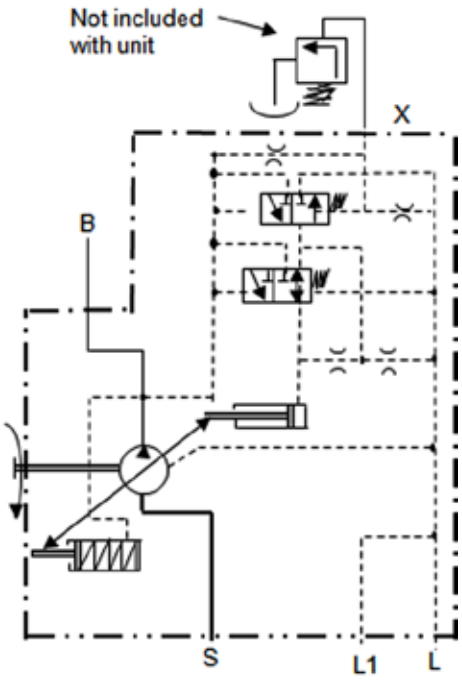
A pressure relief valve may be externally piped to port X for remote control purposes.
It is not, however, included with the DRG control.

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 then 78in (2 meters) from the pump.

Static characteristic
(at n1 = 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 Δp.....max. 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)

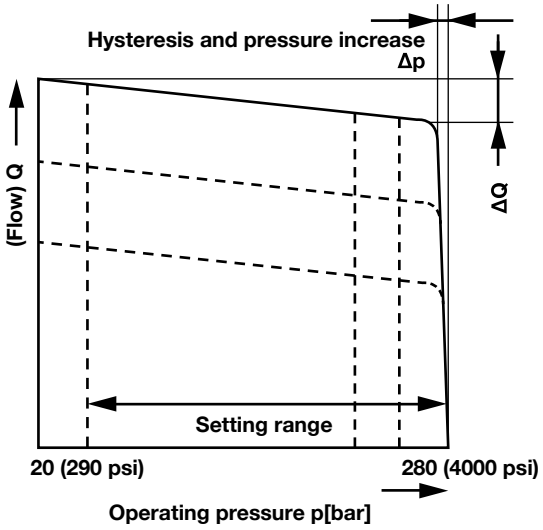
MA10VO/VSO Series 31

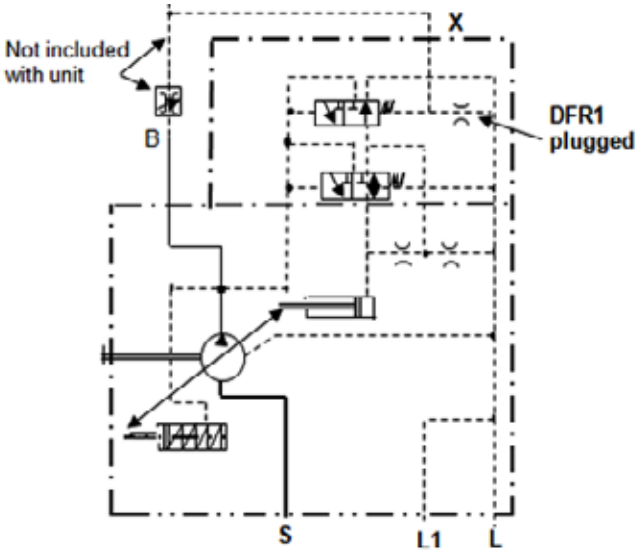
DFR/DFR1 Pressure/Flow Control

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 n1 = 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

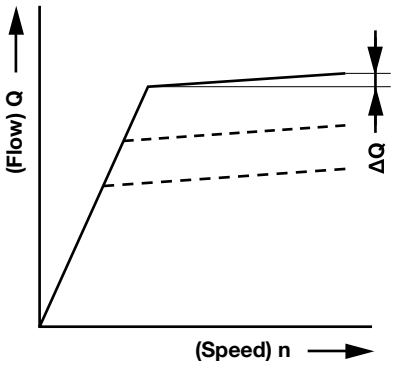
Flow Control/Differential Pressure Δp

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 ± 2 bar (260 ± 30 psi) results.

Static characteristic at variable speed



Control Data

For pressure control technical data see DR pressure control.
Max. flow deviation (hysteresis and increase) measured at drive speed n = 1450 rpm.

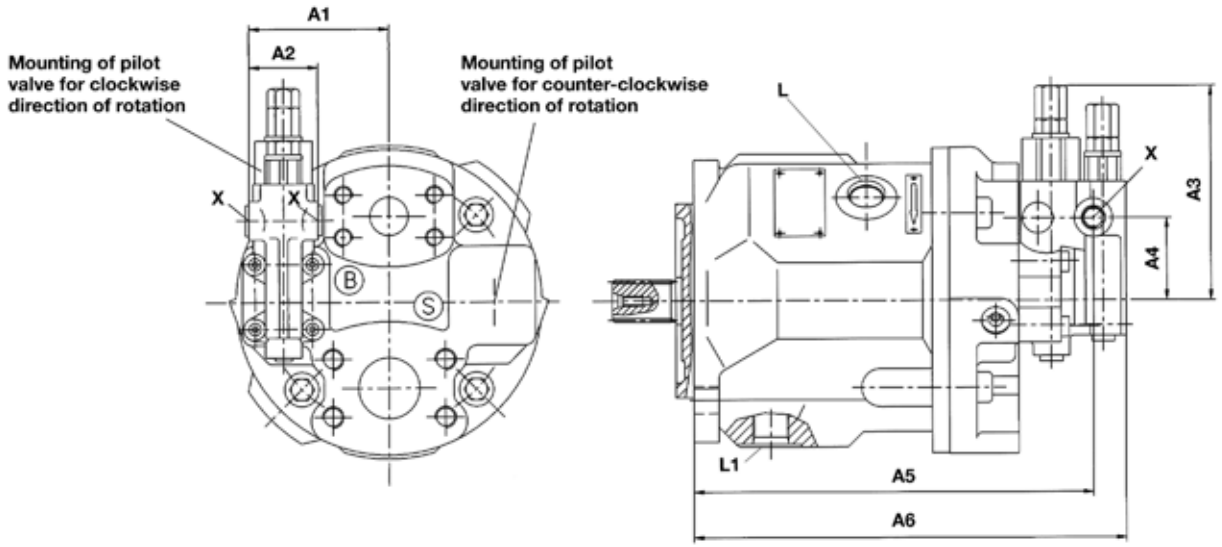
Size	18	28	45	71	100	140
ΔQmax L/min (gpm)	0.5 (0.13)	1.0 (0.26)	1.8 (0.48)	2.8 (0.74)	4.0 (1.06)	6.0 (1.6)

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)

MA10VO/VSO Series 31

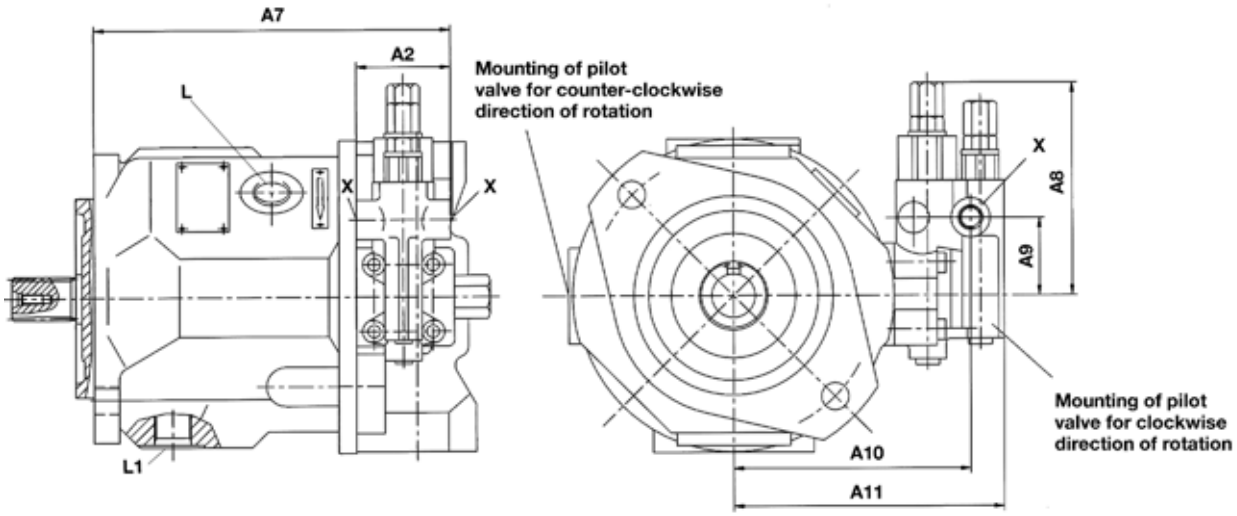
Unit Dimensions DFR/DFR1/DRG
Service Ports at Rear: Models 61N00 and 11N00

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

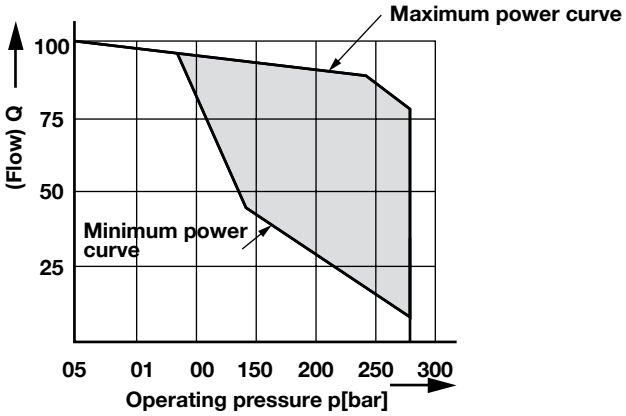
Measurements are in millimeters (mm)

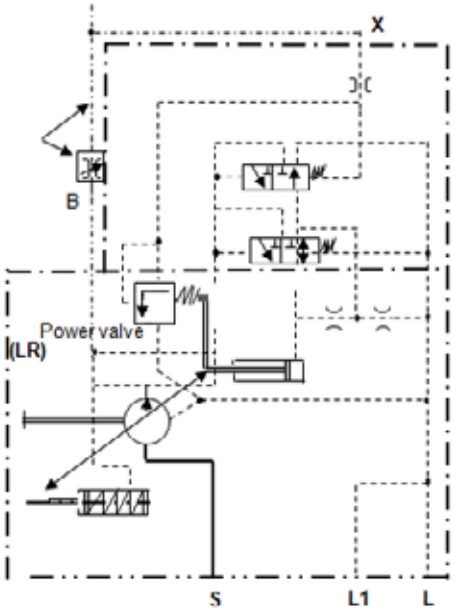
MA10VO/VSO Series 31

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 A .....to 90 bar (1,300 psi)
Spring group B .....to 160 bar (2,320 psi)
Spring group C .....to 240 bar (3,480 psi)
Spring group D .....over 240 bar (3,480 psi)
**Please contact us for 'Spring' part numbers.*

Control Data

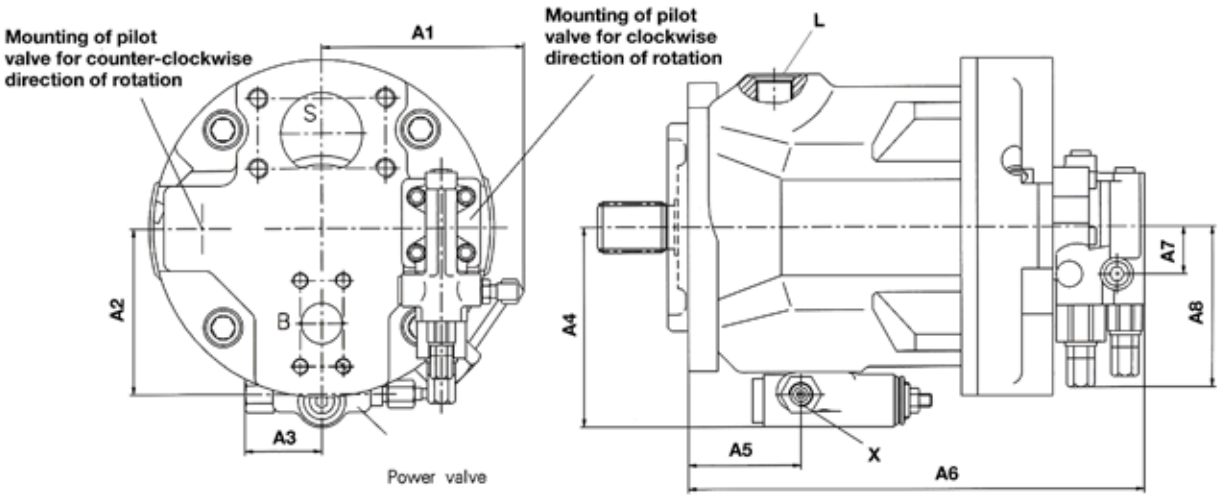
For pressure control technical data see DR pressure control.
For flow control technical data see DFR control.

