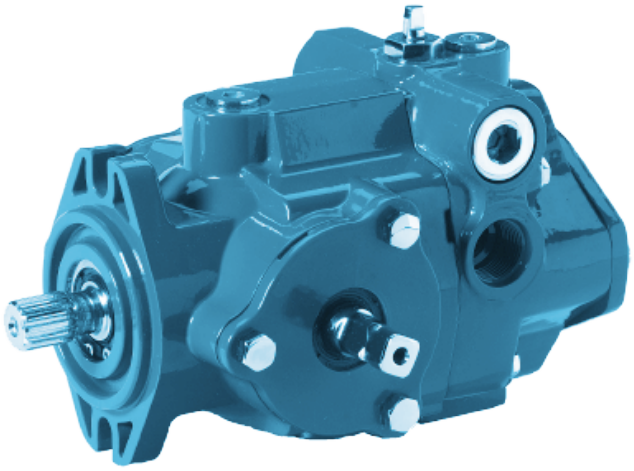
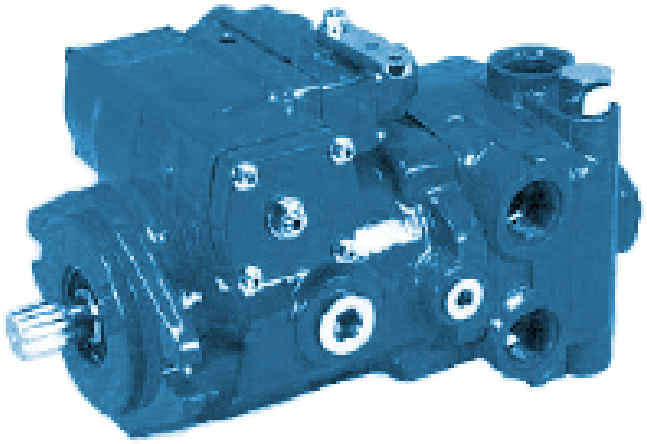
Medium Duty Piston Pump

Variable Displacement Closed Circuit

Model 70160	Model 70360	Model 72400
20.3 cm^3/r [1.24 in^3/r]	40.6 cm^3/r [2.48 in^3/r]	40.6 cm^3/r [2.48 in^3/r]
23.6 cm^3/r [1.44 in^3/r]	49.2 cm^3/r [3.00 in^3/r]	49.2 cm^3/r [3.00 in^3/r]





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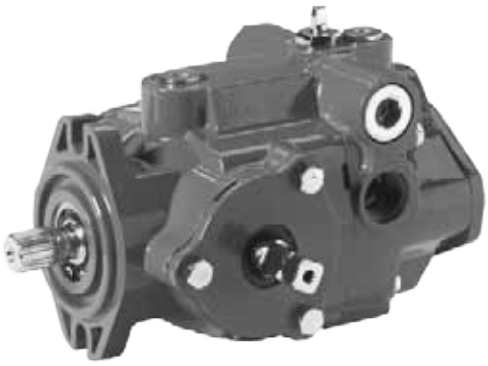
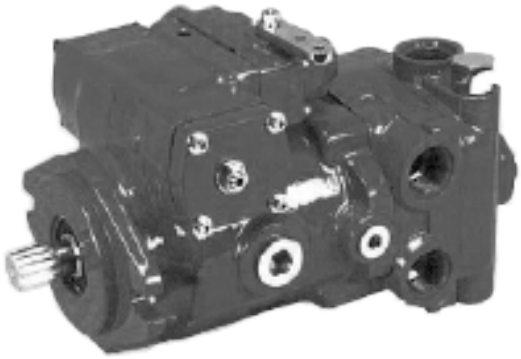




Introduction

In axial piston pumps, the pistons reciprocate parallel to the axis of rotation of the cylinder block. The simplest type of axial piston pump is the swash plate in-line design.

The cylinder block in this pump is turned by the drive shaft. Pistons fitted to bores in the cylinder block are connected through piston shoes and a shoe plate, so that the shoes bear against an angled swash plate causing the pistons to reciprocate. The ports are arranged in the valve plate so that the pistons pass the inlet as they are pulled out and pass the outlet as they are forced back in.

The displacement of axial piston pumps is determined by the size and number of pistons, as well as the stroke length which is determined by the angle of the swash plate.

Variable Displacement Piston Pumps are used in closed loop systems either as a single or tandem pump. Oil is circulated by the pump to the motor and then returned directly back to the pump. A charge supply is used to supplement the closed loop system with oil. The charge supply may be supplied by an internal charge pump (standard) or an external source.

Typical Applications

Harvester Equipment

Combines
Fruit or Vegetable Pickers
Swathers

Forestry Equipment

Log Skidders
Bark Removers
Limb Removers

Construction Equipment

Trenchers
Skid Steer Loaders
Utility Vehicles
Sweepers

Turf Care Equipment

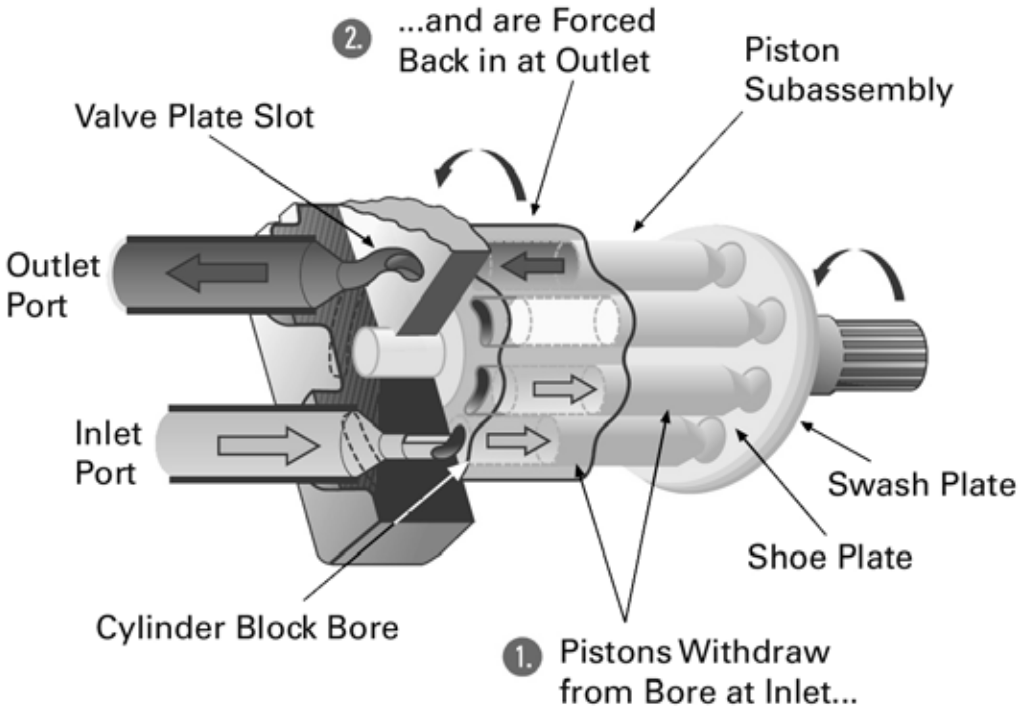
Mowers
Loaders

Paving Equipment

Rollers
Packers

Industrial Equipment

Lift Trucks
Scissor Lifts



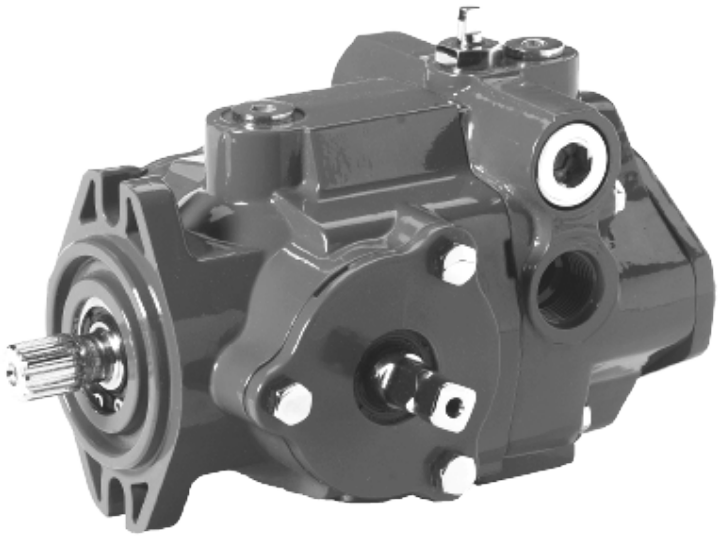
Section 1 - Model 70160

Manual Controlled

20,3 cm^3/r [1.24 in^3/r]

23,6 cm^3/r [1.44 in^3/r]

Displacement



Identification Numbers - Manual Variable Displacement Piston Pump - Closed Circuit

Stamped on each unit.

A – Product Number Description

- 70160 = Single Piston Pump
- 78162 = Single Piston Pump with Gear Pump
- 78161 = Tandem Piston Pumps
- 78163 = Tandem Piston Pumps with Gear Pump

B – Rotation

- R = Right Hand
- L = Left Hand

C – Sequential Letter

D – Design Code Number

Single Pump – Product Number

70160-RAA-03

A B C D

Tandem Pumps – Product Number

78163-RAB-03

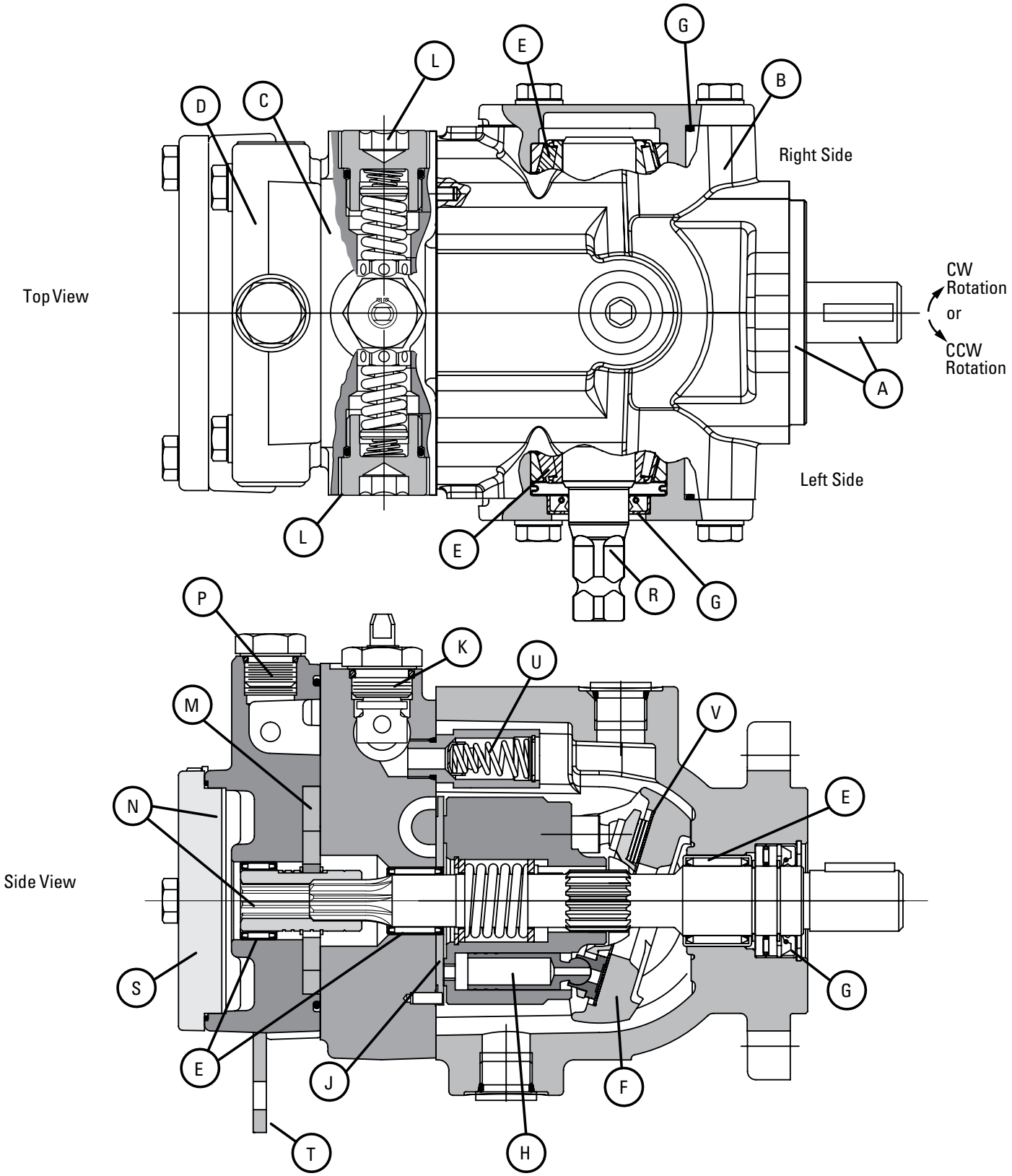
A B C D

Serial Number Code

10 05 06 XXX 1 000

- Last Two Digits of Year Built. (10 for 2010 etc.)
- Month Built (two digits)
- Day Built (two digits)
- Manufacturing Cell
- Shift Number
- Specific Number of the Pump

Model 70160
Features



Model 70160
Features

A Input Shaft and Mounting

- Shaft options
- SAE "A" mounting flange
- Tandem capability

B Housing

- Compact
- Lightweight, die cast aluminum

C Endcover

- Opposite side porting and same side porting available.

D Charge Pump Housing w/ Auxiliary Mount

E Bearings

F Swashplate

G Seals

H Rotating Group

- 20,3 cm^3/r [1.24 in^3/r] displacement
- 23,6 cm^3/r [1.44 in^3/r] displacement

J Valve Plate

K Bypass Valve

- Option for cross porting a closed loop hydraulic circuit — used to move a disabled machine a limited distance.

L Internal High Pressure Relief Valves

- Prevents excessive pressure

M Gerotor Charge Pump

- Two sizes available.
  6,9 cm /r [.42 in /r]
  13,8 cm /r [.84 in /r]

N Auxiliary Pump Drive

P Auxiliary Port

- For pressure check port or remote charge pressure port.

R Control Shaft

- Positioned on left or right side of pump.

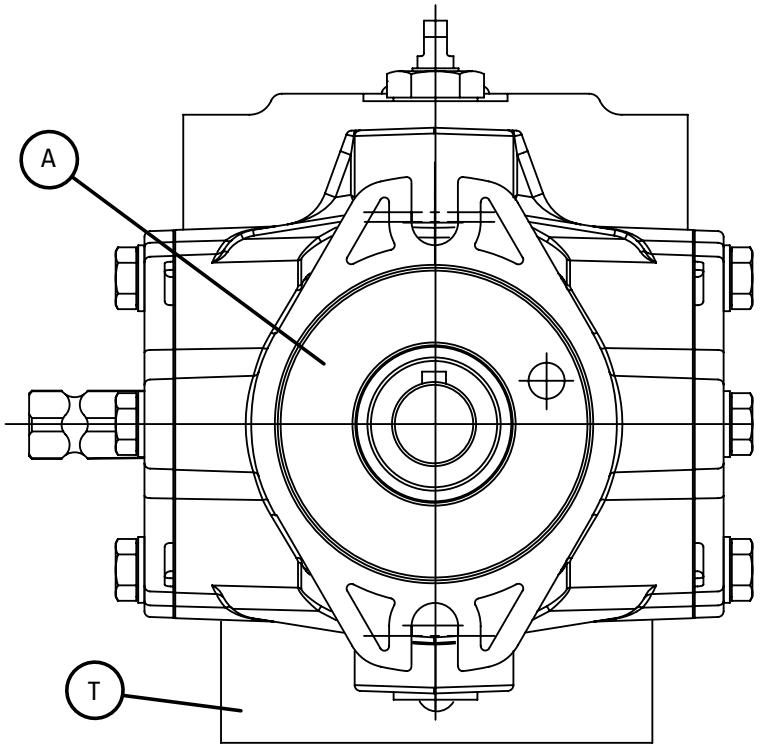
S "A" Pad Rear Cover Plate

T Mounting Bracket

- For support of rear unit of tandem pump. This bracket must be attached to the engine flywheel housing on the bulk-head used to mount the front unit of a tandem pump.

U Low Pressure Relief Valve

V Swashplate Insert

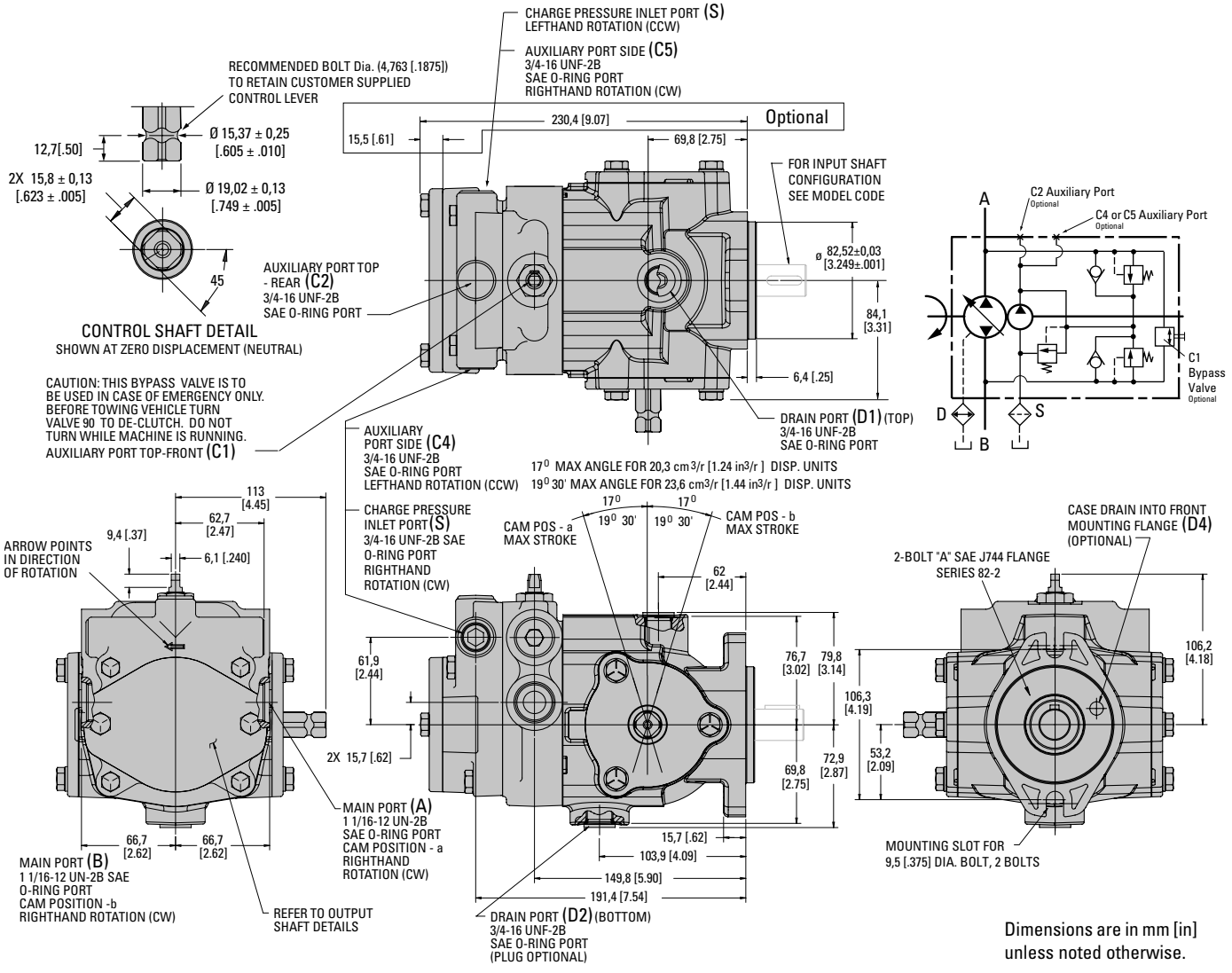


Front View

Model 70160
Assembly Installation Drawings

Opposite Side Porting with Internal Charge

Port ID	Type of Port	Size and Description
A	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
B	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
C1	Auxiliary Port Top - Front or Bypass Valve	3/4 - 16 UNF-2B SAE O-ring
C2	Auxiliary Port Top - Rear	3/4 - 16 UNF-2B SAE O-ring
C4	Auxiliary Port Side - Left Side	3/4 - 16 UNF-2B SAE O-ring
C5	Auxiliary Port Side - Right Side	3/4 - 16 UNF-2B SAE O-ring
D1	Drain Port - Top	3/4 - 16 UNF-2B SAE O-ring
D2	Drain Port - Bottom	3/4 - 16 UNF-2B SAE O-ring
D3	Thru Drain - Rear	9,27 [.365] Dia.
D4	Thru Drain - Front	9,27 [.365] Dia.
S	Charge Suction Port	3/4 - 16 UNF-2B SAE O-ring

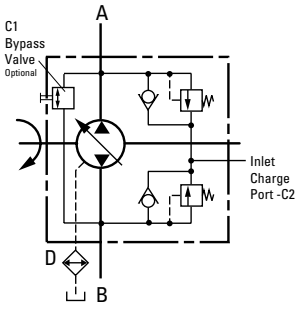


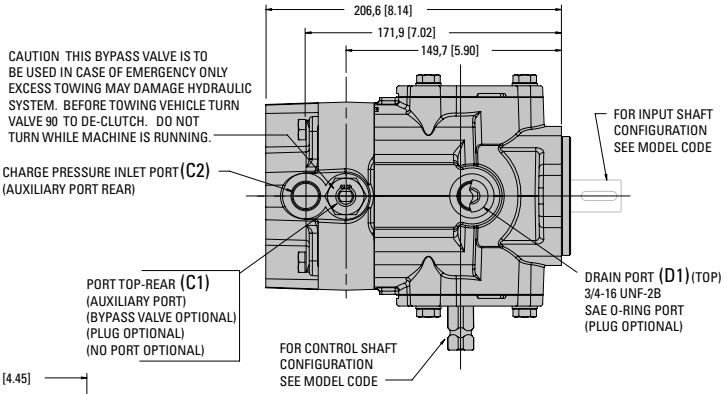
Dimensions are in mm [in]
unless noted otherwise.

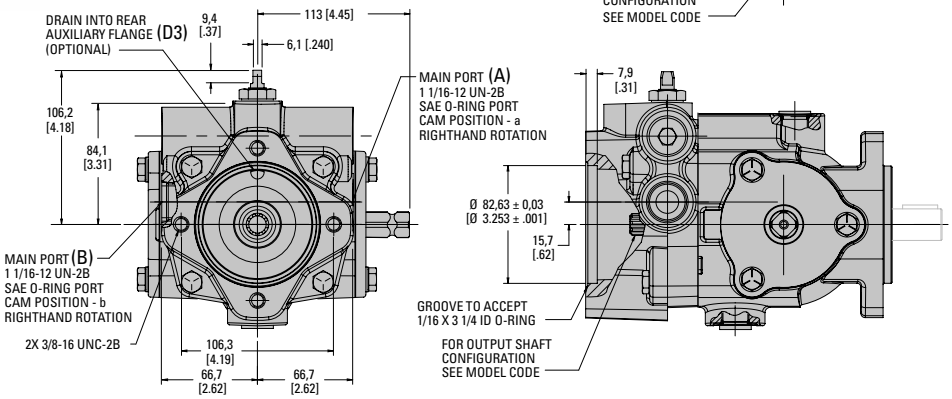
Model 70160
Assembly Installation Drawings

Opposite Side Porting

Note: External charge pump required.

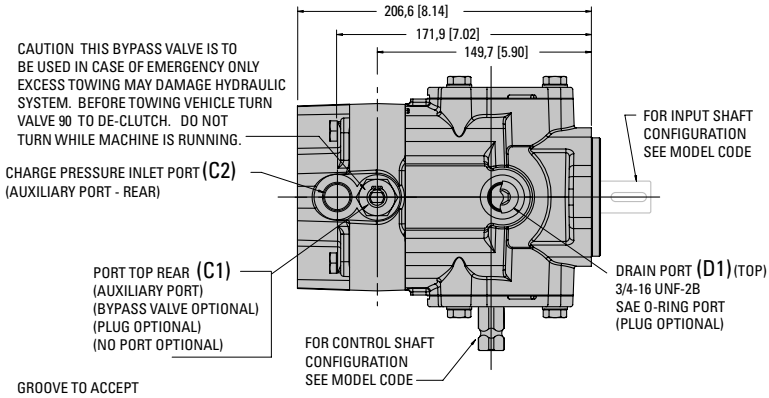


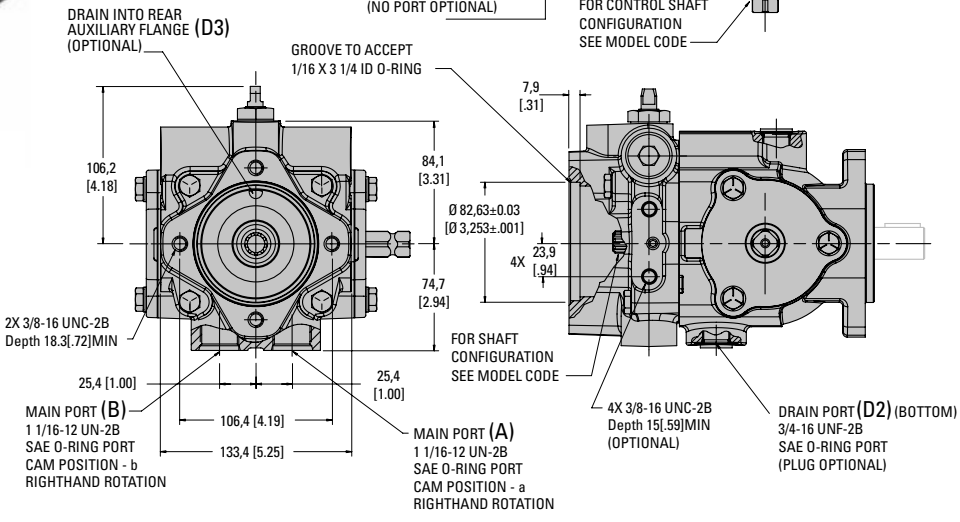




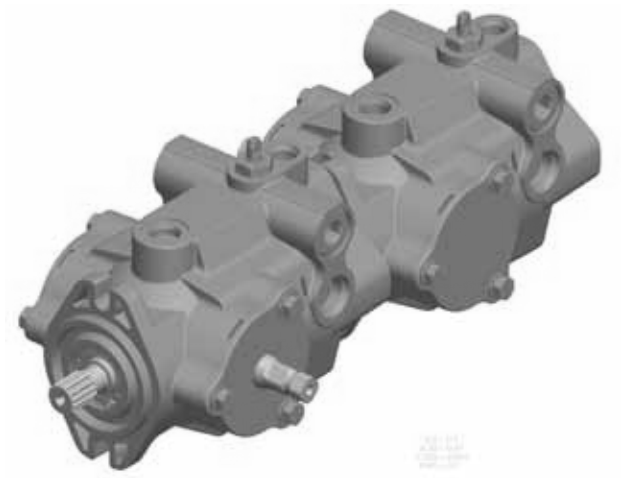
Same Side Porting

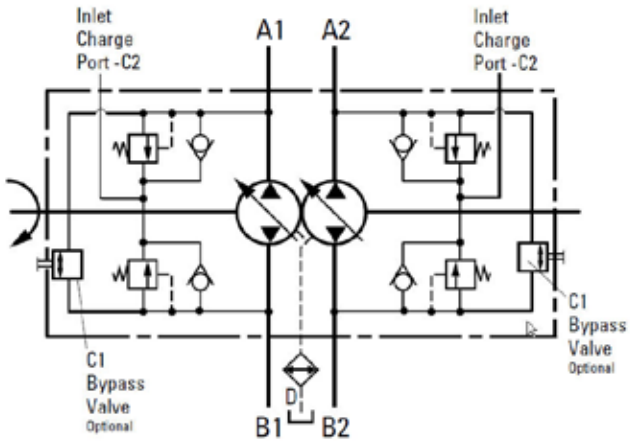
Note: External charge pump required.

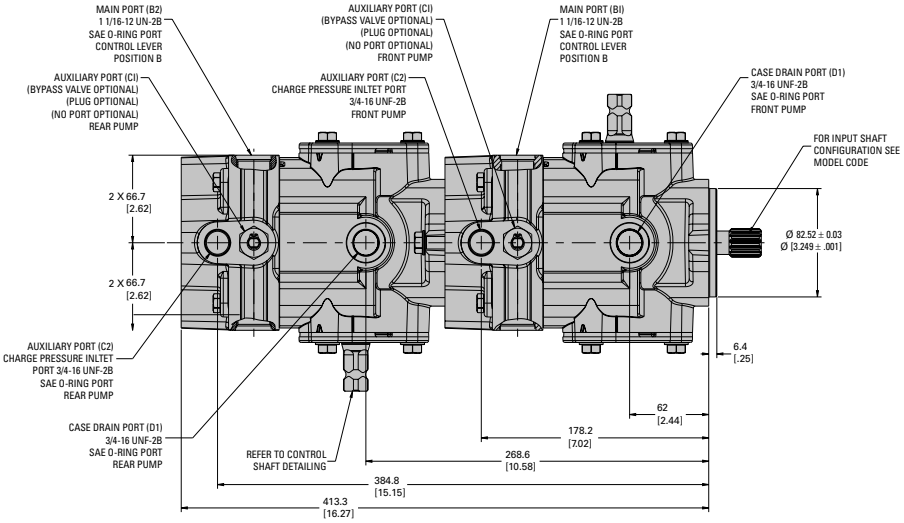


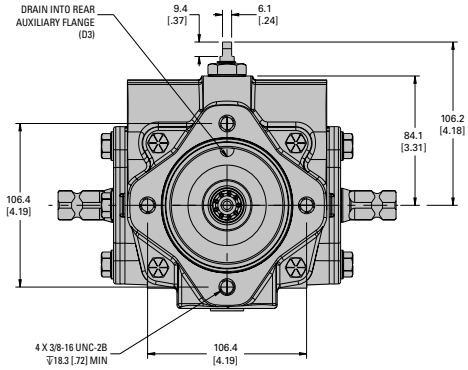


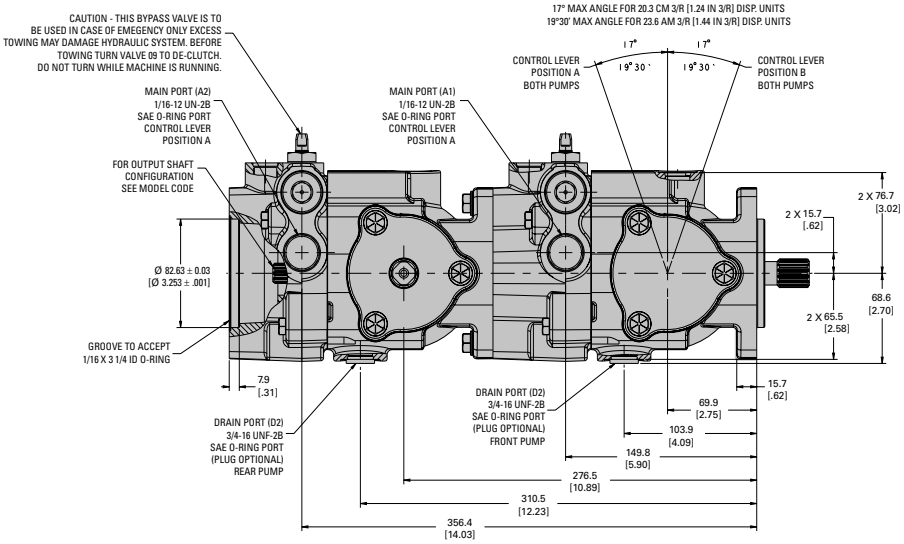
Model 70160
Tandem Assembly Installation Drawing

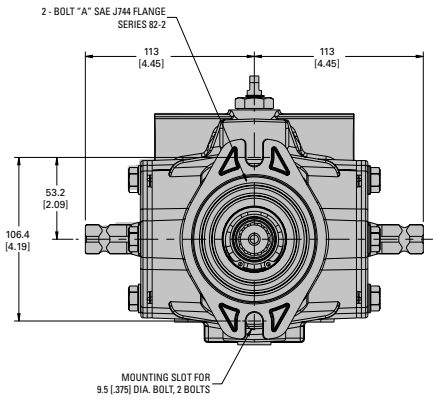




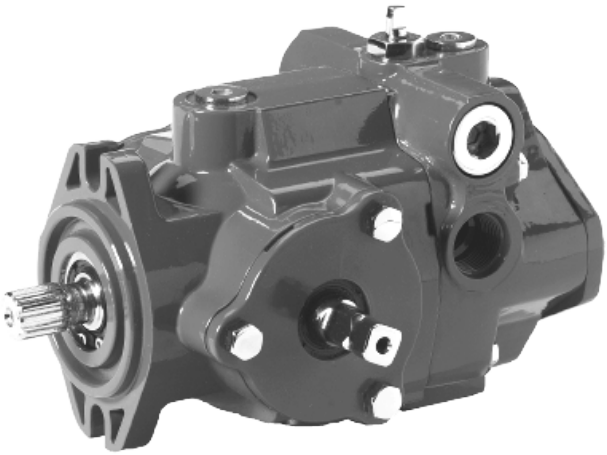








Model 70160
Specifications



Specifications - Piston Pump

Maximum Displacement	20,3 cm^3/r [1.24 in^3/r]	23,6 cm^3/r [1.44 in^3/r]
Input Mounting Flange	SAE "A"	SAE "A"
Flow @ Rated Speed & PSI	64,3 l/min [17 gal/min]	75,7 l/min [20 gal/min]
Maximum Rated Speed	3600 RPM	3600 RPM
Nominal Pressure Rating*	345 bar [5000 PSI]	345 bar [5000 PSI]
Peak Pressure Rating**	380 bar [5500 PSI]	380 bar [5500 PSI]
Max Input Power	42 kw (56 HP)	49 kw (65 HP)
Max Input Torque	119 N-m (1050 lbf-in)	136 N-m (1200 lbf-in)
Continuous Allowable Case Pressure	2 bar [25 PSI]	2 bar [25 PSI]
Maximum Case Drain Temperature	107° C [225° F]	107° C [225° F]
Weight Per Single Pump	9,5 kg [21 lbs]	9,5 kg [21 lbs]

Moment of Inertia

Single 160 Pump (Rotating kit)	1.164e-3 kg*m^2
Two 160 Pumps (Rotating kits)	2.329e-3 kg*m^2
G Load Capacity (Single Pump)***-	10 G

Specifications - Integral Gerotor Charge Pump

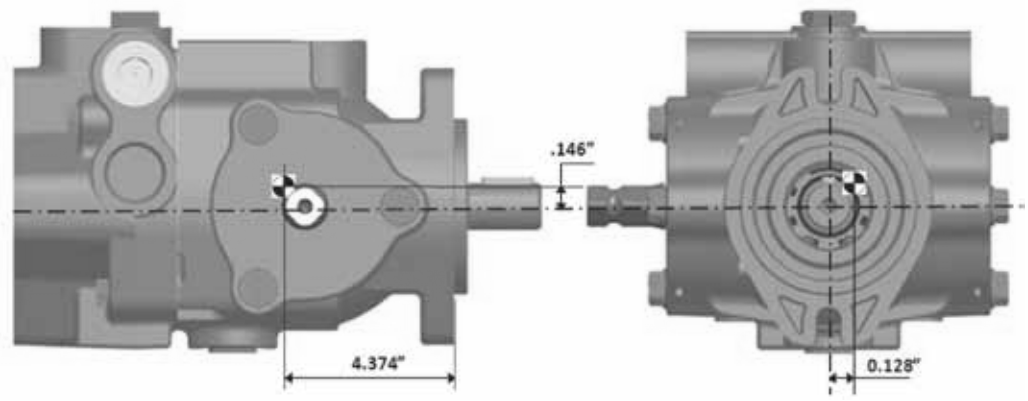
Displacement Options	6,9 cm^3/r [.42 in^3/r] 13,8 cm^3/r [.84 in^3/r]
Operating Pressure Range (std.)	7 to 10 bar [100 to 150 PSI]
Maximum Charge Inlet Vacuum	0,80 bar Abs. [11.6 PSI Abs.]

* Nominal Pressure: Max delta system pressure at which component fatigue does not occur (pump life estimated by bearing life).

** Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).

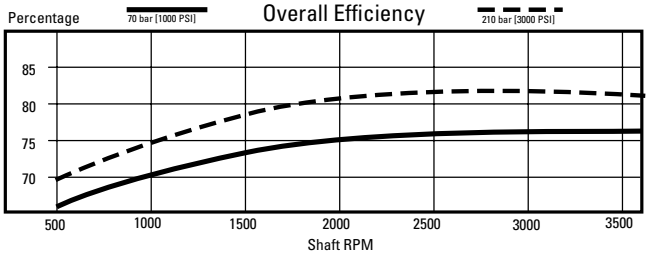
*** Please contact Eaton representative for specific requirements.

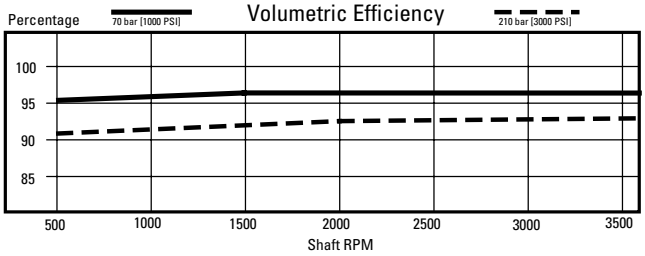
Center of Gravity (C.G.)

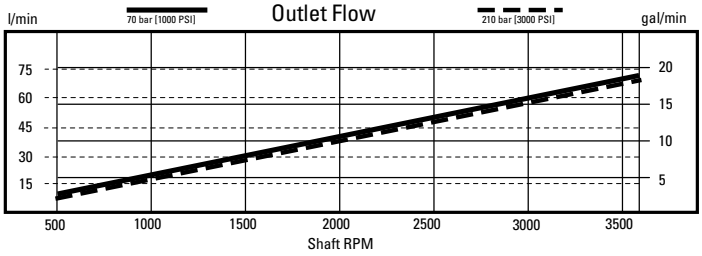


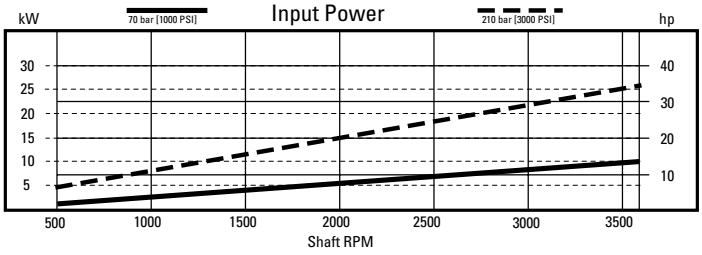
Model 70160
Performance Data

The charts below are representative of a **20,3 cm³/r [1.24 in³/r]** Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity 7 - 9 cSt [50 - 54 SUS] and the pump at maximum displacement.

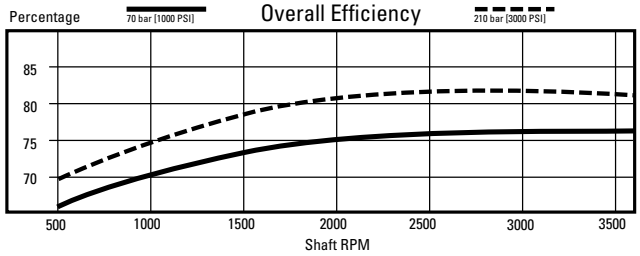


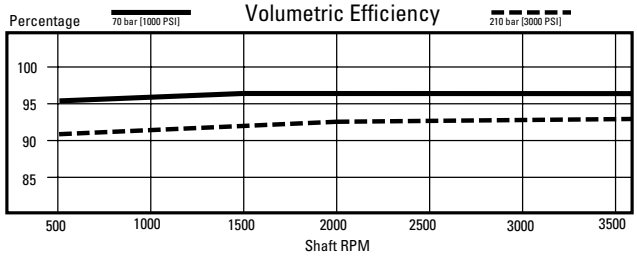


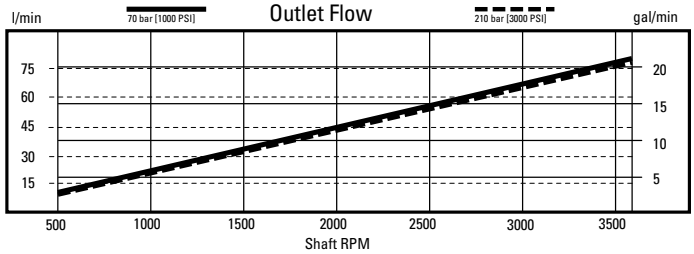


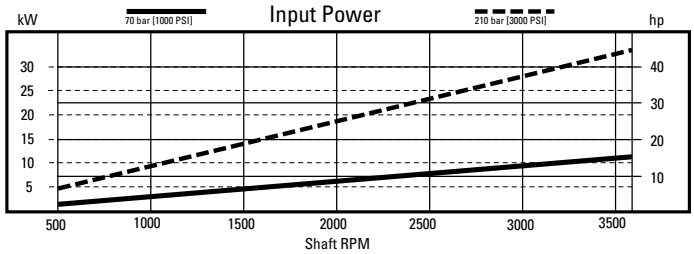


The charts below are representative of a **23,6 cm³/r [1.44 in³/r]** Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity 7 - 9 cSt [50 - 54 SUS] and the pump at maximum displacement.



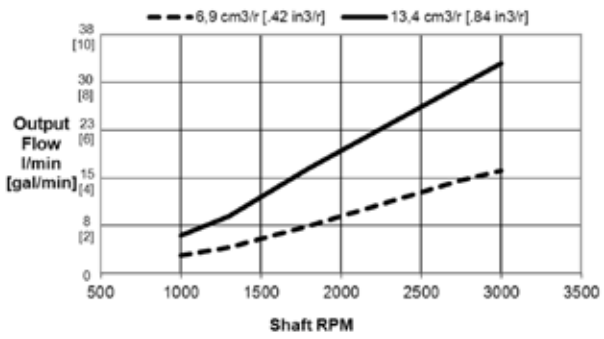






Charge Pump Performance - Flow vs Speed

The chart at right is representative of a 6,9 cm³/r [.42 in³/r] cm³/r and 13,4 [.84 in³/r] displacement charge pumps. The test was run at an oil temperature of 60°C [150°F] with viscosity 13 cSt [65 SUS].



Model 70160 Code

The Model 70160 Variable Displacement Piston Pumps are specified by the following model code. Once a pump is built from the model code, a product number will be assigned to that configuration. Make sure all positions are selected within the 32 digit code for each pump.

Code Example:	**ADB**	**12**	**R**	**1**	**A**	**B**	**D**	**1**	**1**	**T**	**T**	**1**	**A**	**0**	**A**	**AA**	**3**	**1**	**1**	**A**	**0**	**0**	**00**	**0A**	**0**	**C**
Position -	1, 2, 3	4, 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19, 20	21	22	23	24	25	26	27, 28	29, 30	31	32
	ADB			**1**			**D**		**1**					**0**												**C**

Position 1, 2, 3
- **Code Title**

ADB = Series 160 Manually Variable Displacement Axial Piston Pump with SAE J744 Flange 82-2 (2 Bolt A)

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump

	Code	Single Unit	Tandem Unit Front	Tandem Unit Rear
Positions 4, 5 - Displacement				
12 = 20,3 cm^3/r [1.24 in^3/r]	12	Std.	Std.	Std.
14 = 23,6 cm^3/r [1.44 in^3/r]	14	Std.	Std.	Std.
Position 6 - Input Shaft Rotation				
R = Righthand Rotation (CW)	R	Std.	Std.	Std.
L = Lefthand Rotation (CCW)	L	Std.	Std.	Std.
Position 7 - Valve Plate				
1 = Type 1	1	Std.	Std.	Std.
Position 8 - Input Shaft (see page 17 for details)				
A = 13 Tooth 16/32 Pitch Spline, Shaft Extension 41,1 [1.62]	A	Std.	Std.	NA
C = 35 Tooth 48/96 Pitch Spline, Shaft Extension 32,0 [1.26]	C	NA	NA	Std.
F = Straight Shaft Dia. 22,2 [.875], Keyway 6,35 [.25] x 25,9 [1.02], Shaft Extension 41,1 [1.62] (Key Included)	F	Opt.	NA	NA
Position 9 - Control Shaft and Location				
L = Left Side	L	Std.	Std.	Std.
R = Right Side	R	Std.	Std.	Std.
Position 10 - Control Shaft				
D = with 15.7 [.62] square arm, with bolt groove; 113 [4.45] from unit centerline to control shaft end	D	Std.	Std.	Std.
Position 11 - Main Ports (A and B) Location (see page 20 for port location)				
1 = Opposite Sides	1	Std.	Std.	Std.
2 = Same Side (without internal charge pump)	2	Opt.	Opt.	Opt.
Position 12 - Main Ports (A and B) Size				
1 = 1- 1/16 -12 UN-2B Port, SAE Straight Thread O-ring Ports	1	Std.	Std.	Std.
2 = 7/8 -14 UNF-2B Port, SAE Straight Thread O-ring Ports	2	Opt.	Opt.	Opt.
Positions 13, 14 - Relief Valve Setting for Main Ports (Select a setting for port "A" in position 10 and port "B" in position 11.)				
0 = No Relief, Check Valve Assembly Only	0	Opt.	Opt.	Opt.
B = 138 bar [2000 PSI]	B	Opt.	Opt.	Opt.
E = 173 bar [2500 PSI]	E	Opt.	Opt.	Opt.
H = 207 bar [3000 PSI]	H	Opt.	Opt.	Opt.
L = 241 bar [3500 PSI]	L	Opt.	Opt.	Opt.
N = 276 bar [4000 PSI]	N	Opt.	Opt.	Opt.
Q = 310 bar [4500 PSI]	Q	Opt.	Opt.	Opt.
T = 344 bar [5000 PSI]	T	Std.	Std.	Std.
Position 15 - Charge Displacement, Suction Port (S) (see page 20 for port location)				
0 = No Charge	0	Opt.	Std.	Opt.
1 = 6,9 cm^3/r [.42 in^3/r]; 3/4 - 16 UNF-2B SAE o-ring port for suction inlet (right side CCW, Left side CW)	1	Std.	NA	NA
3 = 13,8 cm^3/r [.84 in^3/r]; 3/4 -16 UNF-2B SAE o-ring port for suction inlet (right side CCW, Left side CW)	3	Opt.	NA	Std.
Position 16 - Charge Relief Setting and Routing				
0 = No (requires external relief set between 6,89 bar [100 lbf/in^2] and 20,68 bar [300 lbf/in^2])	0	Opt.	Std.	Opt.
A = 6,89-10,34 bar [100-150 PSI]; Relieved to case	A	Std.	NA	Std.
B = 10,34-13,79 bar [150-200 PSI]; Relieved to case	B	Opt.	NA	Opt.
C = 13,79-17,24 bar [200-250 PSI]; Relieved to case	C	Opt.	NA	Opt.
D = 17,24-20,68 bar [250-300 PSI]; Relieved to case	D	Opt.	NA	Opt.
E = 20,68-24,13 bar [300-350 PSI]; Relieved to case	D	Opt.	NA	Opt.
F = 6,89-10,34 bar [100-150 PSI]; Recirculated	F	Std.	NA	Std.
G = 10,34-13,79 bar [150-200 PSI]; Recirculated	G	Opt.	NA	Opt.
H = 13,79-17,24 bar [200-250 PSI]; Recirculated	H	Opt.	NA	Opt.
J = 17,24-20,68 bar [250-300 PSI]; Recirculated	J	Opt.	NA	Opt.
L = 4.14-7.58 bar [60-110 lbf/in2] Relieved to Case	L	Opt	NA	Opt
P = 11.38-14.82 bar [165-215 lbf/in2] Recirculated	P	Opt	NA	Opt

Dimensions are in mm [in] unless noted otherwise.

Model 70160 Code

Continued

Position 17 - Charge Special Feature				
0 = No Special Feature	0	Std.	Std.	Std.
Position 18 - Auxiliary Rear Mount and Output Shaft (see page 18 for details)				
A = With Integral Charge: Horizontal 2-Bolt "A" SAE J744 Flange 82-2; Accepts 9 tooth internal 16/32 pitch spline with 31,7 [1.25] shaft extention	A	Std.	NA	Std.
B = No Integral Charge: Horizontal or Vertical 2-Bolt "A" SAE J744 Flange 82-2; Accepts 11 tooth external 16/32 pitch spline with 31,7 [1.25] shaft extention (Coupler required)	B	Opt.	NA	Opt.
C = No Integral Charge: Horizontal or Vertical 2-Bolt "A" SAE J744 Flange 82-2; Accepts 9 tooth external 16/32 pitch spline with 31,7 [1.25] shaft extention (Coupler required)	C	Opt.	NA	Opt.
D = No Integral Charge: Horizontal or Vertical 2-Bolt "A" SAE J744 Flange 82-2; Accepts 35 tooth external 48/96 pitch spline with 32 [1.26] shaft extention (Coupler required)	D	Opt.	Std.	Opt.
E = No Integral Charge: Horizontal or Vertical 2-Bolt "A" SAE J744 Flange 82-2; Accepts 9 tooth external 20/40 pitch spline with 31,7 [1.25] shaft extention (Coupler required)	E	Opt.	NA	Opt.
Position 19, 20 - Special Features Auxiliary Mounting				
00 = No Special Features	00	Std.	Std.	Std.
AA = Supply Cover Plate for 2-Bolt "A" SAE J744 Flange 82-2	AA	Opt.	Opt.	Opt.
AB = Supply Shaft Coupler 9 tooth 16/32 pitch	AB	Opt.	Opt.	Opt.
AC = Supply Shaft Coupler 9 tooth 20/40 pitch	AC	Opt.	Opt.	Opt.
AD = Supply Shaft Coupler 11 tooth 16/32 pitch	AD	Opt.	Opt.	Opt.
AE = Supply Shaft Coupler 35 tooth 48/96 pitch	AE	Opt.	Opt.	Opt.
AF = Bottom Mounting Bracket (632), Square Shaped	AF	Opt.	Opt.	Opt.
AG = Bottom Mounting Bracket (709), V Shaped	AG	Opt.	Opt.	Opt.
AH = Auxiliary Mounting Holes, 2 holes .375-16 UNC-2B thread, 15 [.59] min full thread, both sides	AH	Opt.	Opt.	Opt.
AJ = Auxiliary Mounting Holes, 2 holes .375-16 UNC-2B thread, 15 [.59] min full thread, both sides (9T coupler and Mounting Holes)	AJ	Opt.		
Position 21 - Auxiliary Port Top-Front (C1) or Bypass Valve (see page 20 for port location)				
0 = None	0	Std.	Std.	Std.
1 = 3/4 -16 UNF-2B SAE o-ring port	1	Opt.	Opt.	Opt.
2 = 3/4 -16 UNF-2B SAE o-ring port plugged	2	Opt.	Opt.	Opt.
3 = Bypass Valve Installed	3	Opt.	Opt.	Opt.
Position 22 - Auxiliary Port Top-Rear (C2) (see page 20 for port location)				
0 = None	0	Std.	Std.	Std.
1 = 3/4 -16 UNF-2B SAE o-ring port	1	Std.	Std.	Std.
2 = 3/4 -16 UNF-2B SAE o-ring port plugged	2	Opt.	Opt.	Opt.
Position 23 - Auxiliary Port Side (C4 or C5) (Integral Charge Only) (see page 20 for port location)				
0 = None	0	Opt.	NA	Opt.
1 = 3/4 -16 UNF-2B SAE o-ring port (right side CW, left side CCW)	1	Opt.	NA	Opt.
Position 24 - Case Drain (D1 and D2) (see page 20 for port location)				
A = 3/4 -16 UNF-2B SAE o-ring port D1-top (D2-bottom plugged)	A	Std.	Opt.	Std.
B = 3/4 -16 UNF-2B SAE o-ring port D2-bottom (D1-top plugged)	B	Opt.	Opt.	Opt.
C = 3/4 -16 UNF-2B SAE o-ring port (D1-top plugged and D2-bottom plugged)	C	Opt.	Opt.	Opt.
D = 3/4 -16 UNF-2B SAE o-ring port (D1-top and D2-bottom open)	D	Opt.	Opt.	Opt.
Position 25 - Thru Drain (D3 and D4) (see page 20 for port location)				
0 = None	0	Opt.	Opt.	Opt.
A = .365 Dia. D3-rear	A	Opt.	Std.	Opt.
B = .376 Dia. D4-front	B	Opt.	Opt.	Std.
C = .365 Dia. D3-rear and .376 Dia. D4-front	C	Opt.	Opt.	Opt.
Position 26 - Additional Functions				
0 = None	0	Std.	Std.	Std.
A = Bleed-Off Valve in Control Shaft Position "a" set at 13.79-17.24 bar [200-250 lbf/in2]	A	Opt.	Opt.	Opt.
Position 27, 28 - Special Features				
00 = None	00	Std.	Std.	Std.
0A = Flourocarbon rubber drive shaft seal	0A	Opt.	Opt.	Opt.
0D = Polyacrylate Drive Shaft Seal	OD	Opt.	Opt.	Opt.
Position 29, 30 - Paint				
0A = Primer, Red Oxide	0A	Std.	Std.	Std.
0B = Black	0B	Opt.	Opt.	Opt.
CD = Primer, Blue	CD	Opt.	Opt.	Opt.
Position 31 - Identification				
0 = Standard: Nameplate	0	Std.	Std.	Std.
Position 32 - Design Code				
C = C	C	Std.	Std.	Std.

Model 70160
Input Shafts

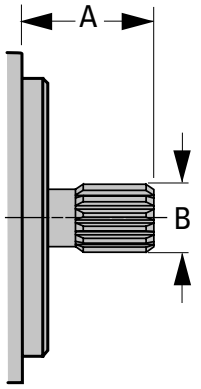
Code Position 8

Dimensions are in mm [in] unless noted otherwise.