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

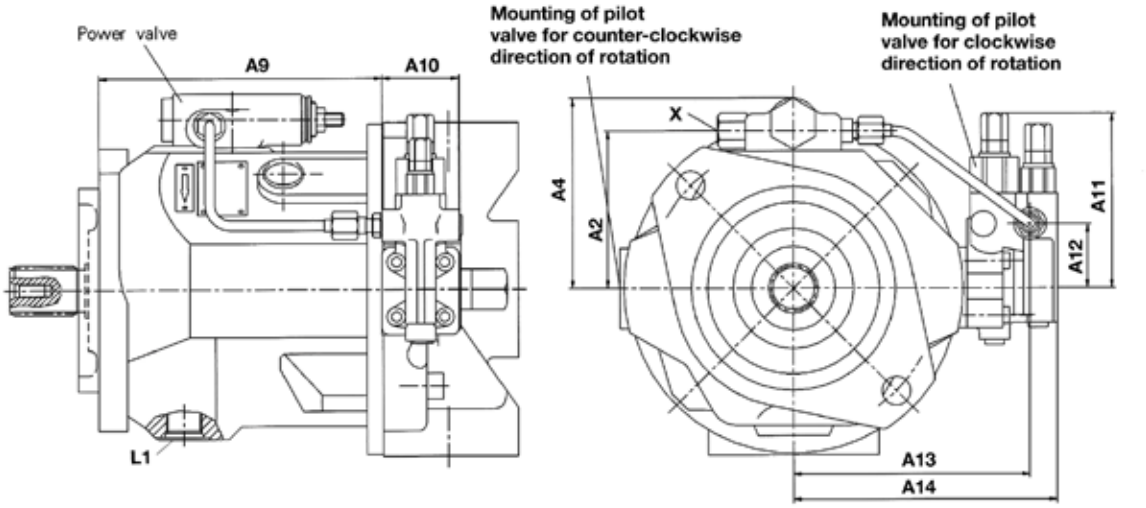
Unit Dimensions DFLR
Service Ports at Rear: Models 61N00 and 11N00

Sizes 18 - 140



Unit Dimensions DFLR
Service Ports on Side: Models 62N00 and 12N00

Sizes 18 - 140

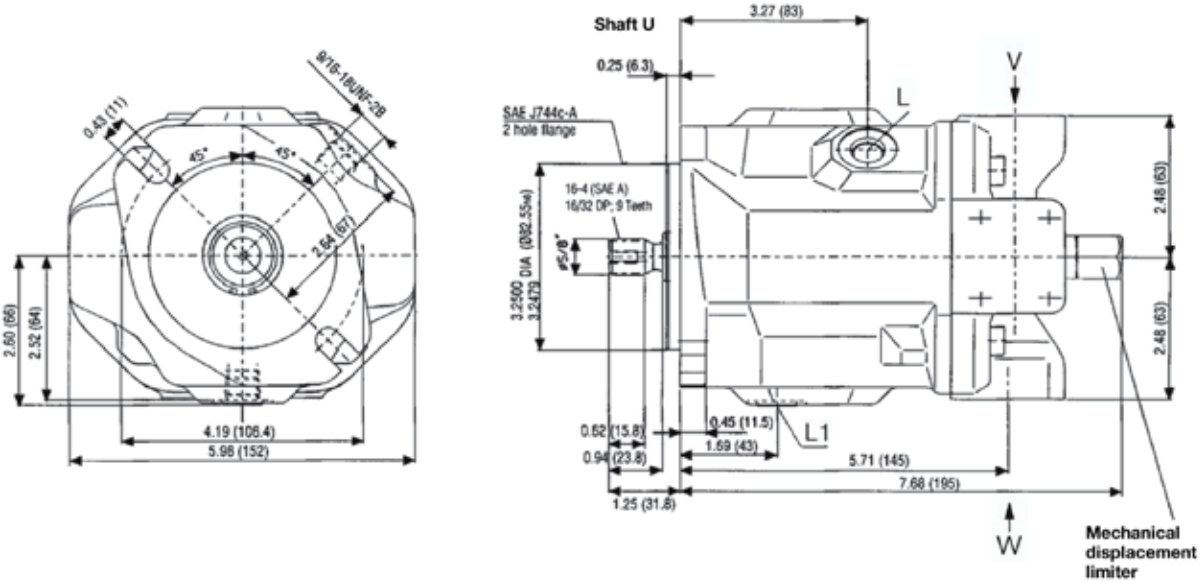


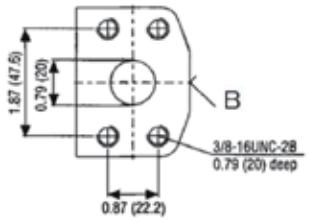
Size	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	Adapter L & L1 (ORB/Metric)	X
18	-	-	-	-	-	-	40	121	130	36	121	40	109	126	#6 ORB / M16 x 1.5	7/16-20UNF-2B
28	102	88	57	109	48	228	40	121	143	36	121	40	116	135	#8 ORB / M18 x 1.5	7/16-20UNF-2B
45	109	90	57	111	54	248	40	121	153	36	118	40	122	140	#10 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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

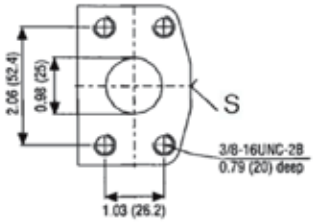
Measurements are in millimeters (mm)