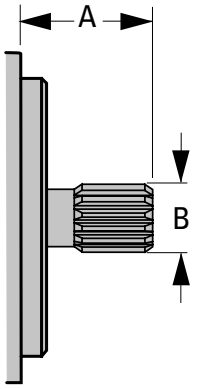
Code	Input Shafts		
	A	**C**	**F**
Type	13 Tooth	35 Tooth	Straight Keyed
A Dimension	41,1 [1.62]	32,0 [1.26]	41,1 [1.62]
B Dimension	21,810 [.8585]	19,0 [.75]	22,23 +0,00/-0,03 [.875 +.000/ -.001] Dia.
Maximum Input Torque	209,3 N•m [1852 lbf•in]	Used for tandem connection only	209,3 N•m [1852 lbf•in]
Shaft Specifications	16/32 Pitch 30 Degree Involute Flat Root, Class 1 Side Fit Spline, SAE J498b	48/96 Pitch 45 Degree Involute Fillet Root, Class 1 Side Fit Spline, SAE J498b	--

Torque Note:

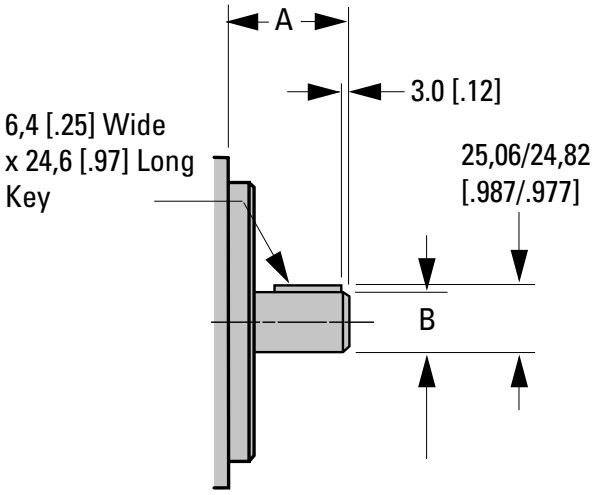
The combined torque required for multiple pumps must not exceed the torque rating of the input drive shaft of the front piston pump. Consult an Eaton representative and/or Eaton engineering on side load recommendations.



Input Shaft A
13 Tooth



Input Shaft C
35 Tooth



Input Shaft F
Straight Keyed

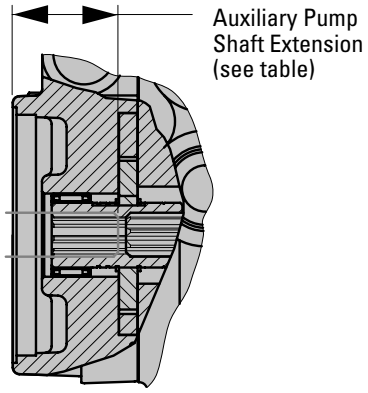
Model 70160
Auxiliary Rear Mounts & Output Shafts

Code Position 18

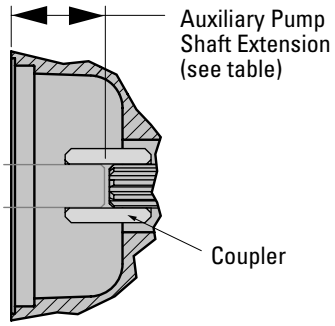
Dimensions are in mm [in] unless noted otherwise.

Code	Input Shafts				
	A	**B**	**C**	**D**	**E**
Type	9 Tooth	11 Tooth	9 Tooth	35 Tooth	9 Tooth
Shaft Outside Diameter	15,88 [.6250]	19,33 [.761]	15,88 [.6250]	19 [.75]	15,88 [.6250]
Shaft Diametrical Pitch	16/32 Pitch Int.	16/32 Pitch Ext.	16/32 Pitch Int.	48/96 Pitch Ext.	20/40 Pitch Ext.
Auxiliary Mount SAE A 2 Bolt	SAE J744	SAE J744	SAE J744	SAE J744	SAE J744
Auxiliary Pump Shaft Extension	31,7 [1.25]	31,7 [1.25]	31,7 [1.25]	32,0 [1.26]	31,7 [1.25]
Charge Pump	Yes	No	No	No	No
Maximum Torque	54 N•m [480 lbf•in]	119 N•m [1050 lbf•in]	76 N•m [672 lbf•in]	Used for tandem connection only	76 N•m [672 lbf•in]
Coupler Required; In code Postion 19, 20 select...	No	Yes, Code "AD"	Yes, Code "AB"	Yes, Code "AE"	Yes, Code "AC"

Auxiliary "A" Mount with Charge Pump



Auxiliary "A" Mount without Charge Pump

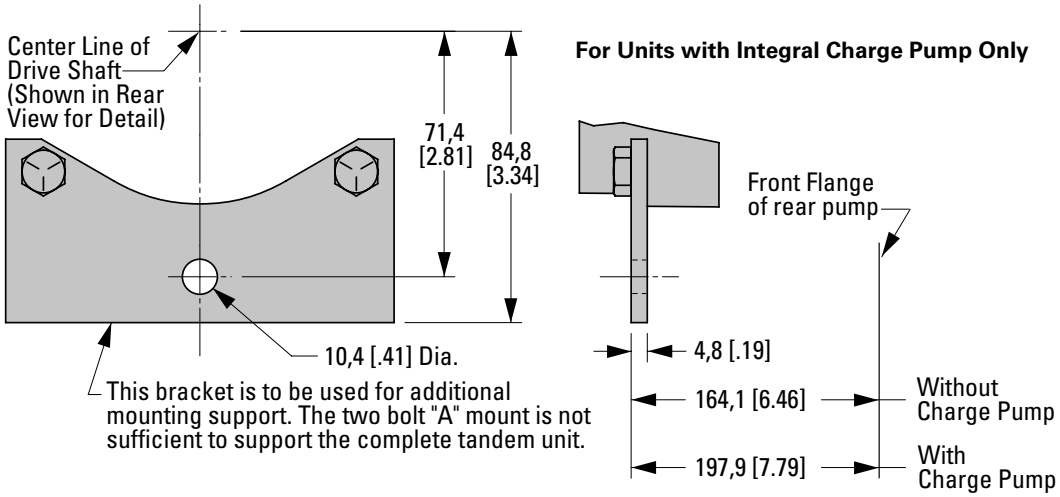


		Type	Diameter	Length
Code Position 12 and 20	**AB**	9T	28,45 [1.12] Dia.	39,12 [1.540]
	AC	9T	28,45 [1.12] Dia.	34,29 [1.35]
	AD	11T	31,8 [1.25] Dia.	38,9 [1.531]
	AE	35T	28,45 [1.12] Dia.	37,9 [1.49]

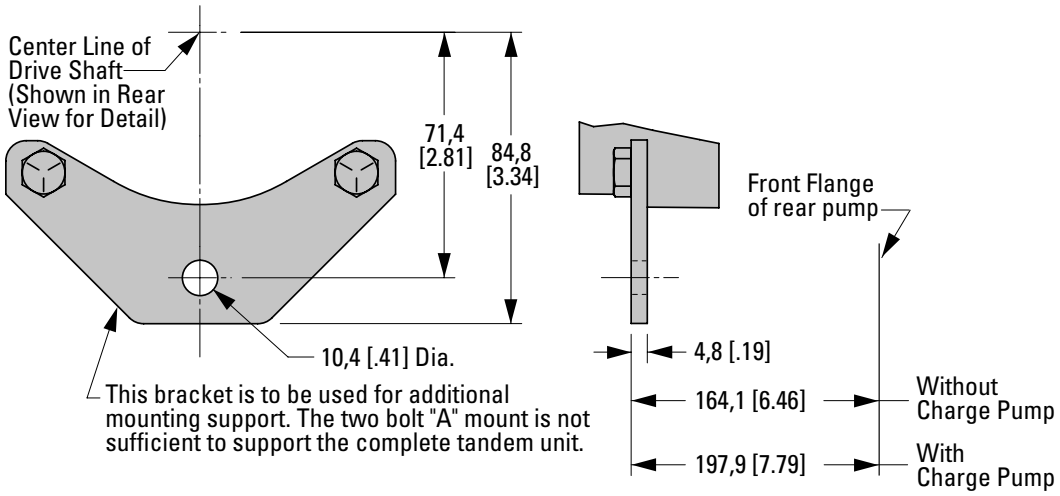
Model 70160
Bracket and Cover Plate

Code Position 19 and 20

Code "AF" Bracket



Code "AG" Bracket



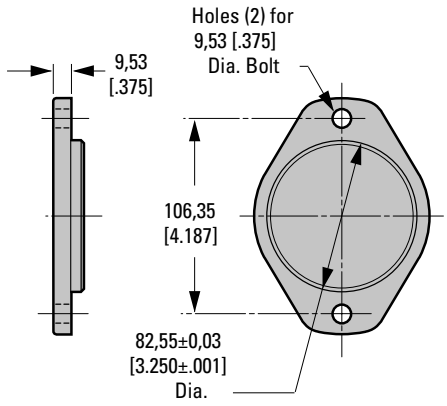
Cover Plate

Code Position 19, 20

Fits SAE "A" auxiliary mounting flange in place of auxiliary pump.

Cover Plate Kit #70142-915 includes cover plate, cap screws (2) and o-ring.

Code "AA"

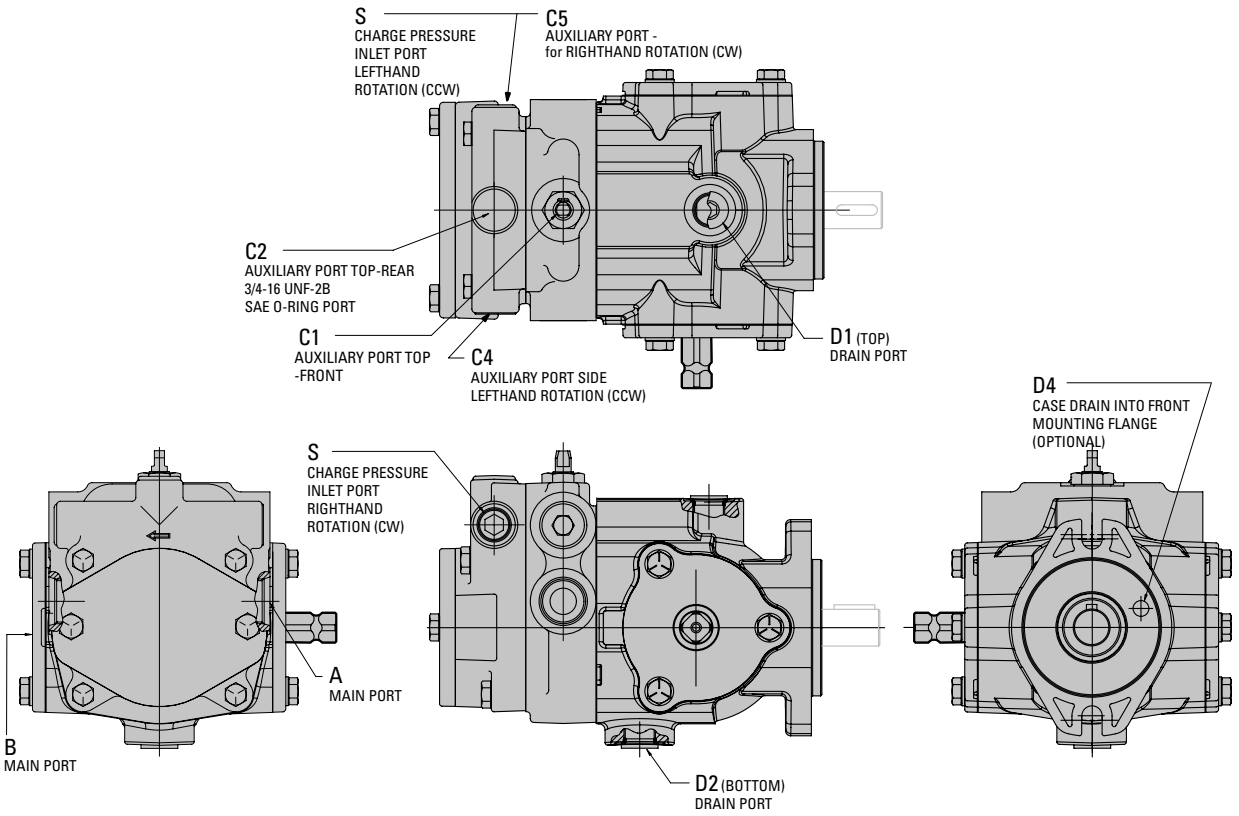


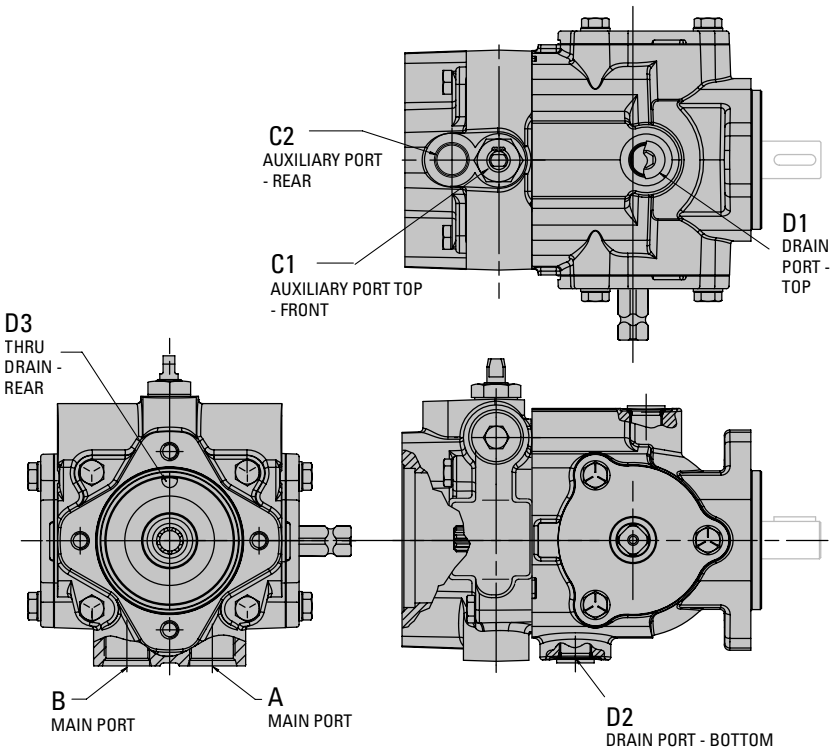
Dimensions are in mm [in] unless noted otherwise.

Model 70160
Port Locations

Code Position 21 through 25

Pump Without Integral Charge





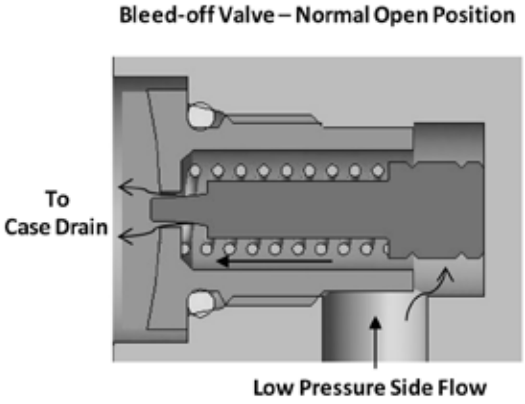
Port ID	Type of Port	Size and Description
A	Main Port	1- 1/16 - 12 UN-2B SAE O-ring, 7/8 -14 UNF-2B SAE O-ring
B	Main Port	1- 1/16 - 12 UN-2B SAE O-ring, 7/8 -14 UNF-2B SAE O-ring
C1	Auxiliary Port TopFront or Bypass Valve	3/4 - 16 UNF-2B SAE O-ring
C2	Auxiliary Port Top-Rear	3/4 - 16 UNF-2B SAE O-ring
C4	Auxiliary Port Side-Left Side	3/4 - 16 UNF-2B SAE O-ring
C5	Auxiliary Port Side - Right Side	3/4 - 16 UNF-2B SAE O-ring
D1	Drain Port - Top	3/4 - 16 UNF-2B SAE O-ring
D2	Drain Port - Bottom	3/4 - 16 UNF-2B SAE O-ring
D3	Thru Drain - Rear	9,27 [.365] Dia.
D4	Thru Drain - Front	9,27 [.365] Dia.
S	Charge Suction Port	3/4 - 16 UNF-2B SAE O-ring

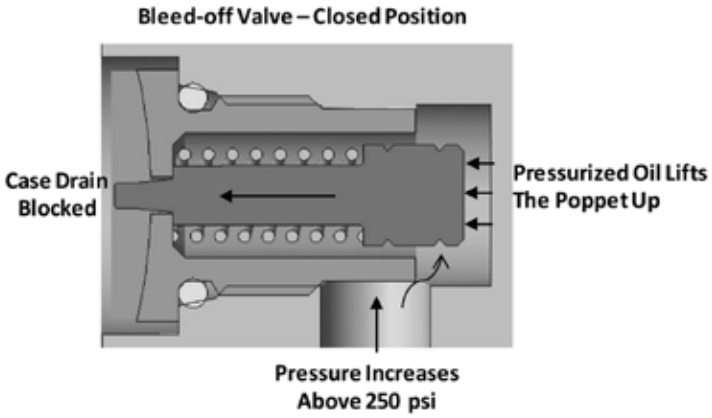
Model 70160
Bleed-Off Valve

Code Position 26, Code "A"

Pump with Integral Charge

Bleed-off valves are used to bleed oil from the low pressure side of the loop. They are "normally open" valves which close when pressurized to 200-250 psi. These valves close and open abruptly, causing vehicles to lurch when operators move across neutral into the opposite direction. As designed, a bleed-off valve can withstand flows of .8 to 1.2 gpm. Increasing the flow capacity of the valve will magnify the lurch that operators experience.