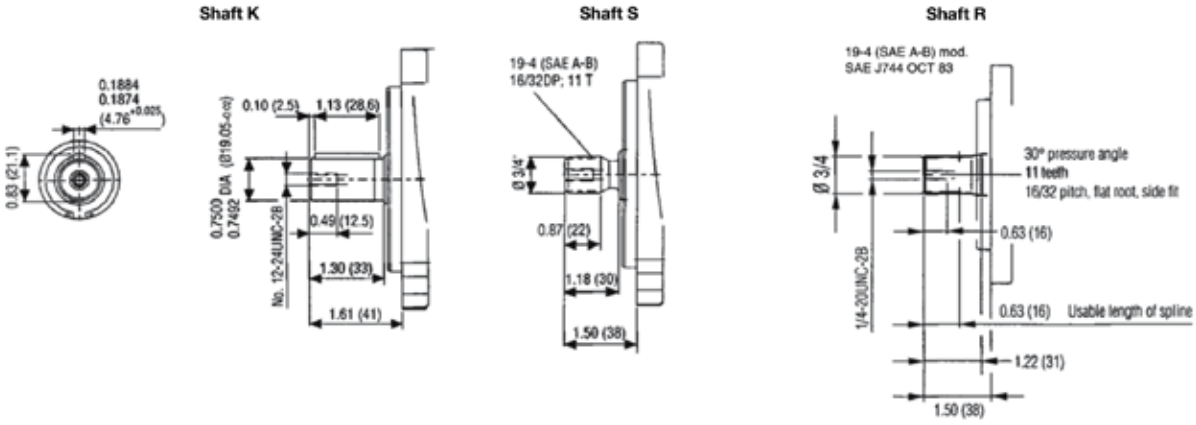
MA10VO/VSO Series 31

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



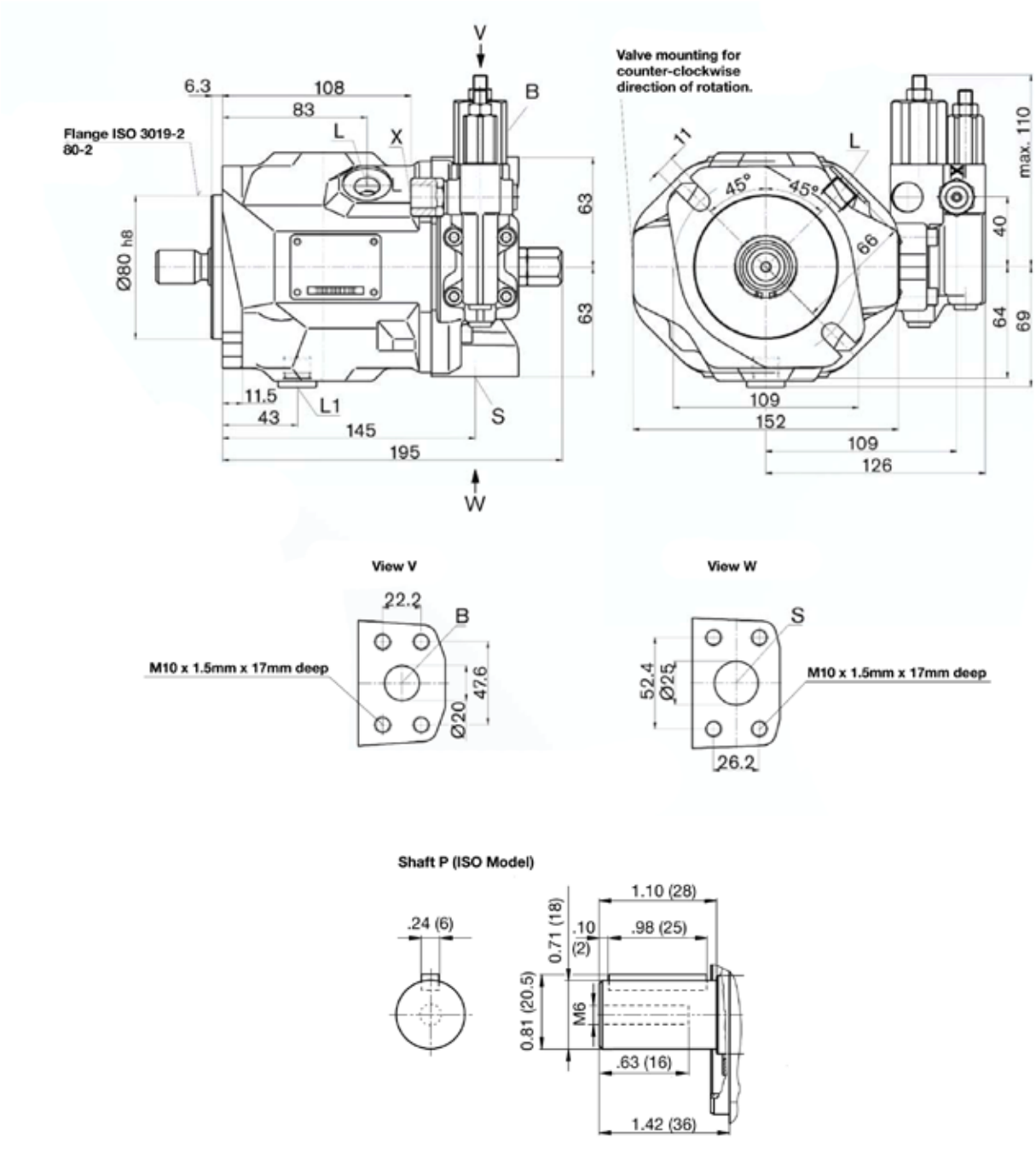






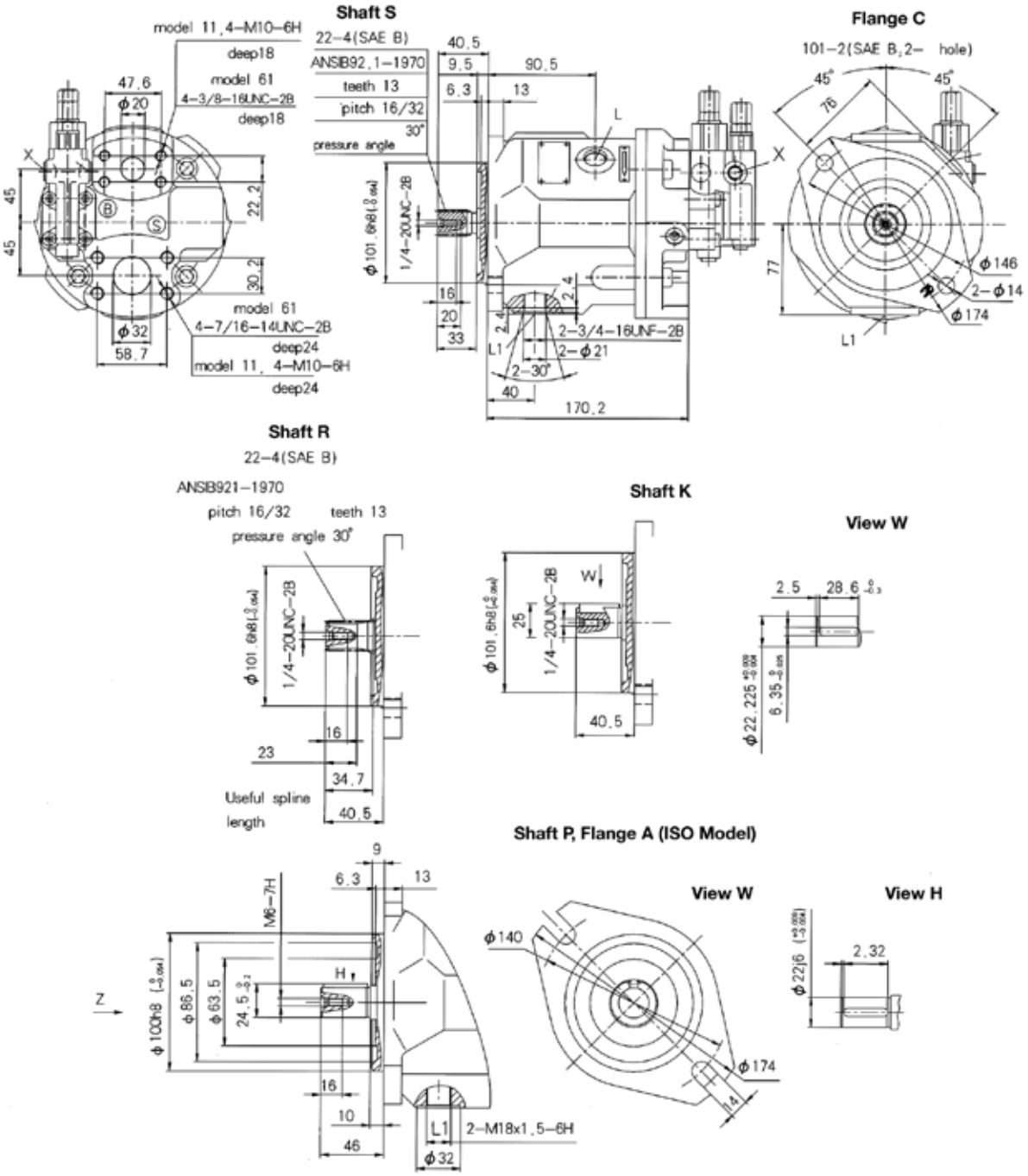
MA10VO/VSO Series 31

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



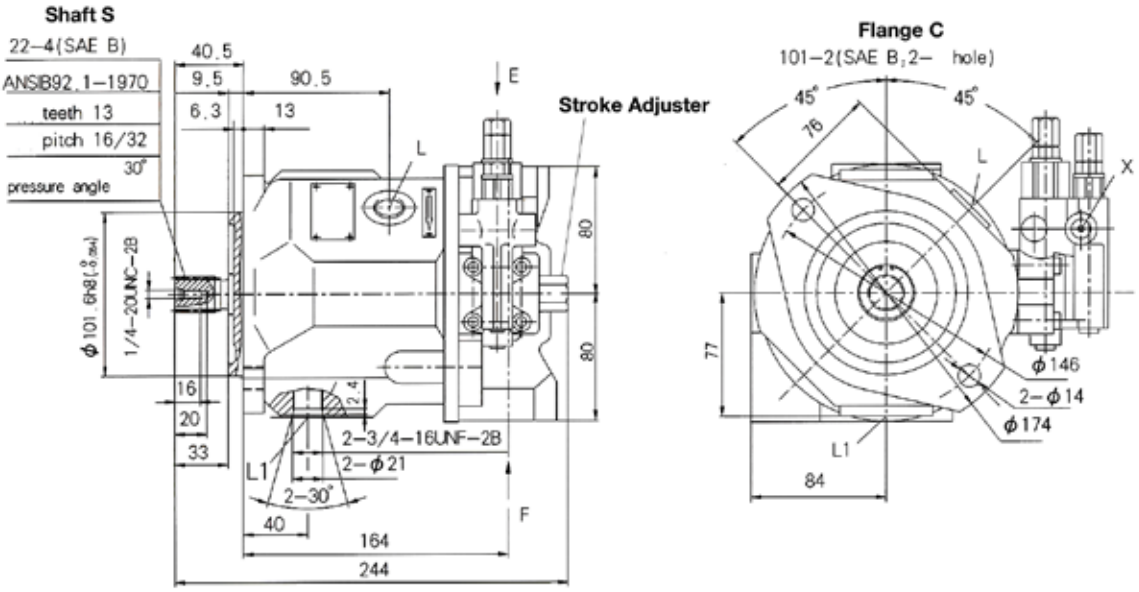
MA10VO/VSO Series 31

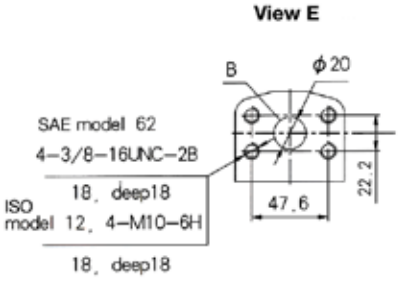
Mounting Dimension, Sizes 28, SAE & ISO
Service Ports at Rear: No Through-drive, Models 61N00 and 11N00

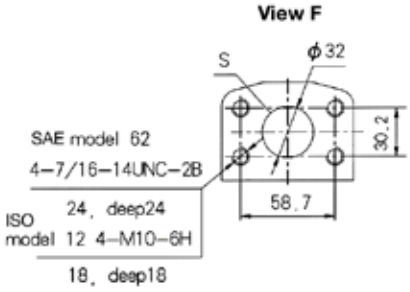


MA10VO/VSO Series 31

Mounting Dimension, Sizes 28
Service Ports at Side: No Through-drive, Models 62N00 and 12N00







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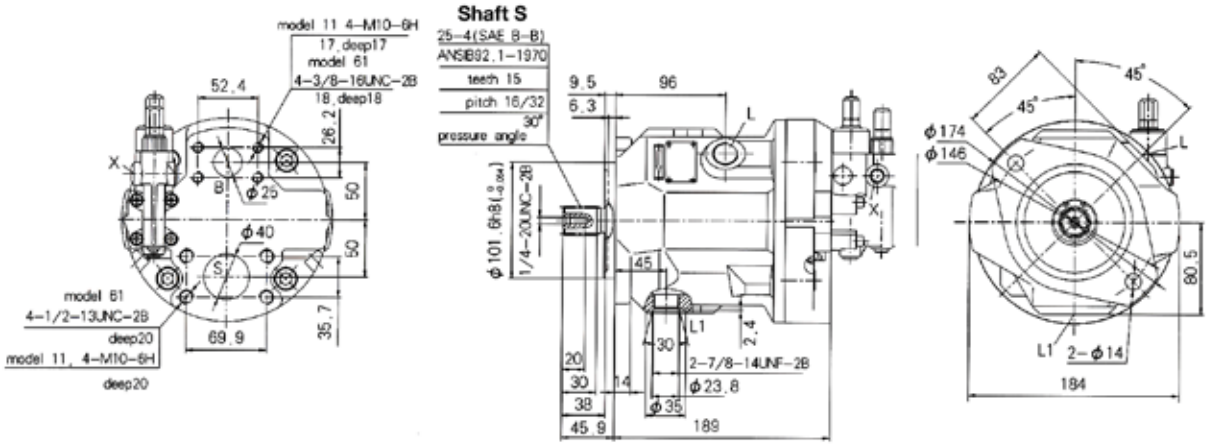
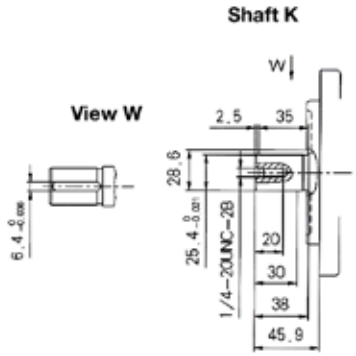
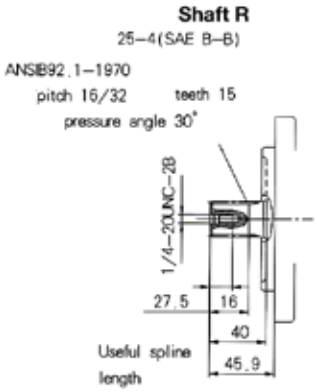
The Right Replacement, Right Now™

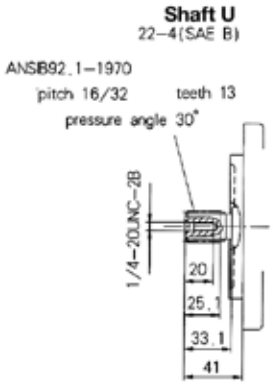
MA10VO/VSO Series 31

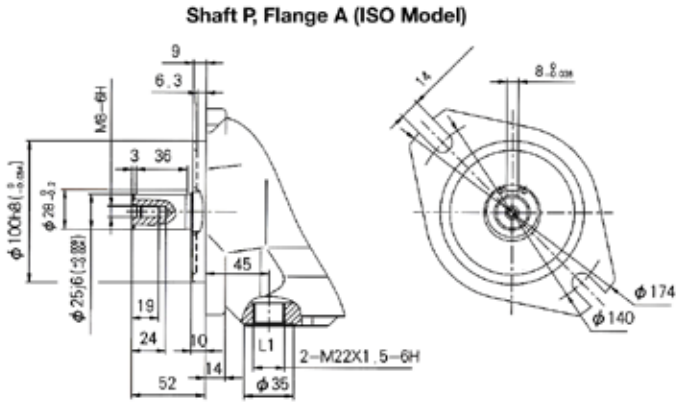
Mounting Dimension, Sizes 45, SAE & ISO
Service Ports at Rear: No Through-drive, Models 61N00 and 11N00





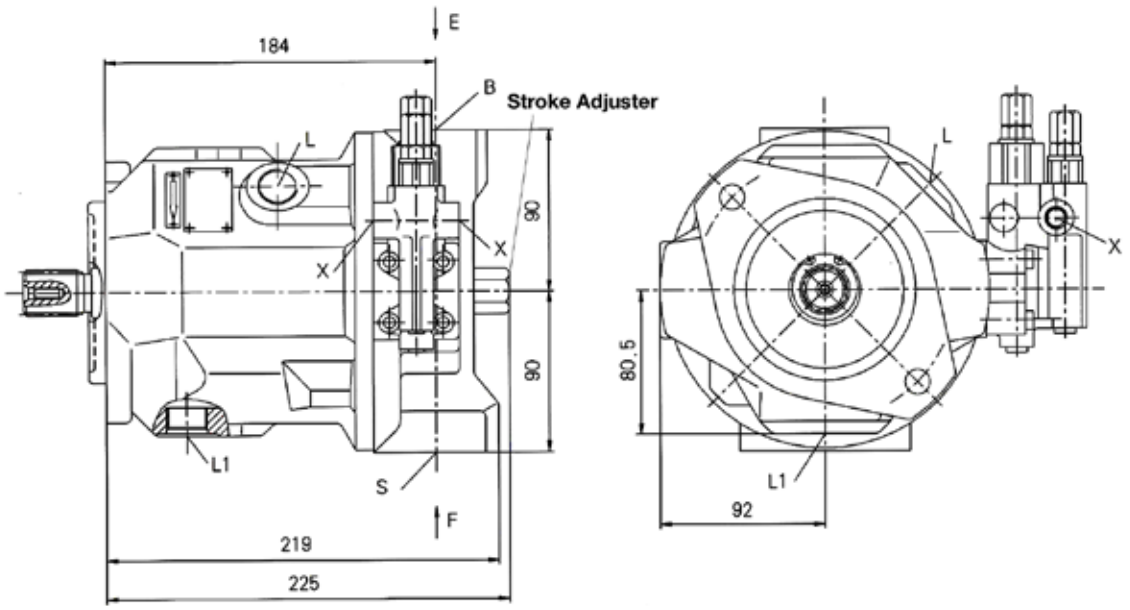


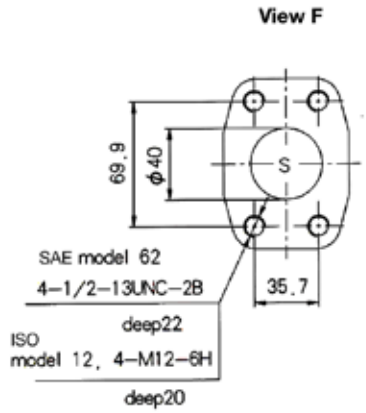


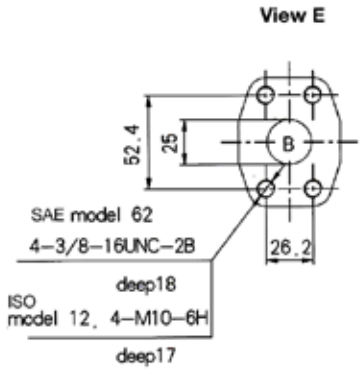


MA10VO/VSO Series 31

Mounting Dimension, Sizes 45
Service Ports at Side: No Through-drive, Models 62N00 and 12N00