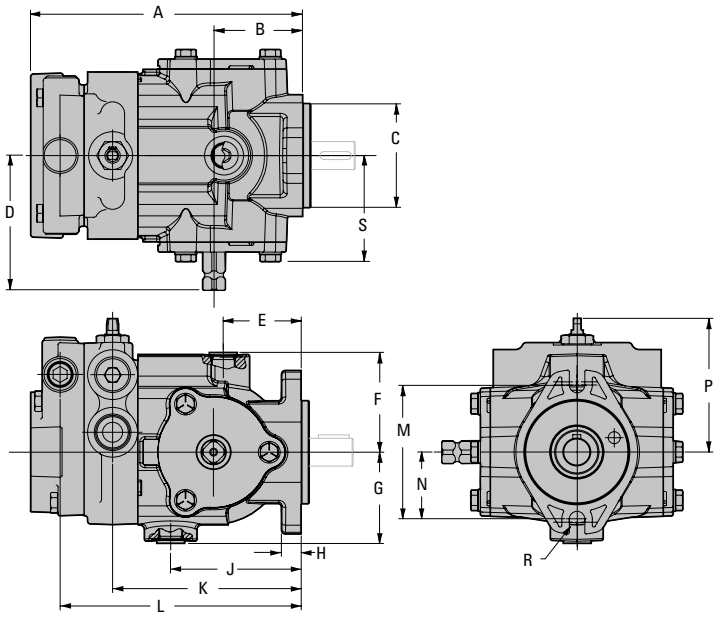




Model 70160 and 70142 Dimension Comparison

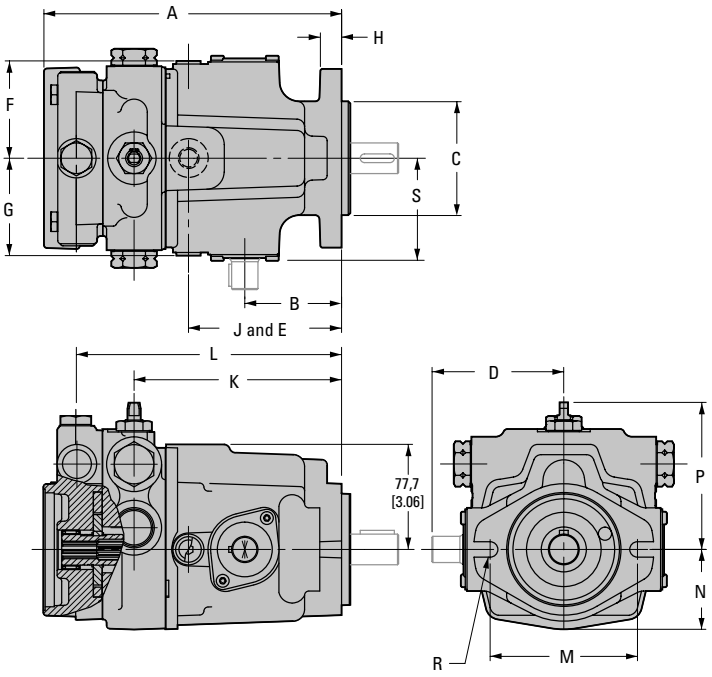
Model 70160

Opposite Side Porting, with Integral Charge



Model 70142

Opposite Side Porting, with Integral Charge



	Model 70160	Model 70142
A	214,8 [8.46]	214,8 [8.46]
B	69,8 [2.75]	69,8 [2.75]
C	82,52 [3.249]	82,52 [3.249]
D	113,0 [4.45]	95,2 [3.75]
E	62,0 [2.44]	110,5 [4.35]
F	79,8 [3.14]	70,6 [2.75]
G	72,9 [2.87]	70,6 [2.75]
H	15,7 [.62]	15,2 [.60]
J	103,9 [4.09]	110,5 [4.35]
K	149,8 [5.90]	149,6 [5.89]
L	191,4 [7.54]	191,4 [7.54]
M	106,6 [4.19]	106,6 [4.19]
N	53,2 [2.09]	53,2 [2.09]
P	106,2 [4.18]	106,6 [4.20]
R	11,2 [.44] Ø Bolt Slot	9,5 [.375] Ø Bolt Slot
S	84,1 [3.31]	74,7 [2.94]

1.24 in³/r Displacement Frame Size Key Improvements

1. Redesigned Trunnion Bearing & Covers
   - Changed from needle to tapered roller bearings
   - Improved thrust load capabilities
   - Minimizes section seal leaks
   - Facilitates assembly and disassembly
2. Swash Plate
   - Incorporates thrust plate to improve serviceability
3. Main Housing & Mounting Flange
   - Mounting flange rotated 90 degrees to facilitate larger trunnion bearings
   - Stiffer mounting flange to minimize requirement for additional mounting brackets
   - Larger case drain for higher flow capacity
   - Top & Bottom case drain locations minimize entrapped air and reduces risks of cavitation
4. Input Control Shaft & Seals
   - Redesigned to ease customer assembly of control linkages
   - Square input shaft to reduce wear between linkage and input shaft
   - Annular groove in input shaft to facilitate retention of linkage to the input shaft
5. Computer Generated Valve Plate Designs
   - Reduces noise and improved sound quality
   - Designs tailored to meet customer control and noise requirements
6. Improved Rotating Group
   - Improved neutral centering characteristics

Section 2 - Model 70360

Manual Controlled

40,6 cm^3/r [2.48 in^3/r]

49,2 cm^3/r [3.00 in^3/r]

Displacement

Identification Numbers - Manual Variable Displacement Piston Pump - Closed Circuit

Identification numbers

Stamped on each unit.

A – Product Number Description

- 70360 = Single Piston Pump
- 78362 = Single Piston Pump with Gear Pump
- 78361 = Tandem Piston Pumps
- 78363 = Tandem Piston Pumps with Gear Pump

B – Rotation

- R / S = Right Hand
- L / M = Left Hand

C – Sequential Letter

D – Design Code Number

Single Pump – Product Number

7 0 3 6 0 - R A A - 0 2

A B C D

Tandem Pumps – Product Number

7 8 3 6 3 - R A B - 0 2

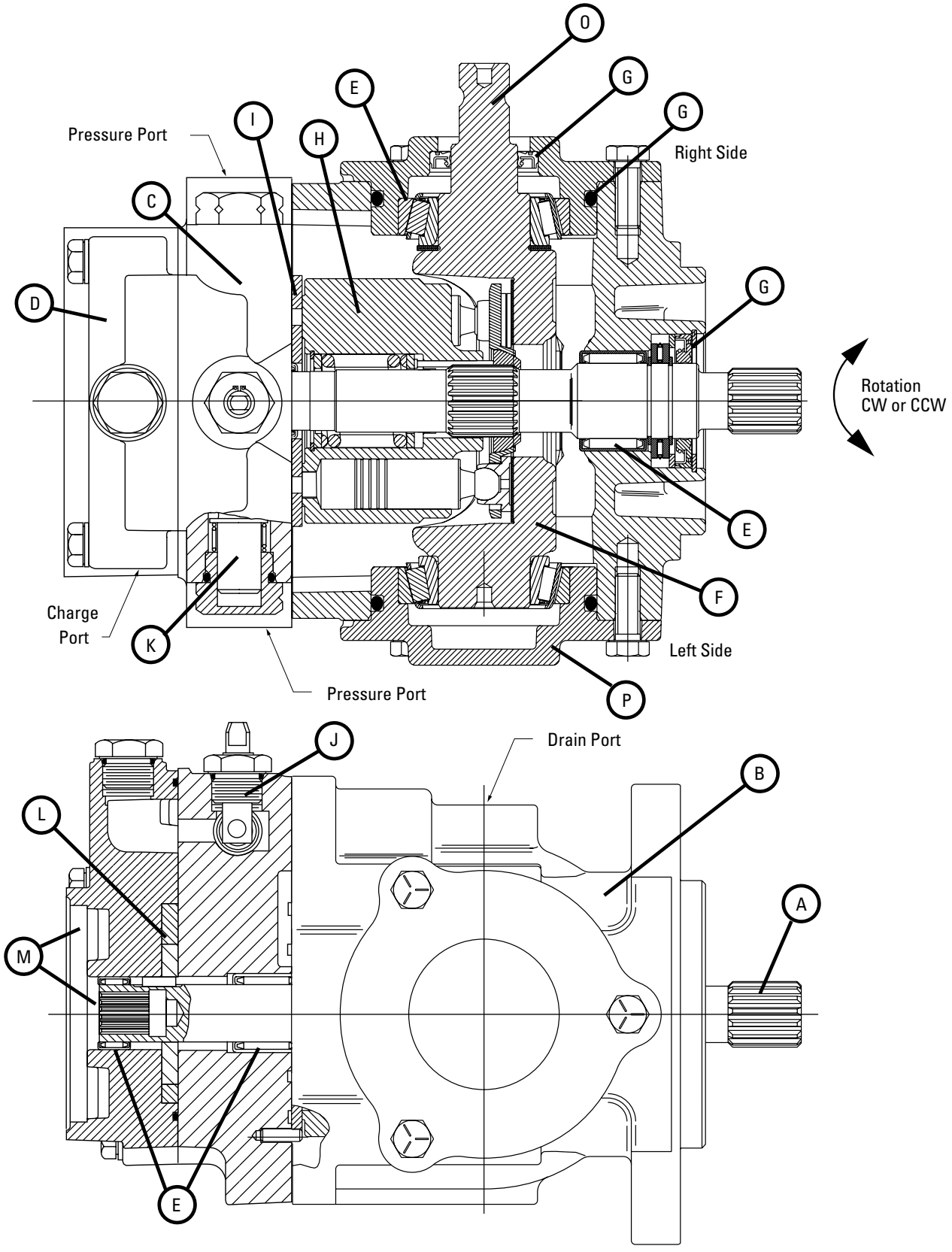
A B C D

Serial Number Code

10 05 06 XXX 1 000

- Last Two Digits of Year Built. (10 for 2010 etc.)
- Month Built (two digits)
- Day Built (two digits)
- Manufacturing Cell
- Shift Number
- Specific Number of the Pump

Model 70360
Features & Benefits



Model 70360
Features & Benefits

A Input Shaft and Mounting
- Auxiliary or tandem mount capability.
- Numerous shaft options.
- SAE "B" or "B-B" Mount (2 Bolt).

B Housing
- Compact and lightweight package size
- Durable, sturdy design.
- Reduces customer requirements for additional support brackets

C End cover
- Opposite side porting and same side porting w/ auxiliary mount

D Charge Pump Housing

E Tapered Trunnion Bearings
- Reduces noise and vibration.
- Improves neutral return thrust load capabilities

F Swash plate
- Reduces noise and vibration

G Seals

H Rotating Group
- 40,6 cm3/r [2.48 in3/r] Displacement
- 49,2 cm3/r [3.00 in3/r] Displacement

I Valve Plate
- Reduces noise and swash plate moments.

J Bypass Valve
- Cross ports the closed loop hydraulic circuit used to move a disabled machine a limited distance.

K Internal High Pressure Relief Valves
- Prevents excessive pressure

L Ge-rotor Charge Pump
- Four sizes available.
  6,9 cm3/r [.42 in3/r]
  13,8 cm3/r [.84 in3/r]
  17.2 cm3/r [1.05 in3/r]
  20.7 cm3/r [1.26 in3/r]

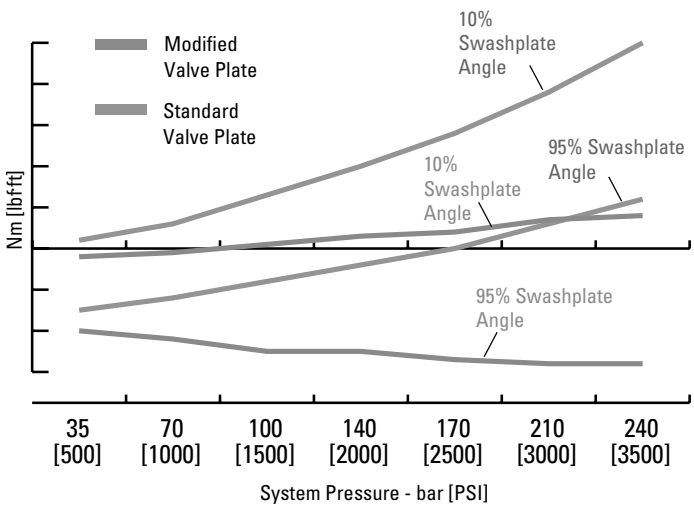
M Auxiliary Pump Mounting Flange (Rear)
- SAE 'A' or 'B'

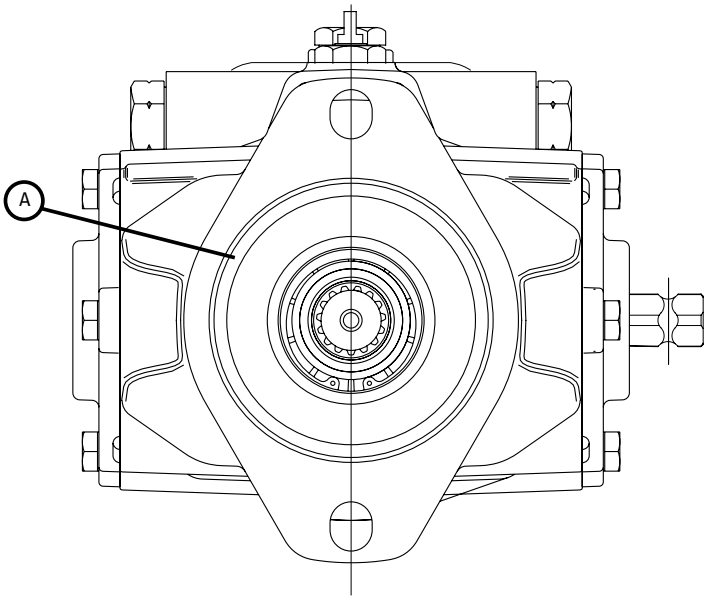
N Auxiliary Port
- For pressure check port or remote charge pressure port.

O Control Shaft (Square Std.)
- Positioned on left or right side of pump.
- Eases the assembly of customer installed control lever
- Reduces wear on control shaft and control lever.

P Cover Plate

Lower Swashplate Moments



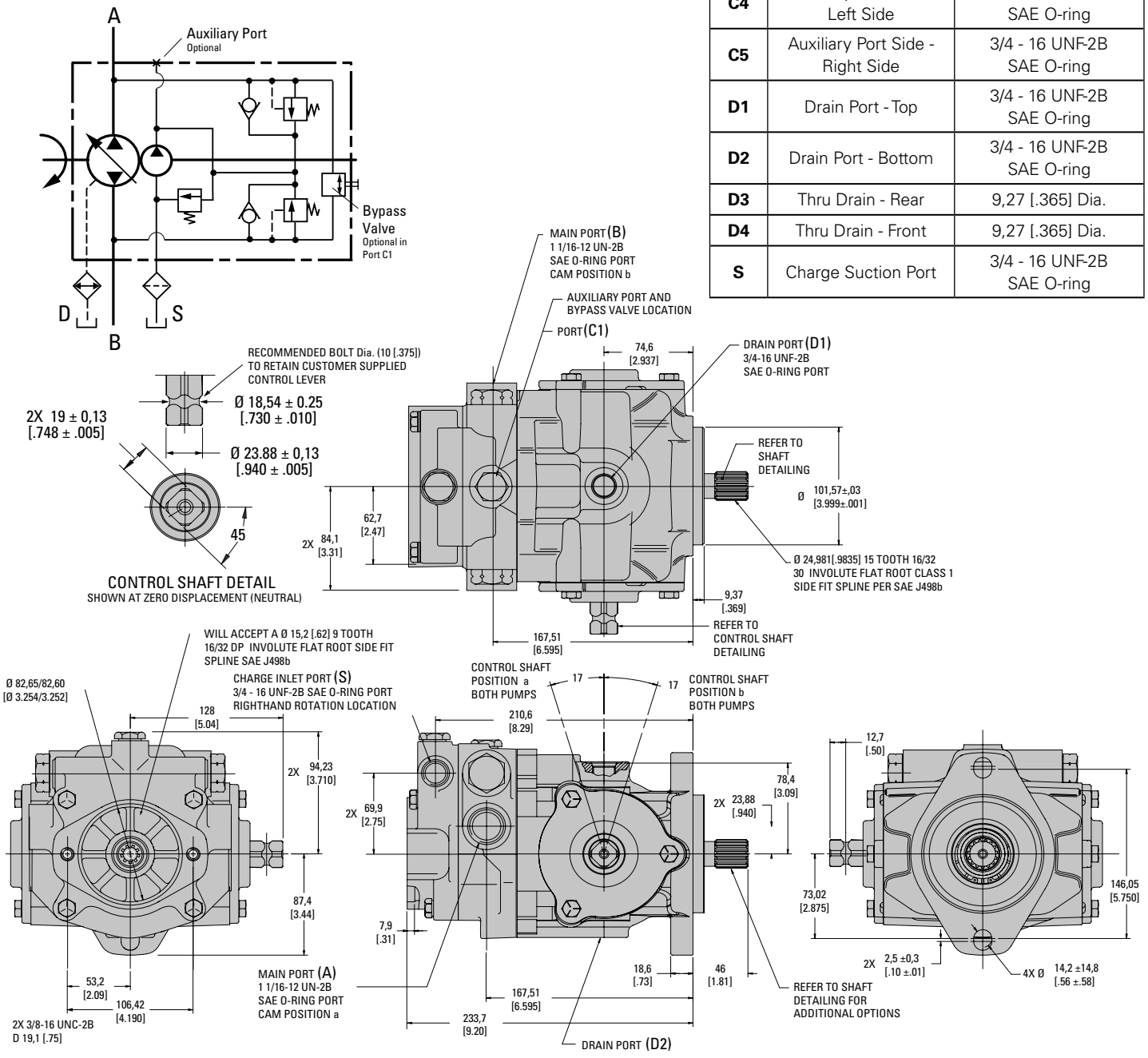


Model 70360
Single Pump Installation Drawing

Port ID	Type of Port	Size and Description
A	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
B	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
C1	Auxiliary Port Top - Front or Bypass Valve	3/4 - 16 UNF-2B SAE O-ring
C2	Auxiliary Port Top - Rear	3/4 - 16 UNF-2B SAE O-ring
C3	Auxiliary Port Rear - Rear	3/4 -16 UNF-2B SAE O-ring
C4	Auxiliary Port Side - Left Side	3/4 - 16 UNF-2B SAE O-ring
C5	Auxiliary Port Side - Right Side	3/4 - 16 UNF-2B SAE O-ring
D1	Drain Port - Top	3/4 - 16 UNF-2B SAE O-ring
D2	Drain Port - Bottom	3/4 - 16 UNF-2B SAE O-ring
D3	Thru Drain - Rear	9,27 [.365] Dia.
D4	Thru Drain - Front	9,27 [.365] Dia.
S	Charge Suction Port	3/4 - 16 UNF-2B SAE O-ring

Opposite Side Porting with internal charge pump. Used as a single pump or on rear of multiple units.

Note: The Charge Pump for a single pump is normally a 6,9 cm^3/r [.42 in^3/r] displacement and for a tandem unit is a 13,8 cm^3/r [.84 in^3/r] displacement.

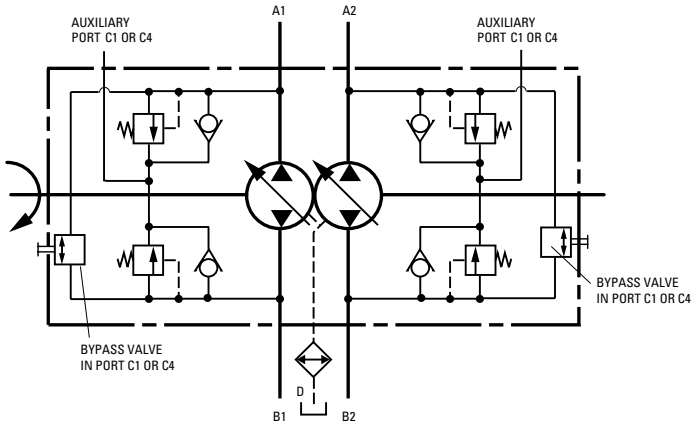


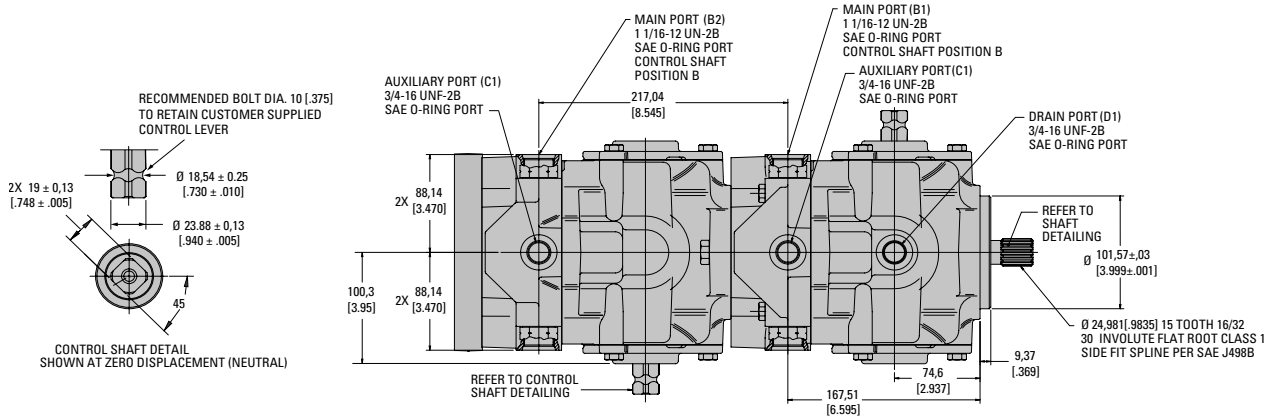
Right-hand (CW) Rotation Shown All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

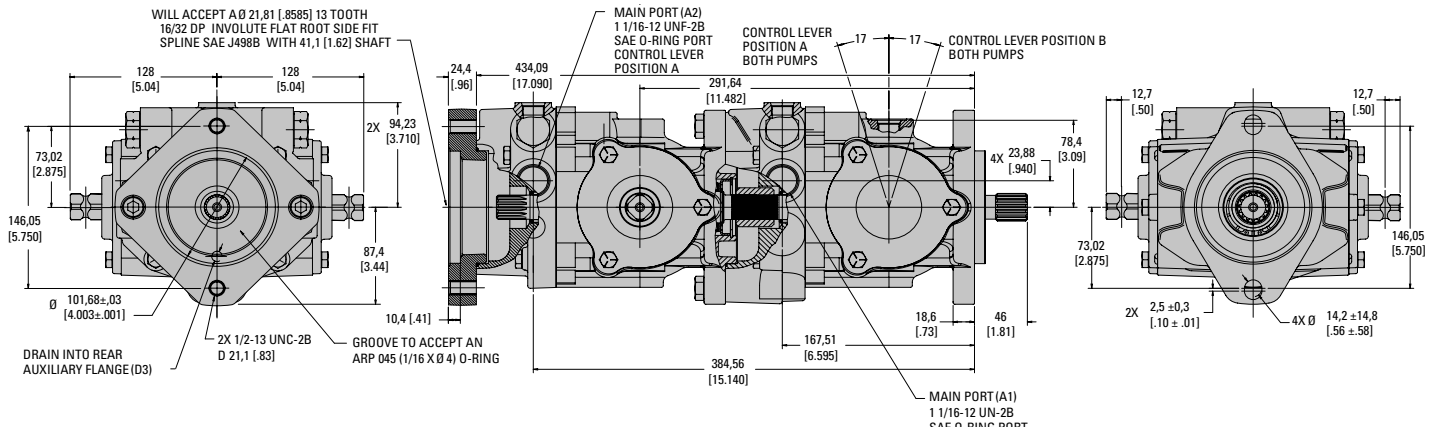
Dimensions are in millimeters [inches], unless otherwise specified.

Model 70360
Tandem Pump Installation Drawing

Opposite Side Porting and Rear SAE "B" Auxiliary Mounting Flange. External Charge Pump Required.







Right-hand (CW) Rotation Shown All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Dimensions are in millimeters [inches], unless otherwise specified.

Model 70360
Specifications

Specifications - Piston Pump

Maximum Displacement	40,6 cm^3/r [2.48 in^3/r]	49,2 cm^3/r [3.00 in^3/r]
Input Mounting Flange	SAE “B” or "BB"	SAE “B” or "BB"
Flow @ Rated Speed & PSI	140 l/min [37.0 gal/min]	169 l/min [44.8 gal/min]
Maximum Rated Speed	3600 RPM	3600 RPM
Nominal Pressure Rating*	345 bar [5000 PSI]	345 bar [5000 PSI]
Peak Pressure Rating**	380 bar [5500 PSI]	380 bar [5500 PSI]
Max Input Power	84 kw (113 HP)	102 kw (137 HP)
Max Input Torque	237 N-m (2099 lbf-in)	286 N-m (2528 lbf-in)
Continuous Allowable Case Pressure	2 bar [25 PSI]	2 bar [25 PSI]
Maximum Case Drain Temperature	107° C [225° F]	107° C [225° F]
Weight Per Single Pump	14,1 to 15,9 kg [31 to 35 lbs]	14,1 to 15,9 kg [31 to 35 lbs]

Moment of Inertia

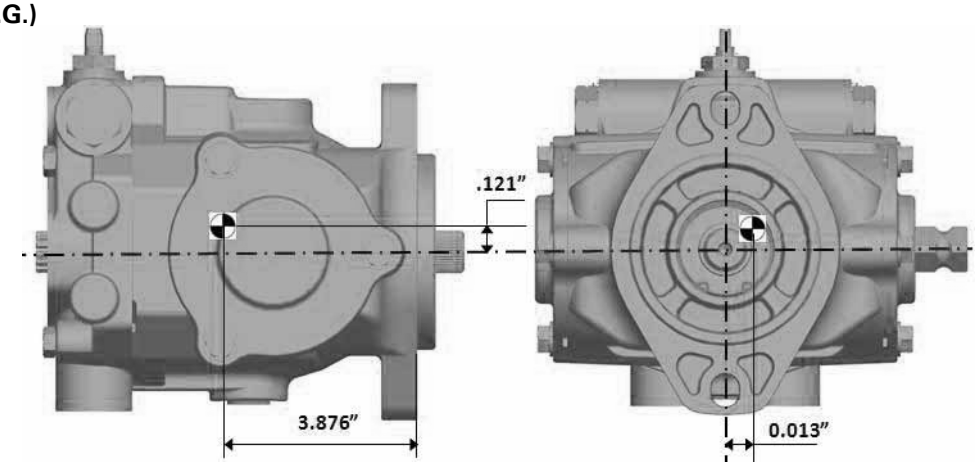
Single 360 Pump (rotating kit and shaft)	2.731e-3 kg*m^2
Two 360 Pumps (two rotating kits and shafts)	5.462e-3 kg*m^2
Two 360 Pumps plus Gear Pump (two rotating kits, shafts and gear pump gears)	5.475e-3 kg*m^2
G Load Capacity (Single Pump)***	10 G

Specifications - Internal Gerotor Charge Pump

Displacement Options	6,9 cm^3/r [.42 in^3/r] 13,8 cm^3/r [.84 in^3/r] 17.2 cm3/r [1.05 in3/r] 20.7 cm3/r [1.26 in3/r]
Operating Pressure Range (std.)	7 to 21 bar [100 to 300 PSI]
Maximum Charge Inlet Vacuum	0,80 bar Abs. [6 inHg]

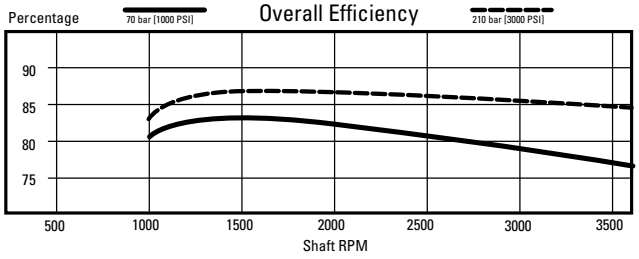
* Nominal Pressure: Max delta system pressure at which component fatigue does not occur (pump life estimated by bearing life).
** Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).
*** Please contact Eaton representative for specific requirements.

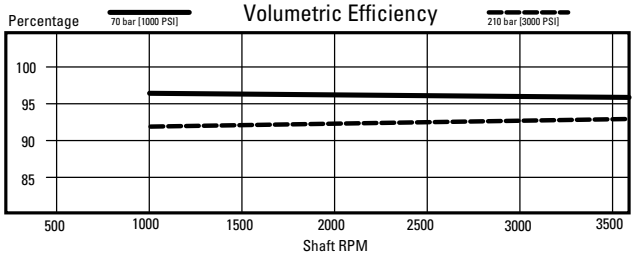
Center of Gravity (C.G.)

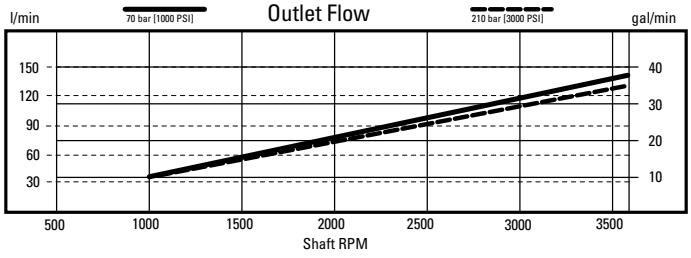


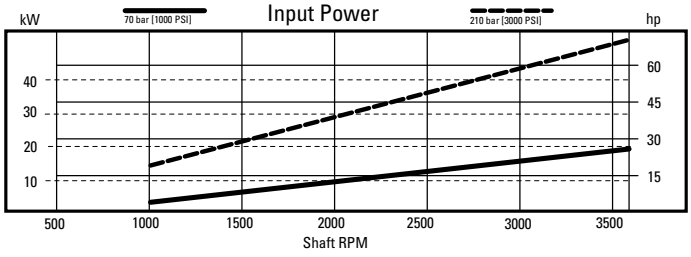
Model 70360
Performance Data

The charts below are representative of a single 40,6 cm^3/r [2.48 in^3/r] Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity at 9 - 12 cSt [54-66 SUS] and the pump at maximum displacement.



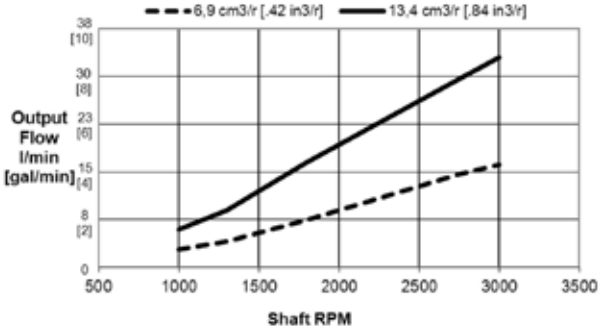






Charge Pump Performance - Flow vs Speed

The chart below is representative of a 6,9 cm^3/r [.42 in^3/r] cm^3/r and 13,4 [.84 in^3/r] displacement charge pumps. The test was run at an oil temperature of 60°C [150°F] with viscosity 13 cSt [65 SUS].



Model 70360 Code

Ordering Instructions: The Model 70360 piston pumps are specified by using the following model code system tailoring the pump configuration to the requirement. Once a pump is built from the model code, a product number will be assigned to that configuration and the pump identified.

Make sure all positions are selected within the 25 digit code for each pump order. Also state if the pumps making up a tandem are required to be mounted together or separately.

Code Example:	**ACV**	**20**	**R**	**A**	**B**	**1**	**T**	**T**	**A1**	**C**	**1**	**11**	**1**	**0**	**0 0**	**CD**	**0**	**A**
Position -	1, 2, 3	4, 5	6	7	8	9	10	11	12, 13	14	15	16, 17	18	19	20, 21	22, 23	24	25

Position 1, 2, 3 - **Code Title**

ACV = Series 360 Manually Variable Displacement Axial Piston pump with SAE J744 Flange 101-2 (2 Bolt "B")

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump

	Code	Single Unit	Tandem Unit Front	Tandem Unit Rear
Positions 4, 5 - Displacement and Valve Plate				
20 = 40,6 cm^3/r [2.48 in^3/r]; Rotating Kit-Standard; Valve Plate - Type 1	20	Std	Std	Std
30 = 49.2 cm^3/r [3.00 in^3/r]; Rotating Kit-Standard; Valve Plate - Type 1	30	Std	Std	Std
Position 6 - Input Shaft Rotation				
L = Lefthand Rotation (CCW)	L	Std.	Std.	Std.
R = Right-hand Rotation (CW)	R	Std.	Std.	Std.
Position 7- Input Shaft				
A = 15 Tooth external spline, 16/32 pitch; 24,981 [.9835] Major Dia.; 46 [1.81] Shaft extension	A	Std	Std	NA
B = 41 Tooth external spline, 48/96 pitch; 22,2 [.875] Major Dia.; 24,4 [.96] Shaft extension	B	NA	NA	Std
C = 13 Tooth external spline, 16/32 pitch; 21,81 [.8585] Major Dia.; 41,1 [1.62] Shaft extension	C	Opt	NA	NA
D = .125 :1 Taper; 25.4 [1.00] Diameter; 6,1 [.25] W x 19,8 [.78] L keyway; 3/8 - 24 UNF -2B Thread; 35,1 [1.38] Shaft extension	D	Opt	Opt	NA
E = Straight 22,2 [.875] Diameter; 6,3 [.25] W x 24,6 [.97] L key; 41,3 [1.62] Shaft extension	E	Opt	NA	NA
G = Straight 25,4 [1.00] Dia.; 6,1 [.25] x 28,4 [1.12] L key, 46,0 [1.81] Shaft extension	G	Opt	NA	NA
Position 8 - Control Shaft and Location				
J = Right; 19 [.748] Square Shaft with bolt groove; 128 [5.04] from centerline to control shaft end	J	Std.	Std.	Std.
K = Left; 19 [.748] Square Shaft with bolt groove; 128 [5.04] from centerline to control shaft end	K	Std.	Std.	Std.
Position 9 - Main Ports (A and B), Size and Location				
1 = 1 - 1/16 - 12 SAE Straight Thread, Opposite Sides	1	Std.	Std.	Std.
2 = 1 - 1/16 - 12 SAE Straight Thread, Same Side (without internal charge pump)	2	Opt.	Opt.	Opt.
Positions 10, 11 - Relief Valve Setting for Main Ports (Select a setting for port "A" in position 10 and port "B" in position 11.)				
0 = Check Valve Only	0	Opt.	Opt.	Opt.
B = 138 bar [2000 PSI]	B	Opt.	Opt.	Opt.
E = 173 bar [2500 PSI]	E	Opt.	Opt.	Opt.
H = 207 bar [3000 PSI]	H	Opt.	Opt.	Opt.
L = 241 bar [3500 PSI]	L	Opt.	Opt.	Opt.
N = 276 bar [4000 PSI]	N	Opt.	Opt.	Opt.
Q = 310 bar [4500 PSI]	Q	Opt.	Opt.	Opt.
T = 344 bar [5000 PSI]	T	Std.	Std.	Std.
U = 379.2 bar [5500 PSI]	Opt.	Opt.	Opt.	
Positions 12, 13 - Auxiliary Mount and Output Shaft (rear)				
A1 = SAE J744 flange 82-2 (2 Bolt A); Accepts 9 Tooth 16/32 DP spline with 31,7 [1.25] shaft extension (No coupler required)	A1	Std	Opt	Std
A2 = SAE J744 flange 82-2 (2 Bolt A) with cover plate; Accepts 9 Tooth 16/32 DP spline with 31,7 [1.25] shaft extension (No coupler required)	A2	Opt	NA	Opt
A3 = SAE J744 flange 82-2 (2 Bolt A); Accepts 11 Tooth 16/32 DP spline with 31,7 [1.25] shaft extension (coupler required)	A3	Opt	NA	Opt
A4 = SAE J744 flange 82-2 (2 Bolt A) with cover plate; Accepts 11 Tooth 16/32 DP spline with 31,7 [1.25] shaft extension (coupler required)	A4	Opt	NA	Opt
B4 = Vertical Accepts a SAE J744 flange 101-2 (2 Bolt B); Accepts 41 Tooth 48/96 DP spline B4 NA Std Opt	B4	NA	Std	Opt
Position 14 - Auxiliary Port and Bypass Valve No Bypass Valve Installed				
0 = No auxiliary port	0	Opt	NA	NA
A = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1)	A	Opt	Opt	Std
B = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1)	B	Opt	NA	Opt
F = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1); Rear (C3)	F	Opt	NA	Opt