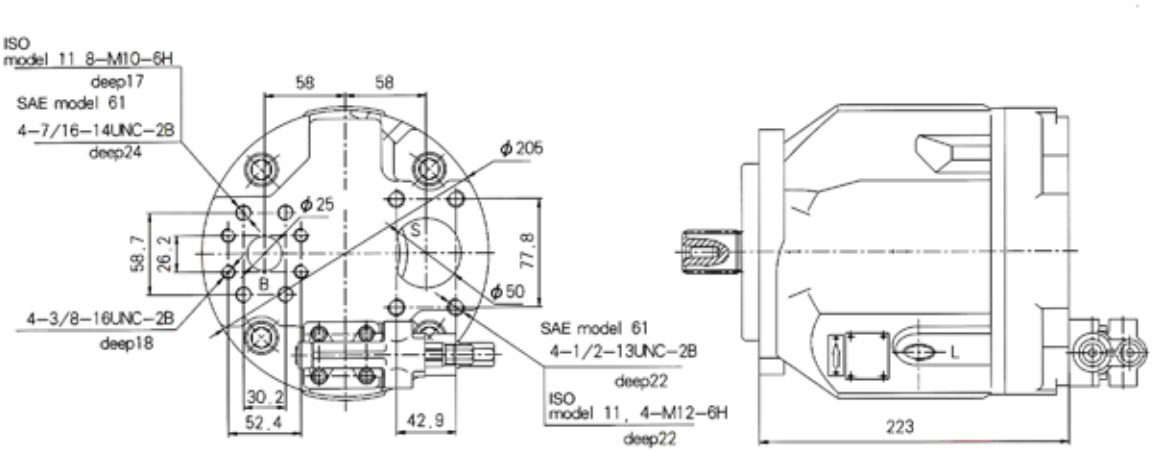






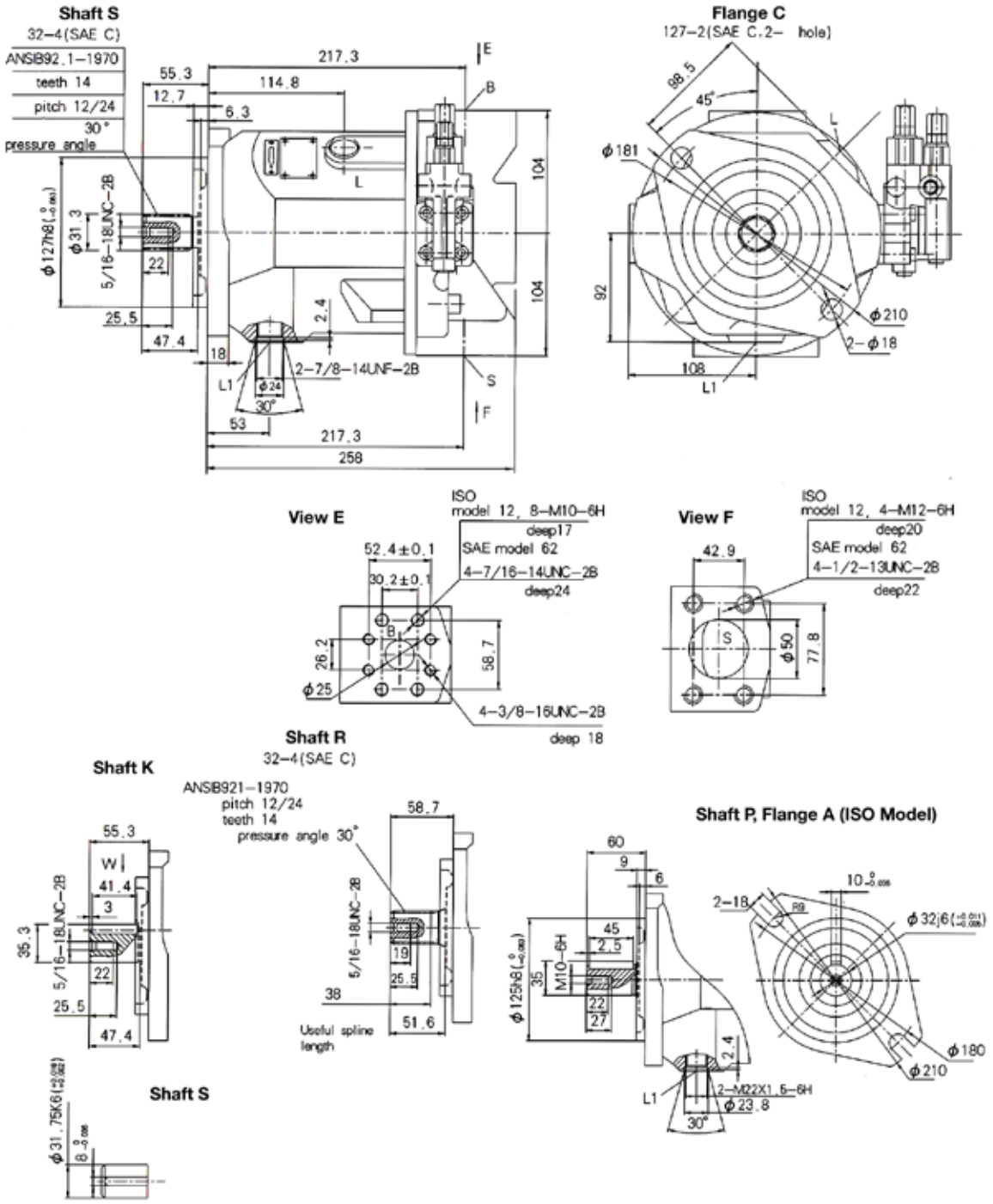
MA10VO/VSO Series 31

Mounting Dimension, Sizes 71
Service Ports at Rear: No Through-drive, Models 61N00 and 11N00



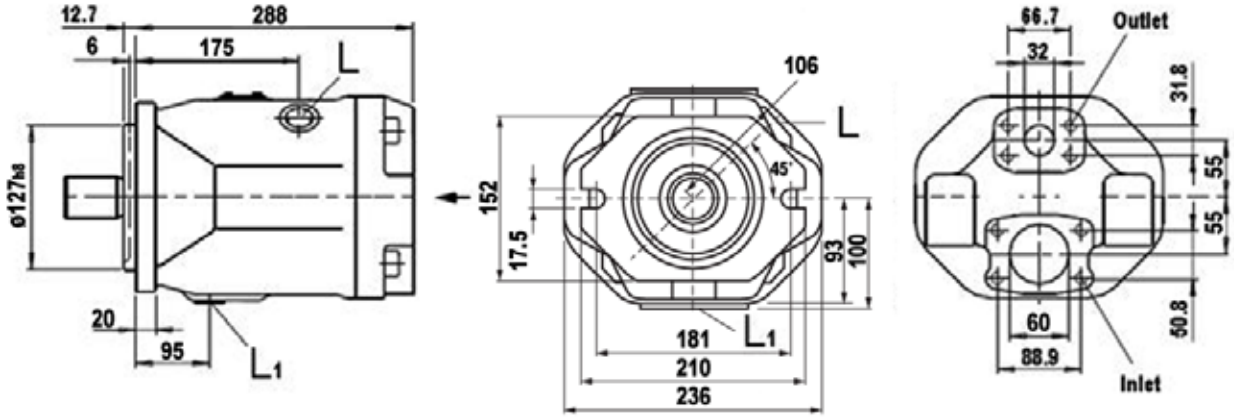
MA10VO/VSO Series 31

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



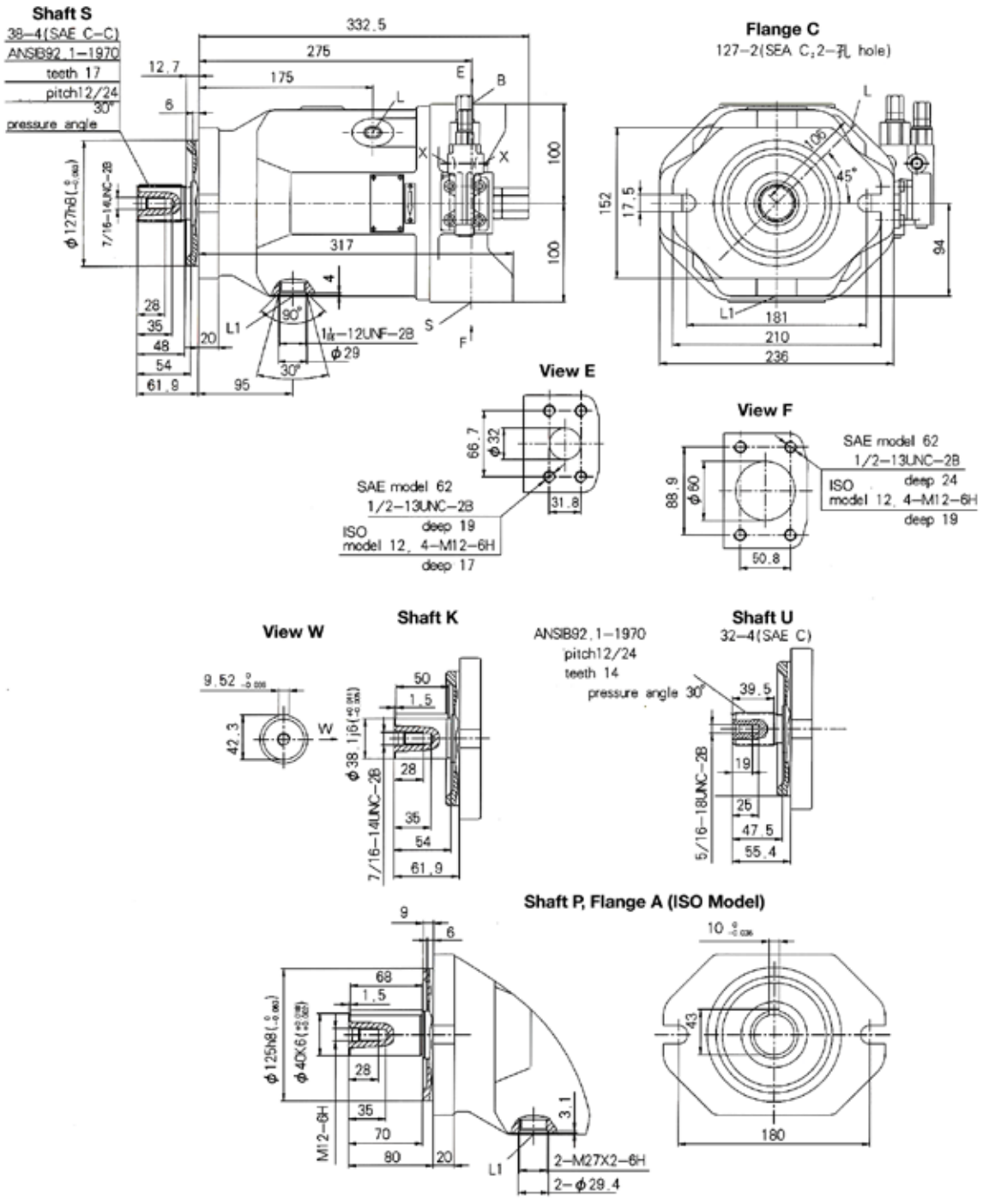
MA10VO/VSO Series 31

Mounting Dimension, Sizes 100
Service Ports at Rear: Models 61N00 and 11N00



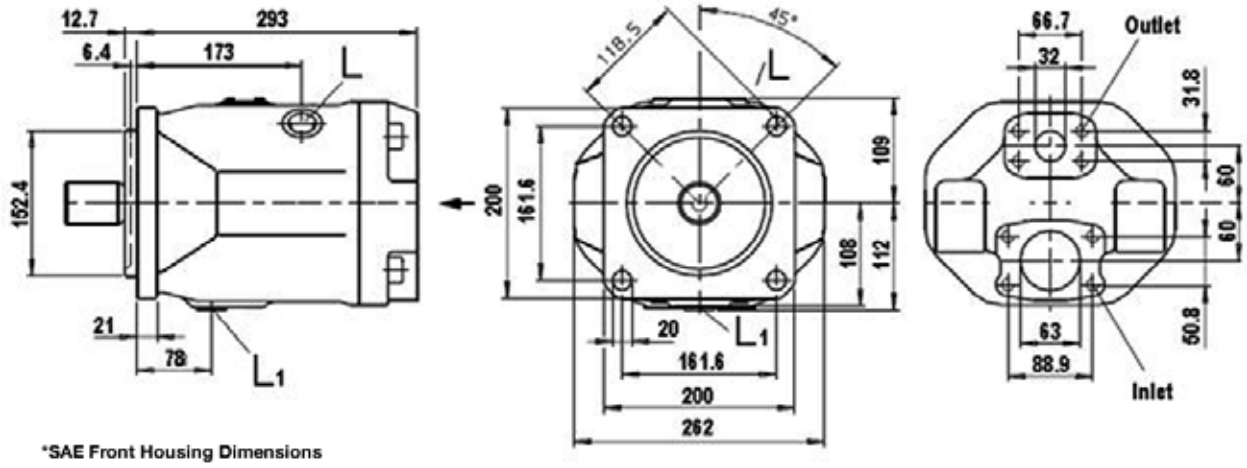
MA10VO/VSO Series 31

Mounting Dimension, Sizes 100
Service Ports at Side: No Through-drive, Models 62N00 and 12N00



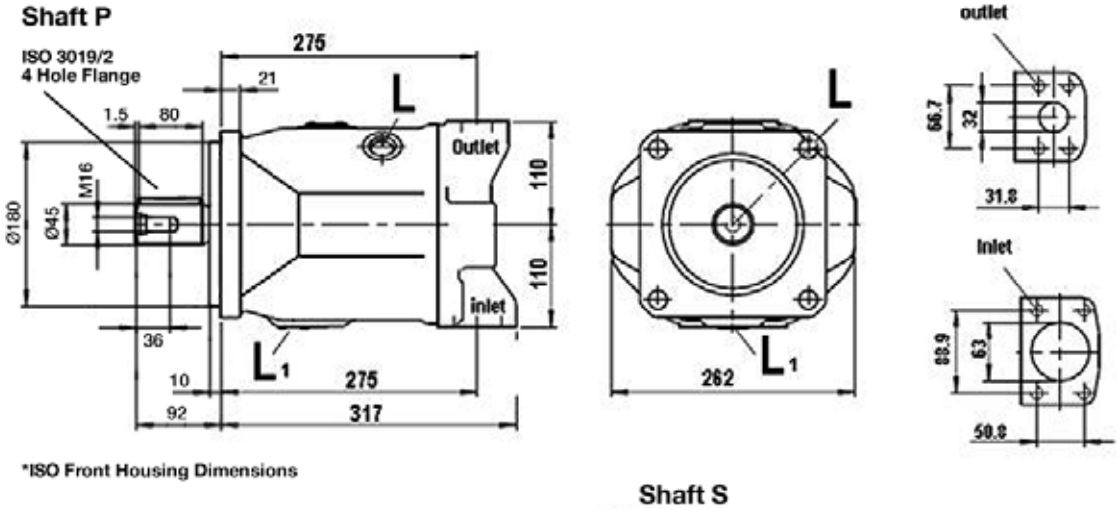
MA10VO/VSO Series 31

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

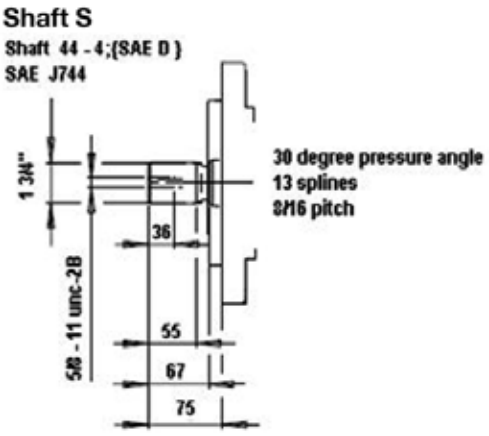


*SAE Front Housing Dimensions

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



*ISO Front Housing Dimensions

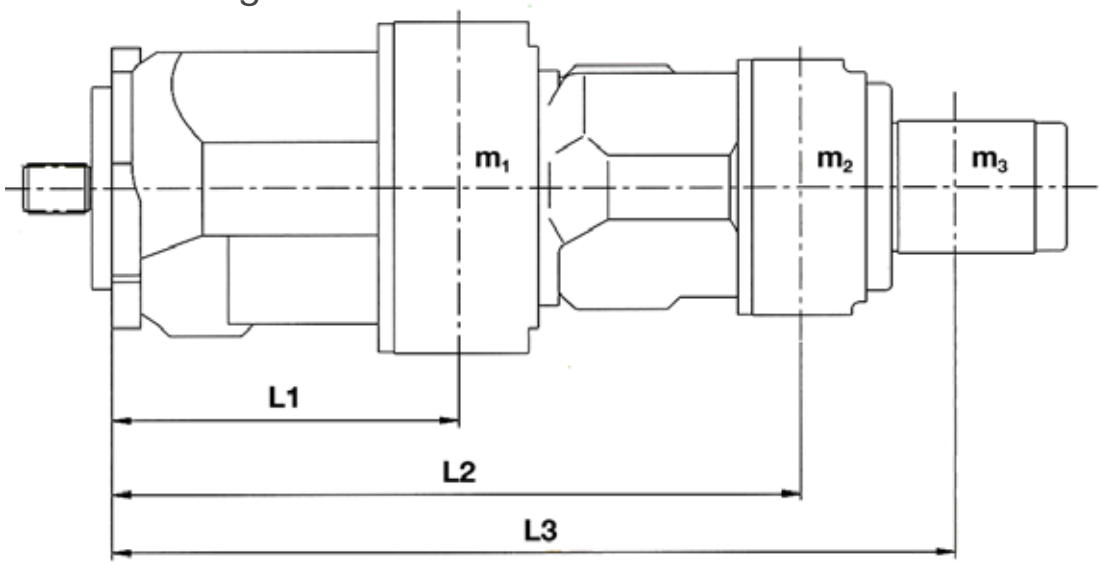


Metric Port Sizes
Pressure Port: M14x2
Inlet Port: M12x1.75

SAE Port Sizes
Pressure Port: 1/2"-13UNC
Inlet Port: 1/2"-13UNC

MA10VO/VSO Series 31

Permissable 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)

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

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

Size			28	45	71	100	140
Permissable 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

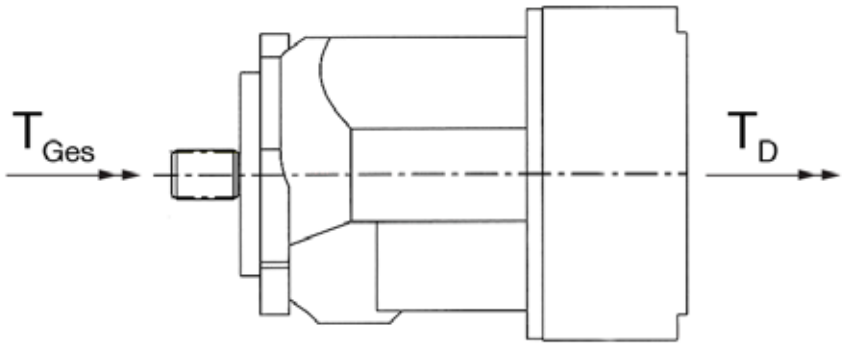
Maximum Permissable Input and Through Drive Torques

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.



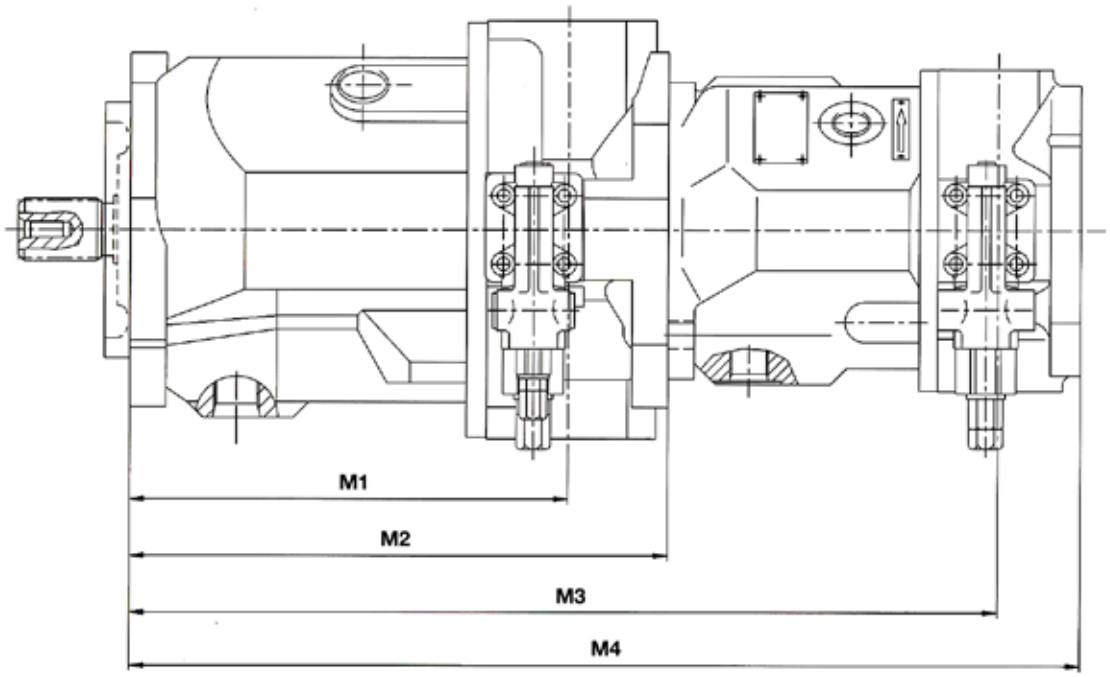
The drive torques for pump 1 and pump 2 can be split up as required. However, the max. permissable input torque T_{tot} as well as the max. permissable through drive torque T_{thr} may not be exceeded.

Size			18	28	45	71	100	140
Max. Permissable 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. permissable input torque pump 1
T_{thr} = Max. permissable through drive torque at 2nd shaft end of pump 1

MA10VO/VSO Series 31

Unit Dimensions of Combination Pumps

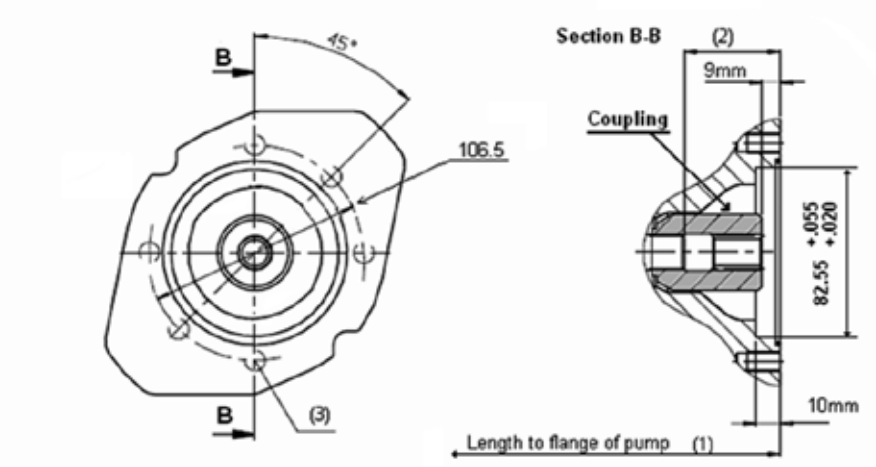


Pump 1		MA10VO28				MA10VO45				MA10VO71				MA10VO100				MA10VO140			
		M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4
Pump 2																					
MA10VO18	in.	6.5	8.03	13.74	15.71	7.24	9.02	14.72	16.69	8.54	10.51	16.21	18.19	10.83	13.31	19.02	20.98	10.83	13.78	19.49	21.46
	mm	165	204	349	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

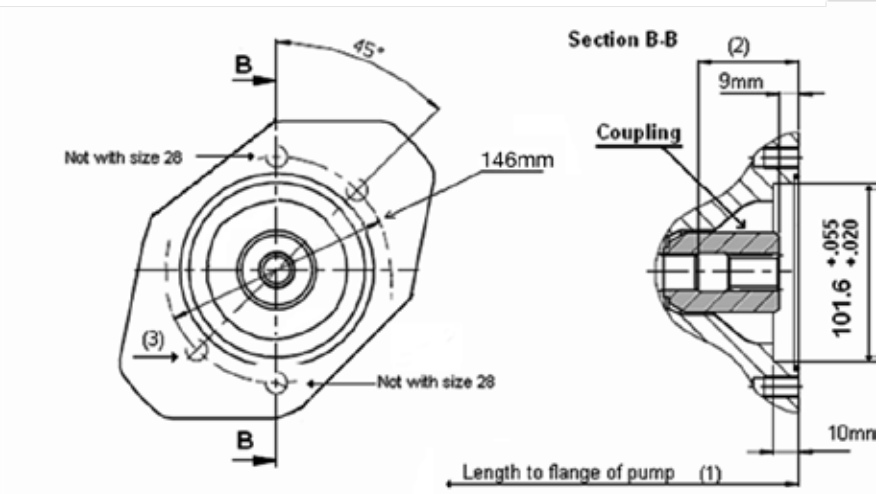
Ordering code with 5/8" 9T spline coupling - K01
Ordering code with 3/4" 11T spline coupling - K52



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

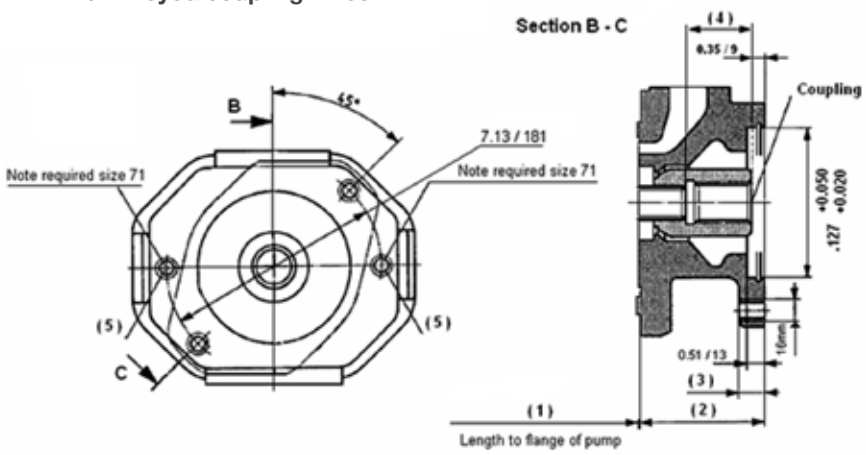


Size	1	2	3
28	204mm	47mm	M12-15mm deep
45	229mm	53mm	M12-18mm deep
71	267mm	60mm	M12-20mm deep
100	338mm	65mm	M12-20mm deep
140	350mm	77mm	M12-20mm deep

MA10VO/VSO Series 31

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

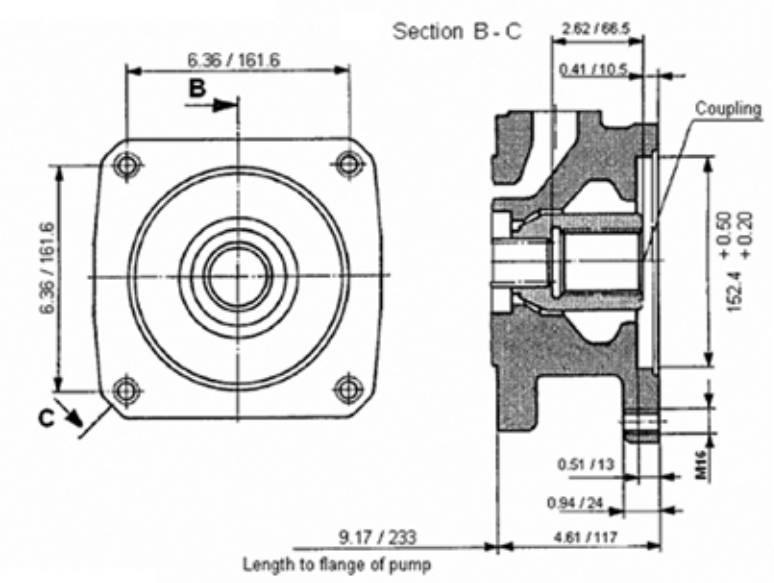
Ordering code with 1-1/4" 14T spline coupling - K07
Ordering code with 1-1/4" keyed coupling - K08