Model 70360 Code

Continued

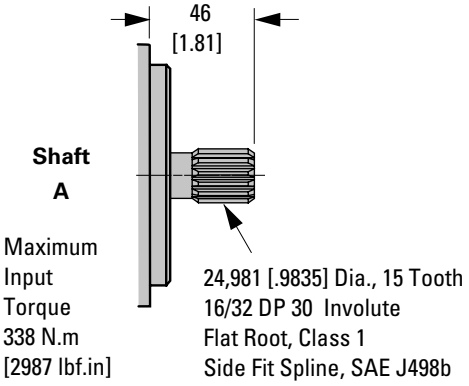
Position 14 - Auxiliary Port and Bypass Valve **No Bypass Valve Installed (Cont...)**				
G = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1); Rear-Left 45° (C4)	G	Opt	Std	Opt
H = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex socket plug (C1); Rear (C3)	H	Opt	NA	Opt
J = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex socket plug (C1); Rear- Left 45° (C4)	J	Opt	Opt	Opt
K = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1); Rear - Left 45° w/ hex plug (C4)	K	Opt	Opt	Opt
L = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1); Rear w/ hex socket plug (C3)	L	Opt	NA	Opt
M = 3/4 - 16 UNF - 2B SAE O-ring port, Rear (C3)	M	Opt	NA	Opt
N = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1), Top - Rearward w/ hex socket plug (C2), Left side w/ hex socket plug (C6), Right side w/ hex socket plug (C7)	N	Opt	NA	Opt
P = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1), Rear - Right 45° (C5)	P	Opt	Opt	Opt
V = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C1), Top - Rearward (C2)	V	Opt	NA	Opt
Bypass Valve installed in Top port (C1)				
C = 3/4 - 16 UNF - 2B SAE O-ring port, Top rearward (C2)	C	Opt	Opt	Opt
E = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1); Rear left 45° (C4)	E	Opt	Opt	Opt
R = 3/4 - 16 UNF - 2B SAE O-ring port, Rear (C3)	R	Opt	NA	Opt
S = 3/4 - 16 UNF - 2B SAE O-ring port, Top w/ hex plug (C2)	S	Opt	NA	Opt
T = 3/4 - 16 UNF - 2B SAE O-ring port, Top - Rearward (C2), Left side w/ hex socket plug (C6), Right side w/ hex socket plug (C7)	T	Opt	NA	Opt
Bypass Valve installed in rear port (C3)				
D = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1)	D	Opt	NA	Opt
U = 3/4 - 16 UNF - 2B SAE O-ring port, Top (C1)	U	Opt	NA	Opt
Position 15 - Charge Pump				
0 = No charge Pump	0	Opt	Std	Opt
1 = 6,9 cm^3/r [.42 in^3/r]; 3/4-16 UNF - 2B SAE O-ring port for suction inlet (S)	1	Std	NA	NA
2 = 13,8 cm^3/r [.84 in^3/r]; 3/4-16 UNF - 2B SAE O-ring port for suction inlet (S)	2	Opt	NA	Std
5 = 17.2 cm3/r [1.05 in3/r]; 1 5/16-12 UN - 2B SAE O-ring port for suction inlet (S)- B Pad only	5	Std.	NA	Std.
6 = 20.7 cm3/r [1.26 in3/r]; 1 5/16-12 UN - 2B SAE O-ring port for suction inlet (S)- B Pad only	6	Std.	NA	Std.
Position 16, 17 - Charge Pump Relief Setting and Routing				
00 = None	00	Opt	Std	Opt
01 = No charge relief (Requires external relief set between 6,89 bar [100 PSI] 17,24 bar [250 PSI])	01	Opt	Opt	Opt
For Units with Charge Pump				
11 = 6,89-10,34 bar [100-150 PSI]; Recirculated	11	Std	NA	Std
12 = 10,34-13,79 bar [150-200 PSI]; Recirculated	12	Opt	NA	Opt
13 = 13,79-17,24 bar [200-250 PSI]; Recirculated	13	Opt	NA	Opt
14 = 17,24-20,68 bar [250-300 PSI]; Recirculated	14	Opt	NA	Opt
For Units without Charge Pump				
21 = 6,89-10,34 bar [100-150 PSI]; Relieved to case	21	Opt	NA	Opt
22 = 10,34-13,79 bar [150-200 PSI]; Relieved to case	22	Opt	NA	Opt
23 = 13,79-17,24 bar [200-250 PSI]; Relieved to case	23	Opt	NA	Opt
Position 18 - Drain Port Size and Location				
0 = 3/4 - 16 UNF - 2B SAE o-ring port, Top (D1); Bottom plugged (D2); Thru drain in front mounting flange (D4)	0	NA	NA	Std
1 = 3/4-16 UNF-2B SAE o-ring port, Top (D1); Bottom, Plugged (D2)	1	Std	Std	Opt
Position 19 - Additional Functions				
0 = None	0	Std	Std	Std
D= Bleed-off in Control ShaftPosition "a" 13.8-17.2 bar [200-250 lbf/in2]	D	Opt	Opt	Opt
E= Bleed-off in Control ShaftPosition "b" 13.8-17.2 bar [200-250 lbf/in2]	E	Opt	Opt	Opt
F= Bleed-off in Control ShaftPosition "a" & "b" 13.8-17.2 bar [200-250 lbf/in2]	F	Opt	Opt	Opt
Positions 20, 21 - Special Features				
00 = None	00	Std	Std	Std
0A = Fluorocarbon Rubber Drive shaft seal and control shaft seal	0A	Opt	Opt	Opt
0C = Bottom Mounting Bracket with 13,7 [.54] diameter hole	0C	NA	NA	Std
0D = Coupling and o-ring included for rear mount	0D	Opt	Opt	Opt
Positions 22, 23 - Paint				
0A = Primer	0A	Std	Std	Std
0B = Black	0B	Opt	Opt	Opt
Position 24 - Identification				
0 = Standard (Nameplate)	0	Std	Std	Std
Position 25 - Design Code				
B = B	B	Std	Std	Std

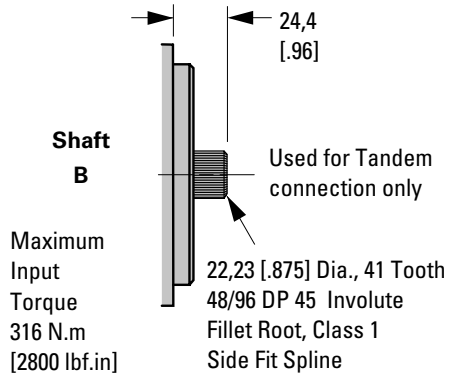
NA = Not Available Opt. = Optional Std. = Standard

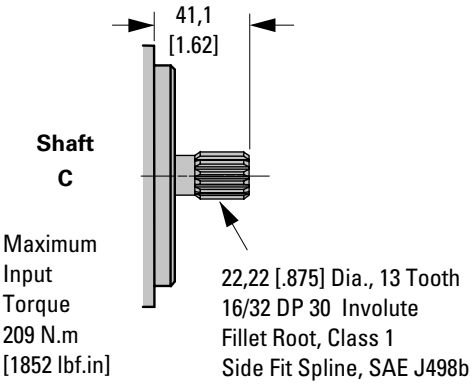
Model 70360
Input Shafts

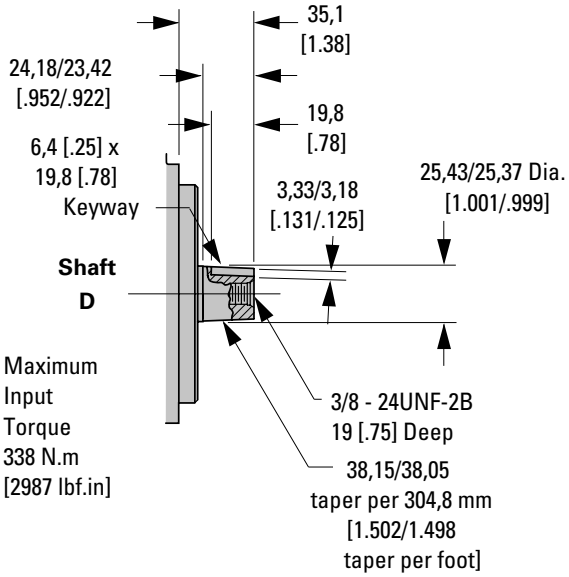
Code Position 7

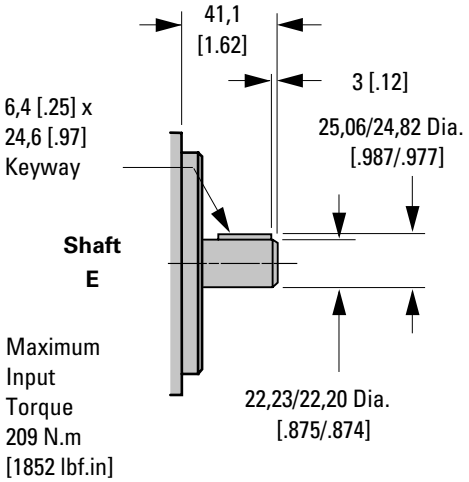
Dimensions are in millimeters [inches], unless otherwise specified.

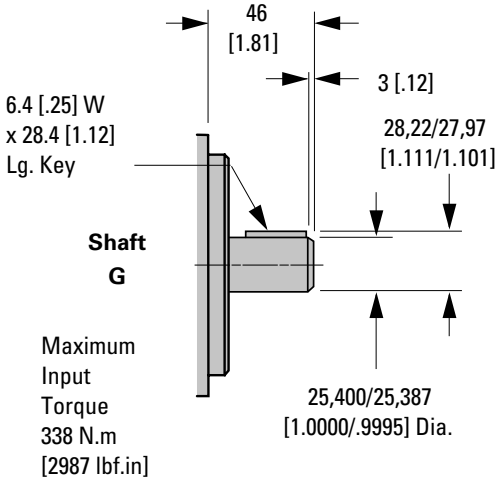












Torque Note:

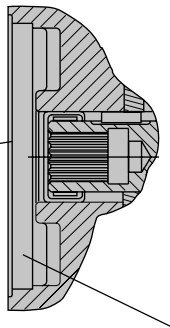
The combined torque required to turn multiple pumps must not exceed the torque rating of the input drive shaft of the front piston pump. Consult an Eaton representative and/or Eaton engineering on side load recommendations.

Model 70360
Auxiliary Mounts & Output Shafts

Code Position 12 and 13

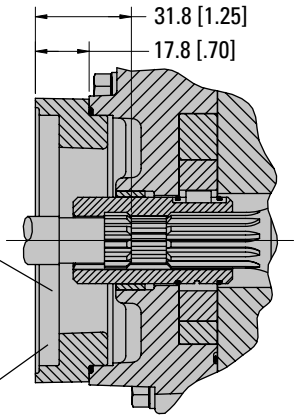
9 Tooth, 16/32 DP Int., 15,88 [.6250] O.D., Accepts 31,8 [1.25] Shaft Ext., SAE "A" Mount J744

Torque limit on internal rear spline of piston pump with internal charge pump must not exceed 54 N• m [480 lbf • in]. Piston pump without internal charge pump must not exceed 76 N • m [672 lbf • in]



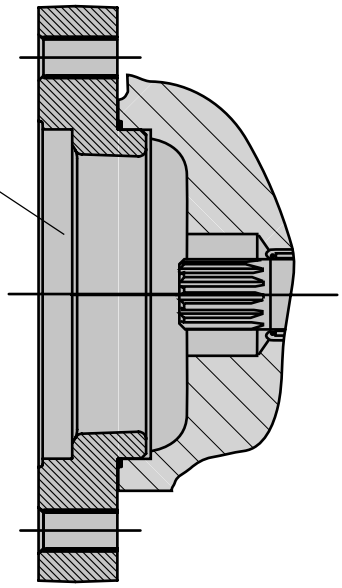
11 Tooth, 16/32 DP Int.; 19,33 [.761] O.D.; Accepts 31,8 [1.25] Shaft Ext., "A" Auxiliary Mount SAE J744
(Used on piston pump with internal charge pump)

Maximum Torque
119 N • m [1050 lbf • in]



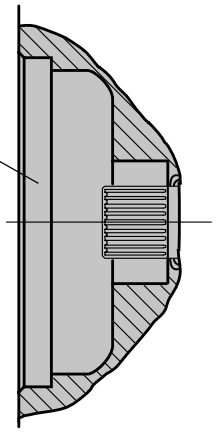
SAE "A" Auxiliary Mount with Charge Pump Shown

13 Tooth , 16/32 DP Ext.; 21,81 [.8585] O.D., Accepts 41,1 [1.62] Shaft Ext.; "B" Auxiliary Mount SAE J744
(Used on piston pump without internal charge pump)



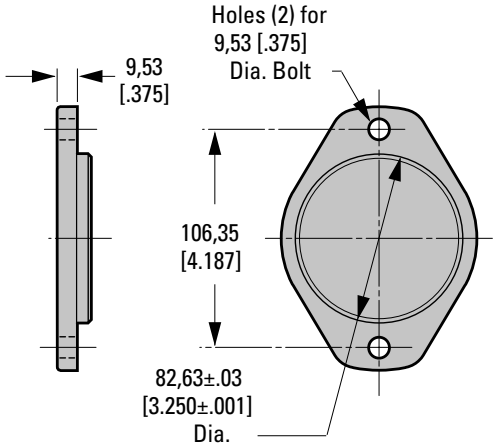
41 Tooth , 48/96 DP Ext., 22,23 [.8750] O.D., Accepts 24,9 [.98] Shaft Ext.; "B" Auxiliary Mount SAE J744
(Used for Tandem Connections)

Maximum Torque
316 N • m [2,800 lbf • in]



Cover Plate

Fits "A" SAE Auxiliary Mounting Flange. Cover Plate Kit #70142-915: Includes plate, cap screws (2), and O-ring



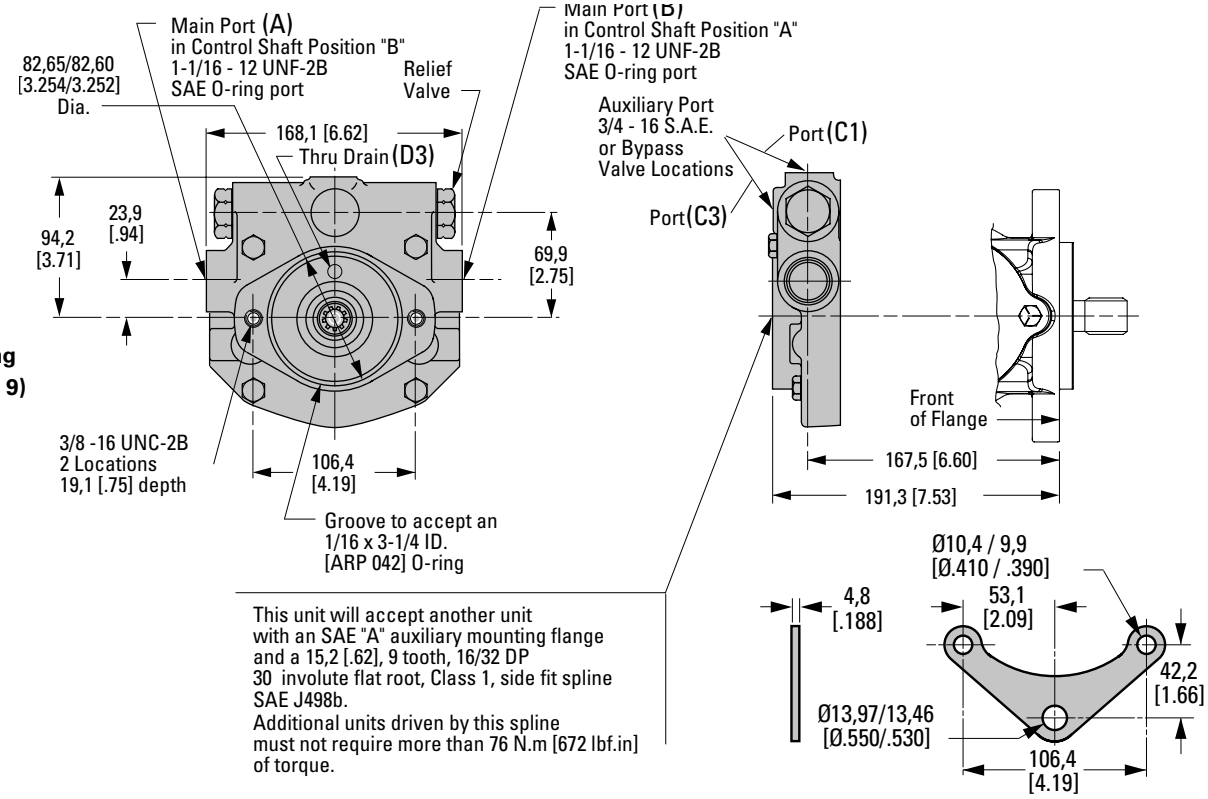
All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Model 70360
Port Locations

Code Position 12 and 13

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Opposite Side Porting
(Selected in Position 9)

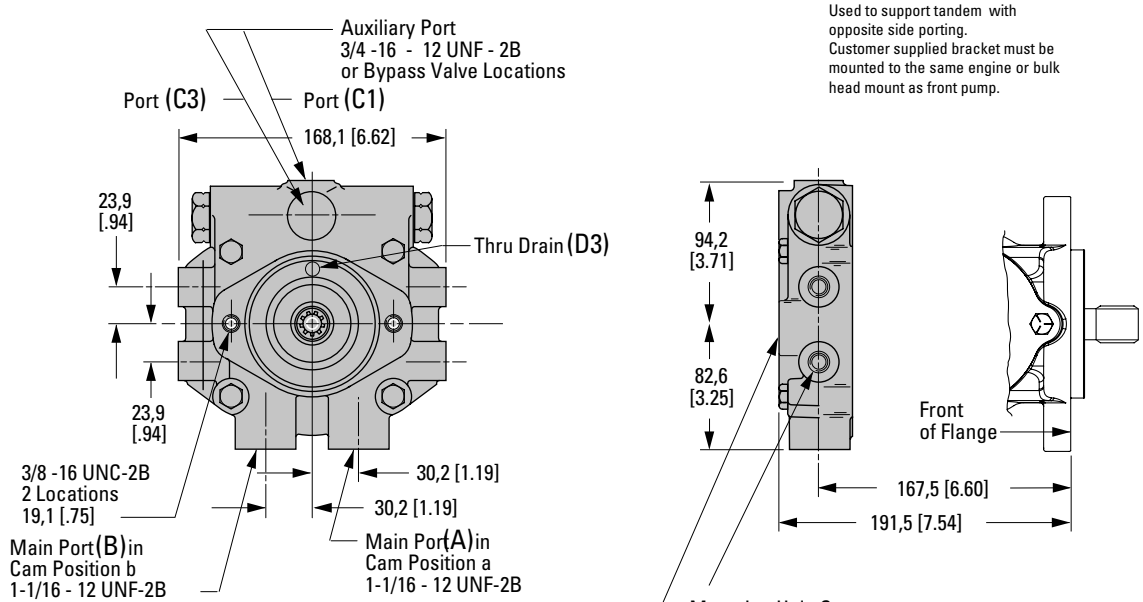


This unit will accept another unit with an SAE "A" auxiliary mounting flange and a 15,2 [.62], 9 tooth, 16/32 DP 30 involute flat root, Class 1, side fit spline SAE J498b.
Additional units driven by this spline must not require more than 76 N.m [672 lbf.in] of torque.