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

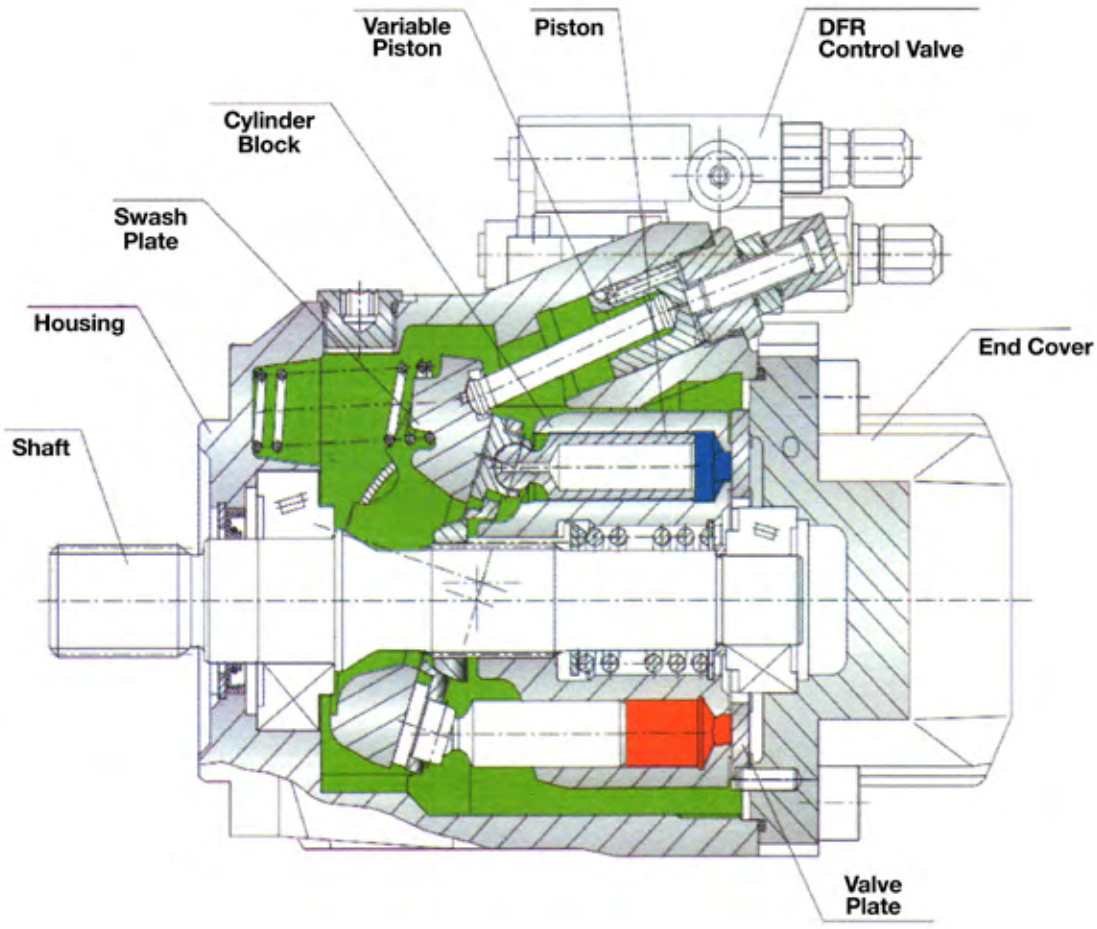


MA10VO/VSO Series 52

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



MA10VO/VSO Series 52

Technical Data

1. 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)

2. Output operating pressure range

   Pressure at port B

   Nominal pressure P_N.....3625 psi (250 bar)

   Peak pressure P_{max}.....4500 psi (315 bar)

3. 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.

4. Direction of flow

   ("S" inlet port to "B" pressure port)

5. Table of values (theoretical values, without considering η_{mh} and η_v ; values rounded)

Size			45	60
Displacement	V_{gmax}	cm³/rev (in³/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 Δp = 4000 psi (280 bar)	P_{omax}	kW (HP)	49 (65)	68 (90)
Max. Torque Δp = 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

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

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

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

V_g = Displacement per revolution in in³ (cm³)

Δp = Differential pressure in psi (bar)

n = Speed in rpm (min^{-1})

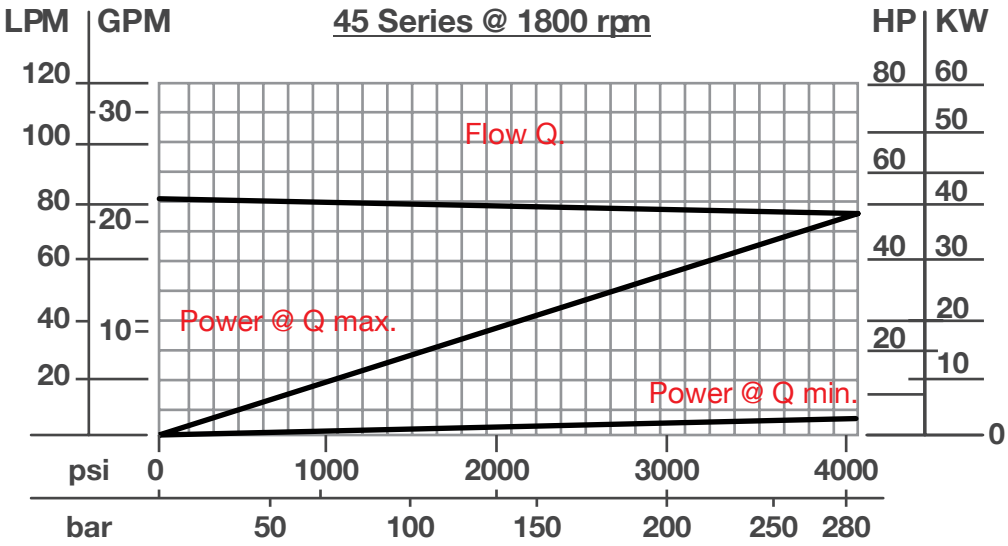
η_v = Volumetric efficiency

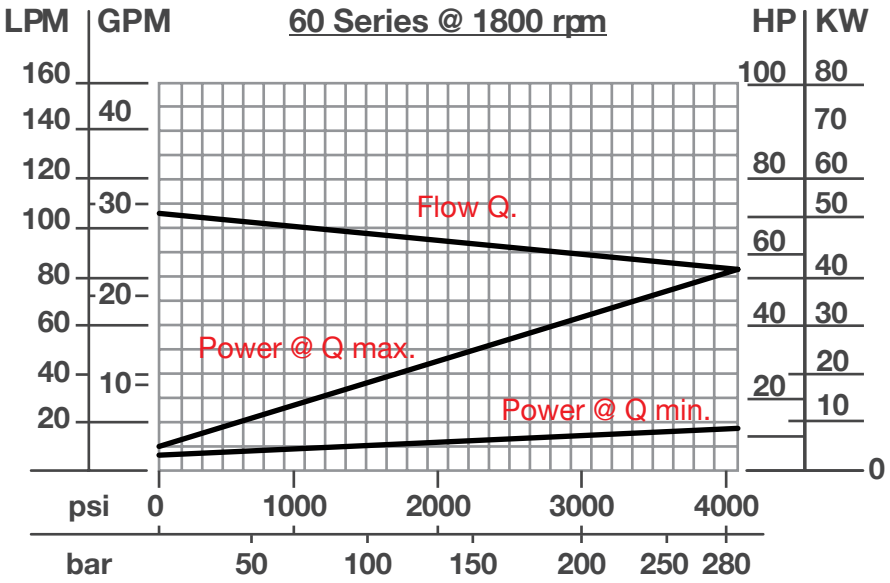
η_{mh} = Mechanical-hydraulic efficiency

η_t = Total efficiency

MA10VO/VSO Series 52

Performance Information





MA10VO/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 (2.75)	60 (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)	⅞”	1”
W = SAE Splined Shaft, Reinforced U-type Shaft	⅞”	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) ⅝” 9T (A) A10V18(U,W)	•	•
K02 = 101-2 (B) ⅞” 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 ORB Ports	•	-

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 mm² / s ~ 36 mm² / 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 = opt. operating viscosity 16 ~ 36 mm² / s

   Referred to tank temperature (open loop circuit).

   Limits of viscosity range
   (The following values are valid for extreme operating conditions):

   V min = 10 mm² / s (60 sus)
   For short periods (t ≤ 1 minute) at max. leakage oil temperature of 80°C (176°F)

   V max = 1000 mm² / s
   For short periods upon cold start

3. Temperature range

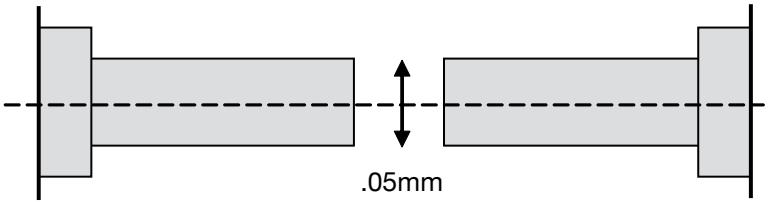
   T min = -20°C (-13°F); T max = +80°C (+176°F)

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 10µm.

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).



MA10VO/VSO Series 52

Pump Installation Notes

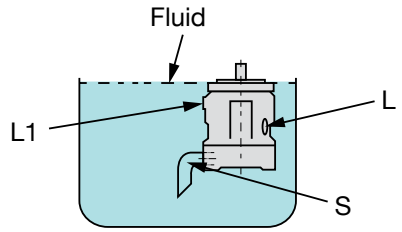
The installation position of the pump is optional.

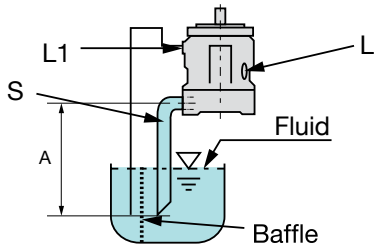
The pump housing must be filled with fluid both when commissioning and in operation. In order to achieve low noise levels, all connecting lines (inlet, case drain) should be isolated from the tank by flexible lines.

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)

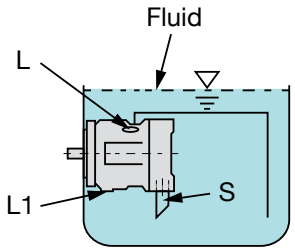


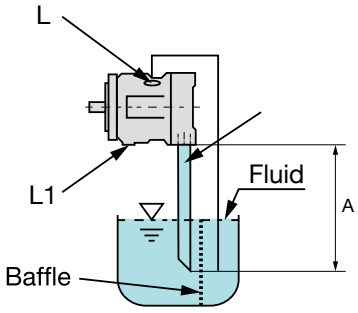


Horizontal Installation

The following conditions should be noted:

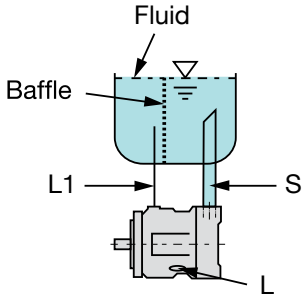
- The pump must be installed in such a manner, that either (L) or (L1) (case drain) is at the top
- If the minimum fluid level is below the ports of the pump, pipe the ports (L) or (L1) & S below the minimum oil level
- Avoid mounting above the tank whenever possible in order to maintain a low noise 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

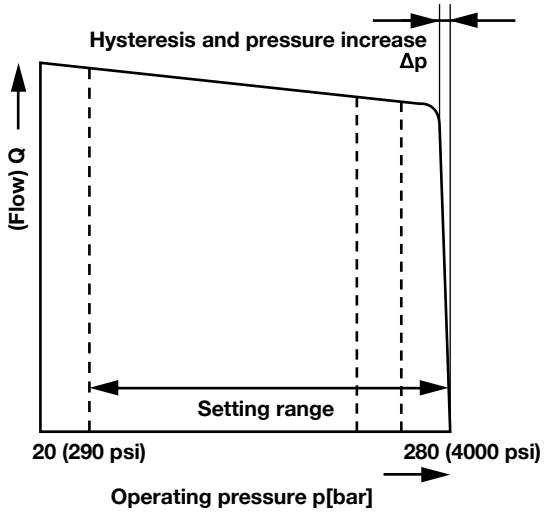


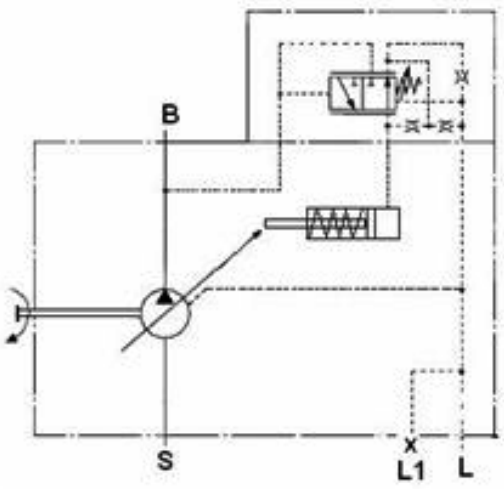
MA10VO/VSO Series 52

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 n1 = 1500 rpm; oil temp. = 125°F / 51°C)





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

Control Data

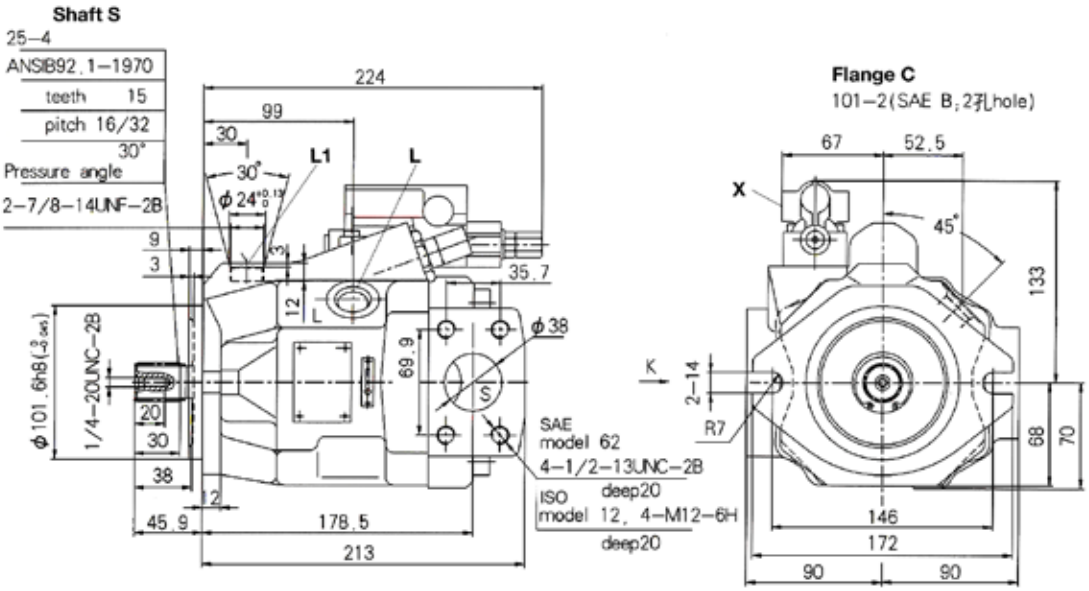
Hysteresis and repetition accuracy Δp.....max. 3 bar (45 psi)

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

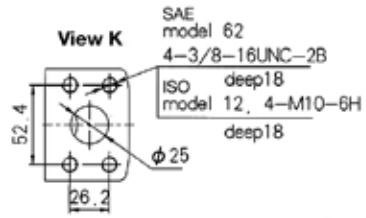
Pilot oil consumption.....max. approx. 3 L/min (0.8 gpm)

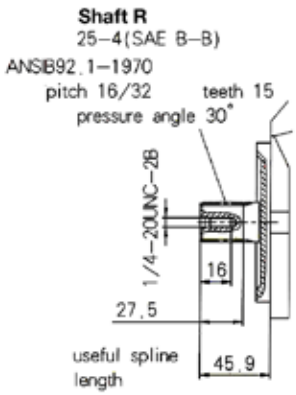
MA10VO/VSO Series 52

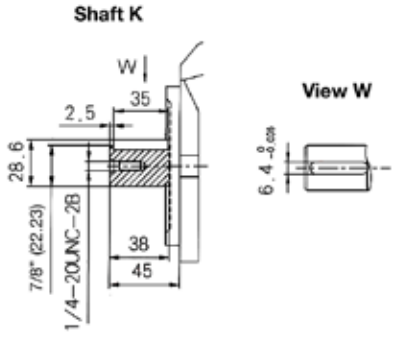
Mounting Dimension, Sizes 45
DR Pressure Control (Version: MA10VSO45DR/52R-XXC62/12N00)

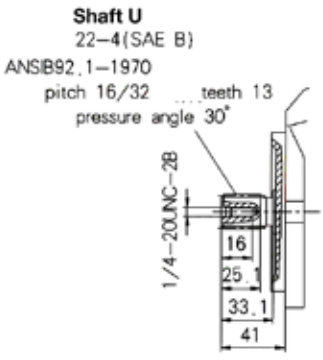


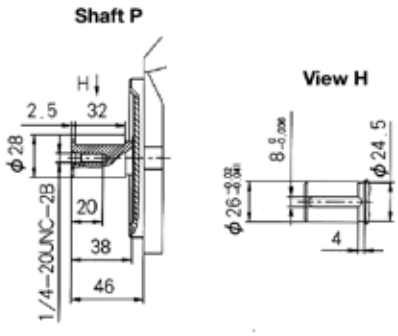
Standard Size	
L & L1	X
7/8-14UNF	7/16-30UNF











MA10VO/VSO Series 52

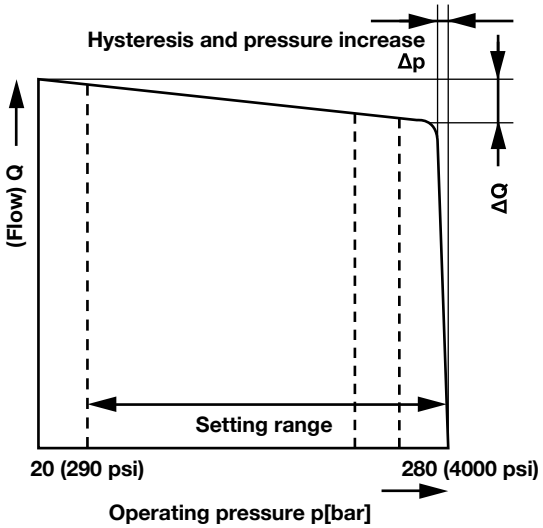
DRG Pressure Control, Remote Control

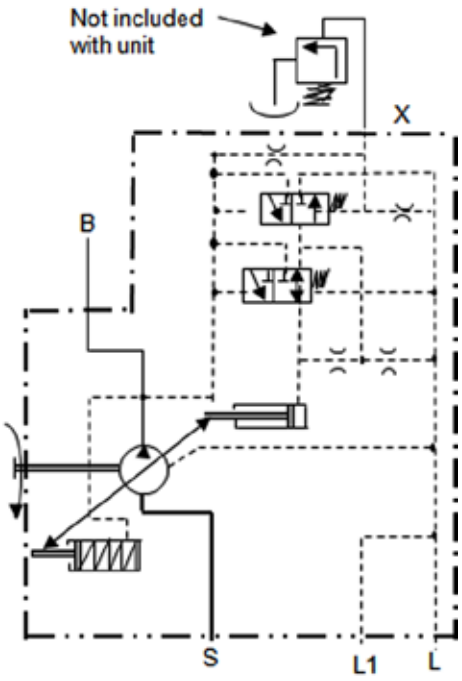
A pressure relief valve may be externally piped to port X for remote control purposes.
It is not, however, included with the DRG control.

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 then 78in (2 meters) from the pump.

Static characteristic
(at n1 = 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 Δp.....max. 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)

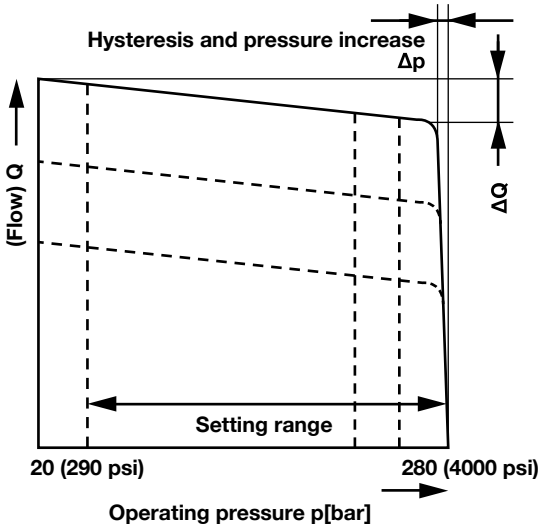
MA10VO/VSO Series 52

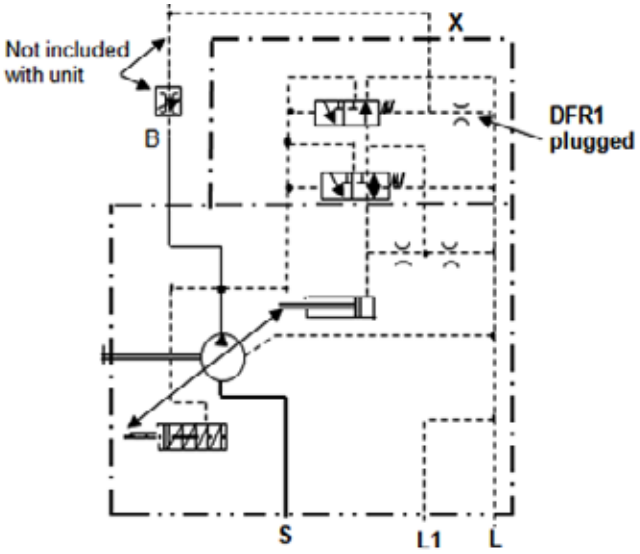
DFR/DFR1 Pressure/Flow Control

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 n1 = 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

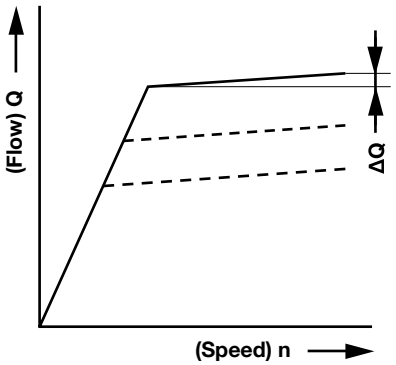
Flow Control/Differential Pressure Δp

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 ± 2 bar (260 ± 30 psi) results.

Static characteristic at variable speed



Control Data

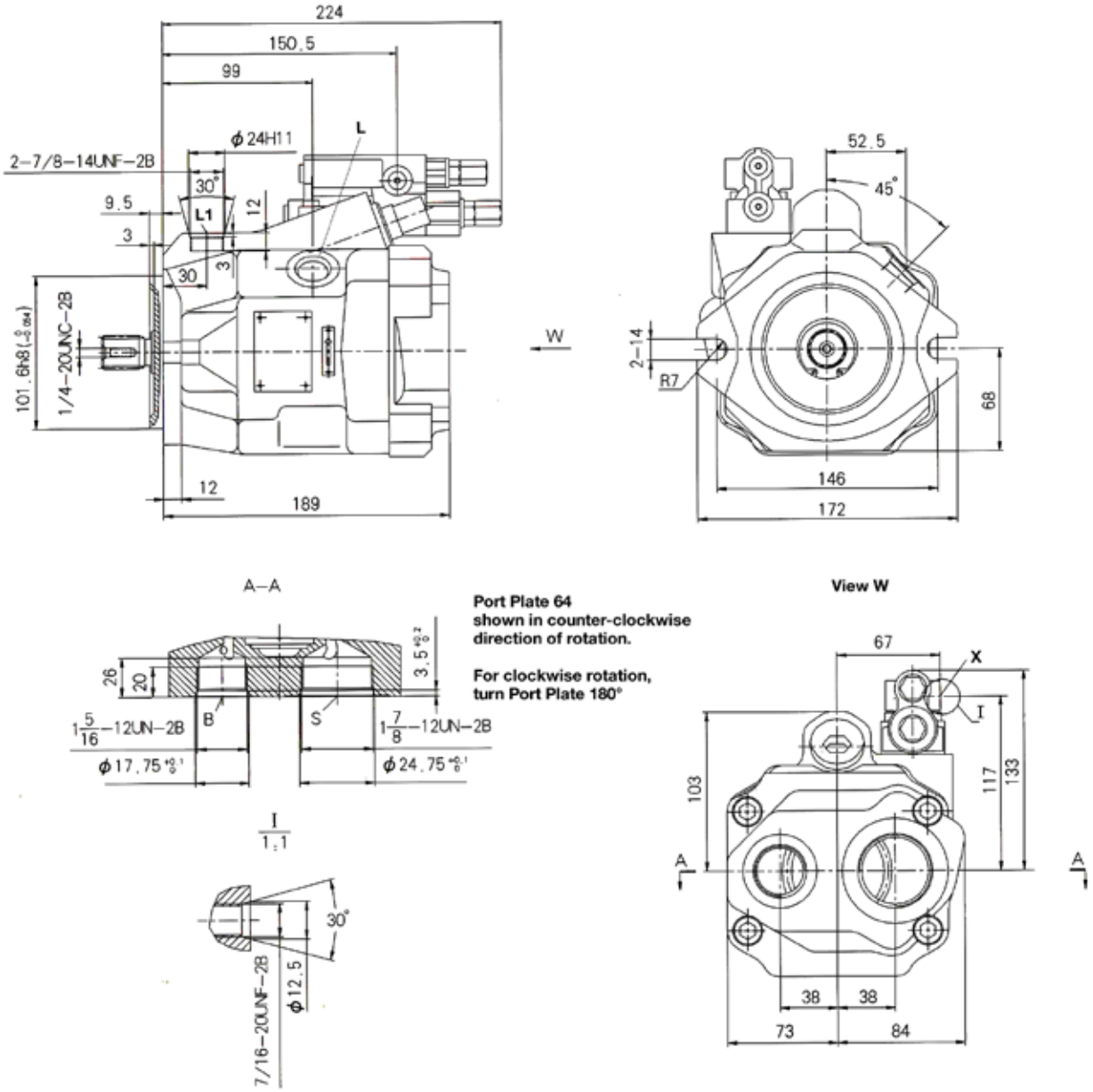
For pressure control technical data see DR pressure control.
Max. flow deviation (hysteresis and increase) measured at drive speed n = 1450 rpm.

Size	45	60
ΔQmax 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)

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

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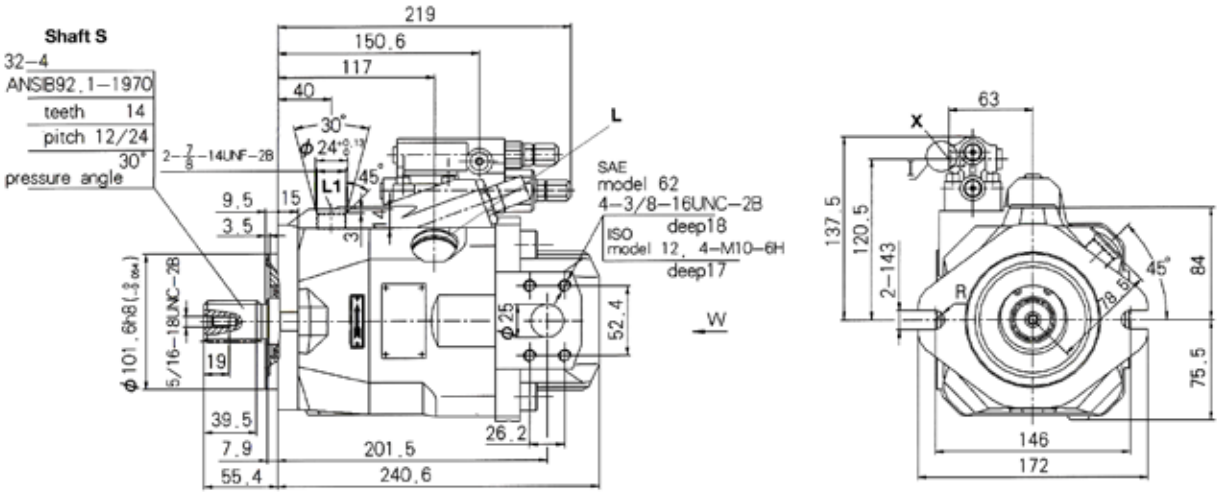
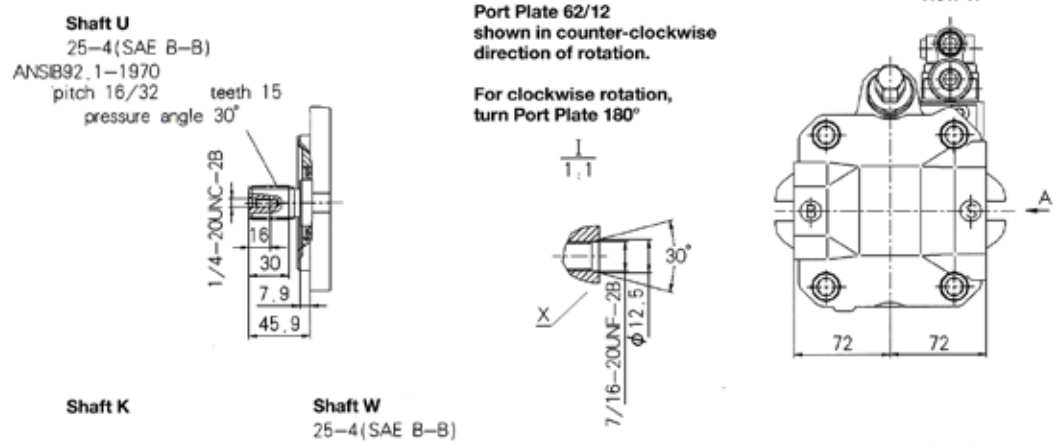
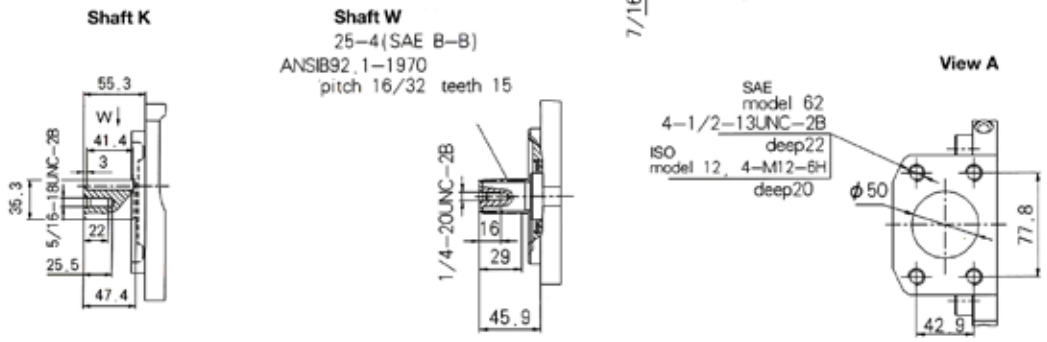
MA10VO/VSO Series 52

Mounting Dimension, Sizes 60
DFR, DFR1 & DRG Controls (Version: MA10VSO60***/52L-XXC62/12N00)



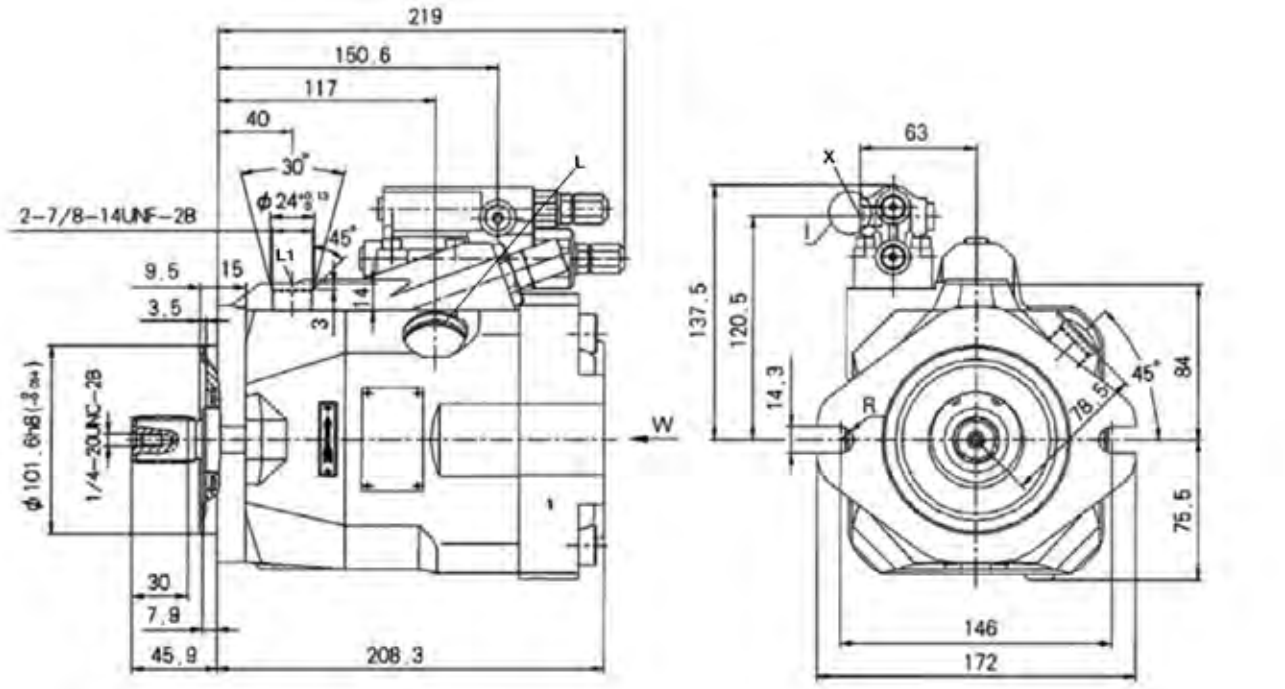




Standard Size	
L & L1	**X**
7/8-14UNF	7/16-30UNF

MA10VO/VSO Series 52

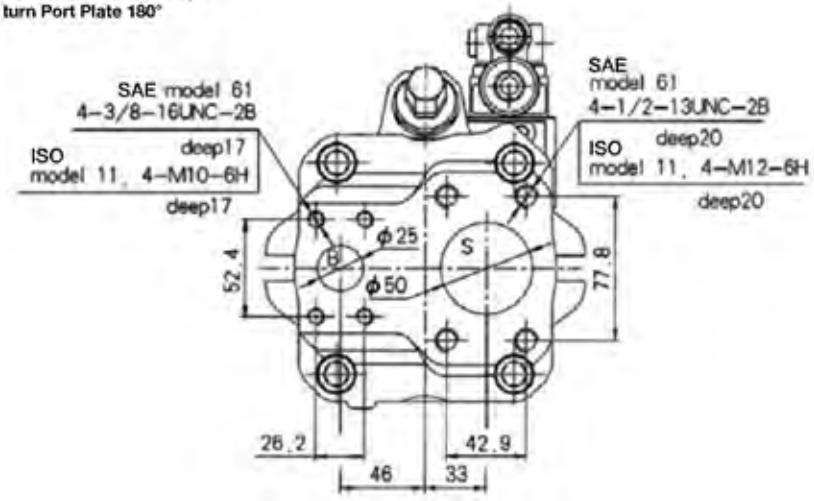
Mounting Dimension, Sizes 60
DFR, DFR1 & DRG Controls (Version: MA10VSO60***/52L-XXC61/11N00)



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

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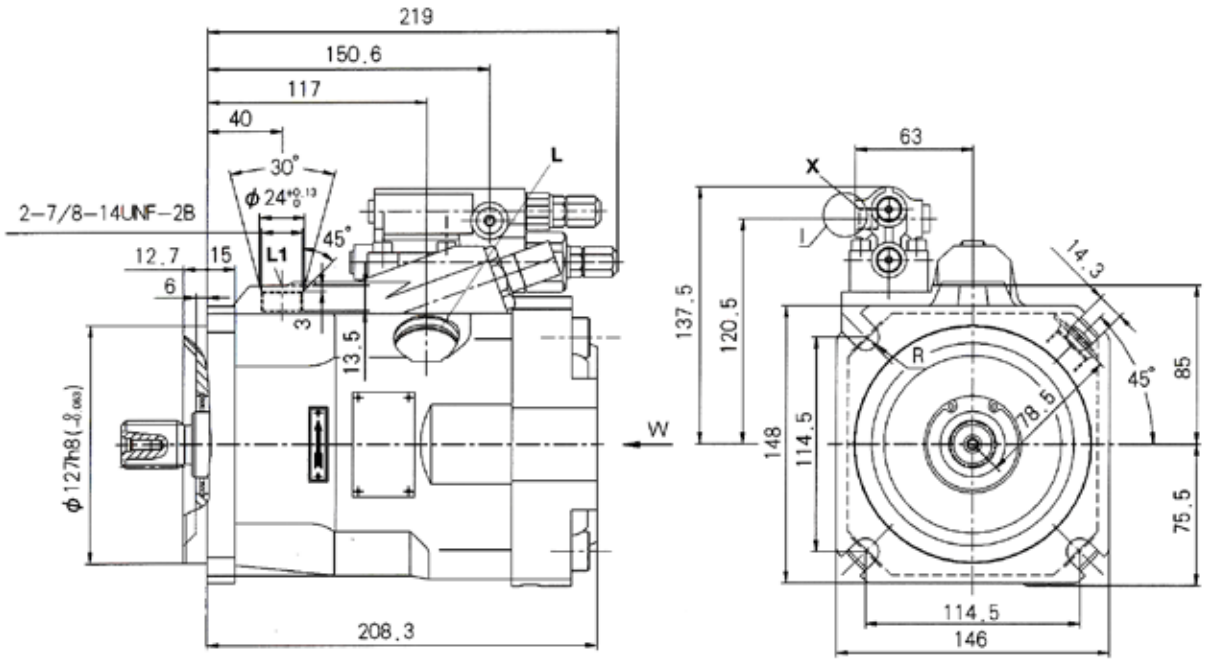
MA10VO/VSO Series 52

Mounting Dimension, Sizes 60
DFR, DFR1 & DRG Controls (Version: MA10VSO60***/52L-XXD61/11N00)



Port Plate 61/11
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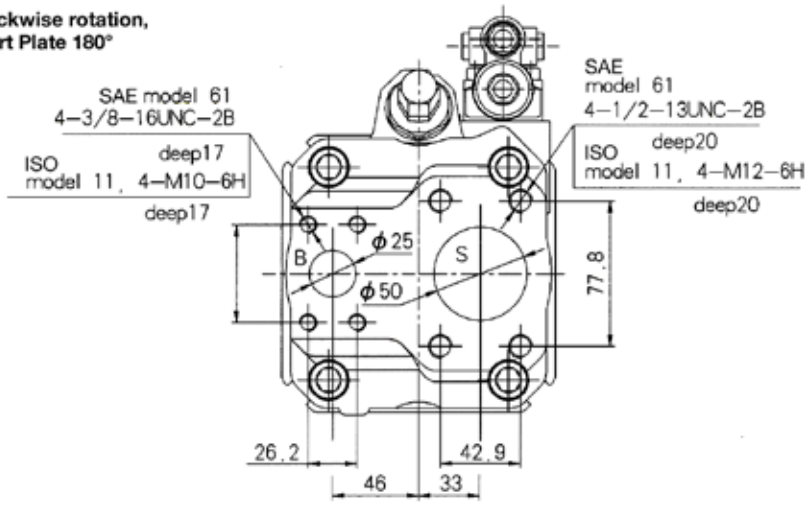
For clockwise rotation, turn Port Plate 180°

View W



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

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