Mounting Bracket

Used to support tandem with opposite side porting.
Customer supplied bracket must be mounted to the same engine or bulk head mount as front pump.

Same Side Porting
(Selected in Position 9)



This unit will accept another unit with an SAE "A" auxiliary mounting flange and a 15,2 [.62], 9 tooth, 16/32 DP 30 involute flat root, class 1, side fit spline SAE J498b.
Additional units driven by this spline must not require more than 76 N.m [672 lbf.in] of torque.

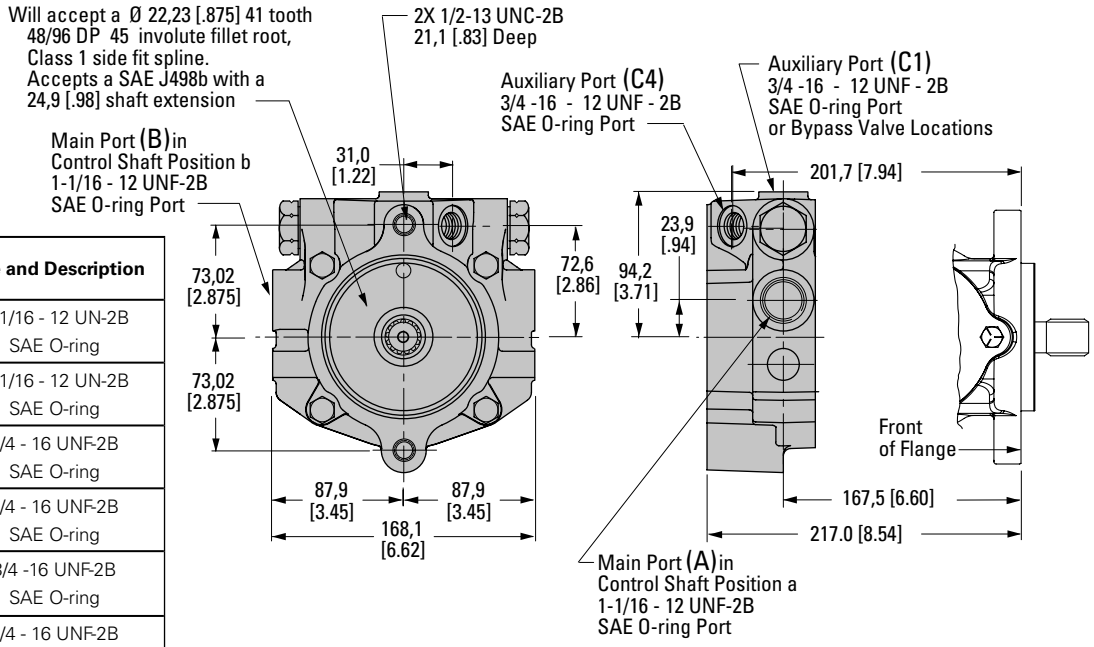
Mounting Hole Supports
4 x 7/16 -14 UNC-2B
18,8 [.74] deep
Customer supplied bracket must be mounted to the same engine or bulk head mount as front pump.

Model 70360
Port Locations

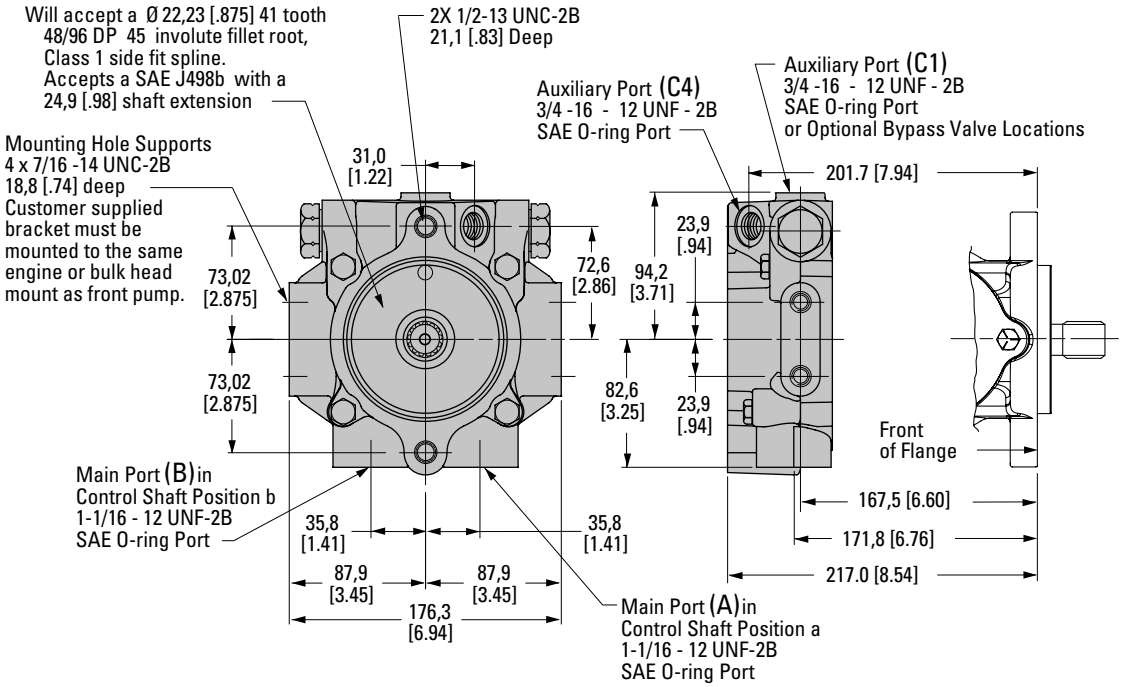
Code Position 12 and 13

Opposite Side Porting
(Selected in Position 9)

Port ID	Type of Port	Size and Description
A	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
B	Main Port	1- 1/16 - 12 UN-2B SAE O-ring
C1	Auxiliary Port Top - Front or Bypass Valve	3/4 - 16 UNF-2B SAE O-ring
C2	Auxiliary Port Top - Rear	3/4 - 16 UNF-2B SAE O-ring
C3	Auxiliary Port Rear - Rear	3/4 -16 UNF-2B SAE O-ring
C4	Auxiliary Port Side - Left Side	3/4 - 16 UNF-2B SAE O-ring
C5	Auxiliary Port Side - Right Side	3/4 - 16 UNF-2B SAE O-ring
D1	Drain Port - Top	3/4 - 16 UNF-2B SAE O-ring
D2	Drain Port - Bottom	3/4 - 16 UNF-2B SAE O-ring
D3	Thru Drain - Rear	9,27 [.365] Dia.
D4	Thru Drain - Front	9,55 [.376] Dia.
S	Charge Suction Port	3/4 - 16 UNF-2B SAE O-ring



Same Side Porting
(Selected in Position 9)



Servo Controlled

40,6 cm^3/r [2.48 in^3/r]

49,2 cm^3/r [3.00 in^3/r]

Displacement

Identification Numbers - Manual Variable Displacement Piston Pump - Closed Circuit

Identification numbers

Stamped on each unit.

A – Product Number Description

- 72400 = Single Piston Pump
- 78461 = Tandem Piston Pump
- 78462 = Single or Tandem Piston Pump with Gear Pump

B – Rotation

- R / S = Right Hand
- L = Left Hand

C – Sequential Letter

D – Design Code Number

Single Pump – Product Number

7 2 4 0 0 - R A K - 0 4

A B C D

Tandem Pumps – Product Number

7 8 4 6 1 - L A A - 0 4

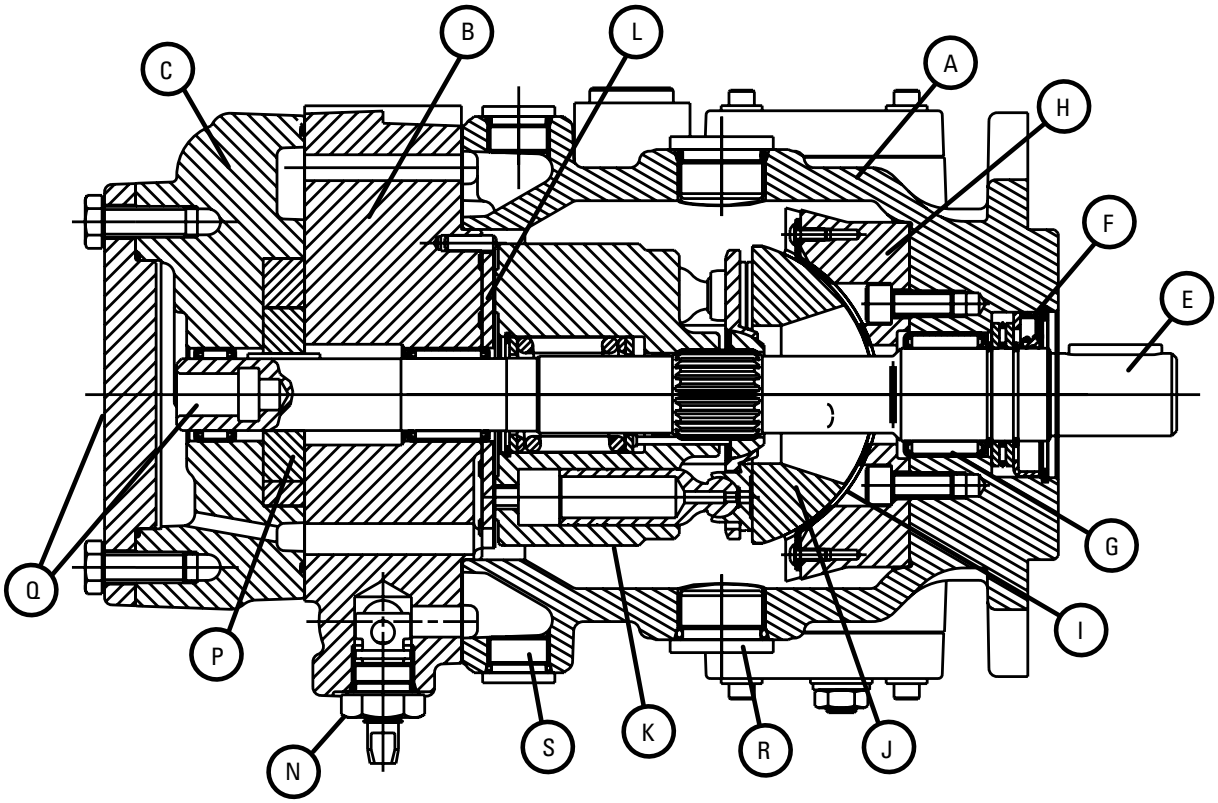
A B C D

Serial Number Code

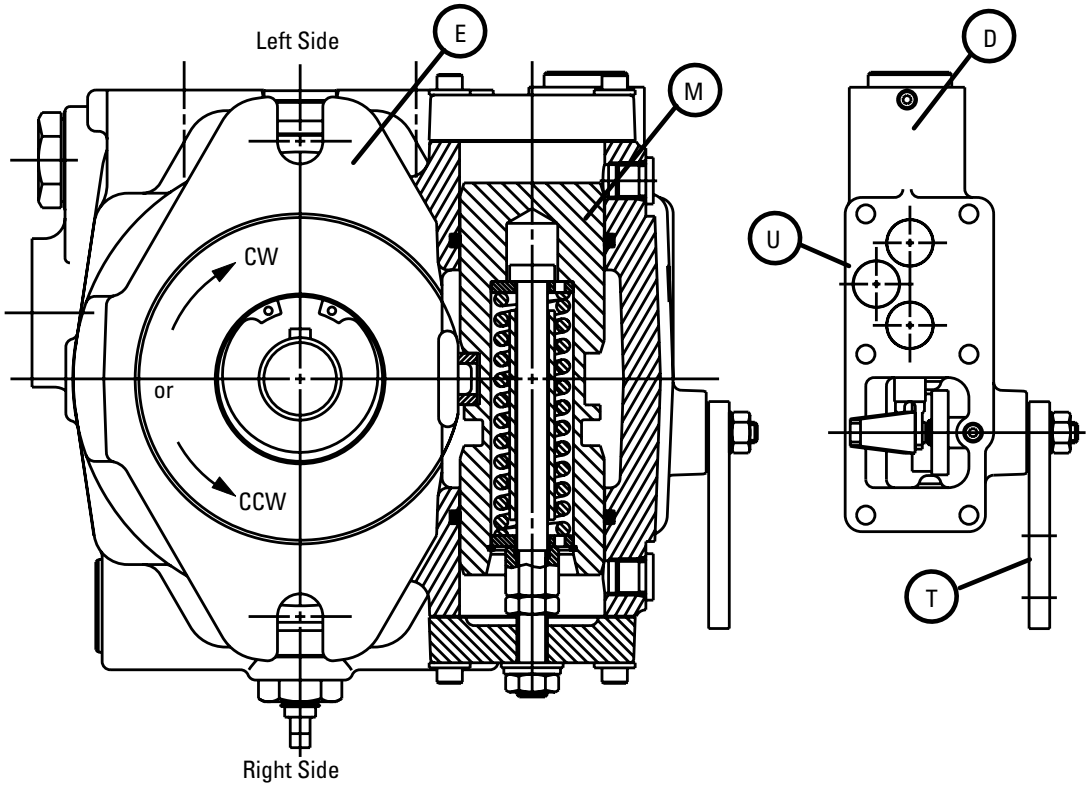
10 05 06 XXX 1 000

- Last Two Digits of Year Built. (10 for 2010 etc.)
- Month Built (two digits)
- Day Built (two digits)
- Manufacturing Cell
- Shift Number
- Specific Number of the Pump

Model 72400 Servo Controlled Features



View "A - A"



Model 72400 Servo Controlled Features and Benefits

A Housing

- Modular design
- Compact package size.
- Durable cast iron design.
- Multiple drain options.
- Quiet operation.
- Improved serviceability

B Endcover

C Charge Pump Adapter

D Manual Displacement Servo Control Valve

- Low operator effort.
- Modular design.

E Input Shaft and Mounting

- SAE "B" or "B-B" Mount (2 Bolt)
- Numerous shaft options.

F Seals

G Bearings

H Swashplate Cradle

I Swashplate Bushing

J Swashplate

K Rotating Group

- 40,6 cm3/r [2.48 in3/r] Displacement
- 49,2 cm3/r [3.00 in3/r] Displacement

L Valve plate

- Improved serviceability.

M Servo Piston Assembly

N Bypass Valve

- Cross ports the closed loop hydraulic circuit - used to move a disabled machine a limited distance.

O Internal High Pressure Relief Valves

- Prevents excessive pressure..

P Gerotor Charge Pump

- Four sizes available.
  6,9 cm3/r [.42 in3/r]
  13,8 cm3/r [.84 in3/r]
  17.2 cm3/r [1.05 in3/r]
  20.7 cm3/r [1.26 in3/r]]

Q Auxiliary Pump Mounting Flange (Rear)

- SAE " A" or "B"
- Auxiliary or tandem mount capability

R Case Drain Port

- Multiple drain options

S Auxillary Port

- For pressure check port or remote charge pressure port.

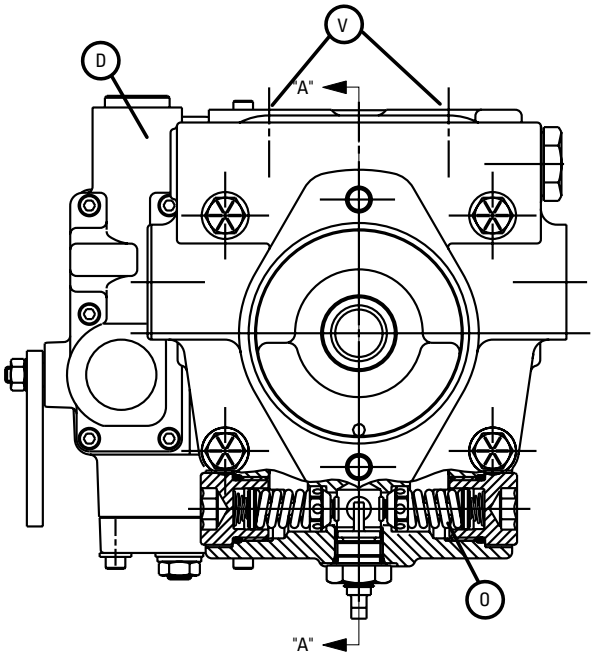
T Control Lever

- Low operator effort

U Control Orifices

- Controls rate of change of displacement.

V Main System Ports

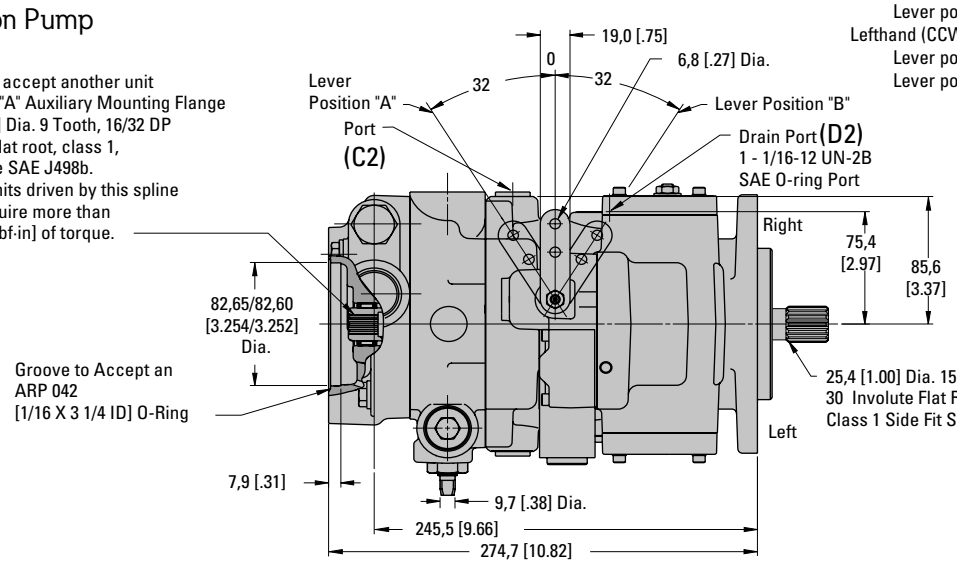


Model 72400 Servo Controlled Installation Drawing

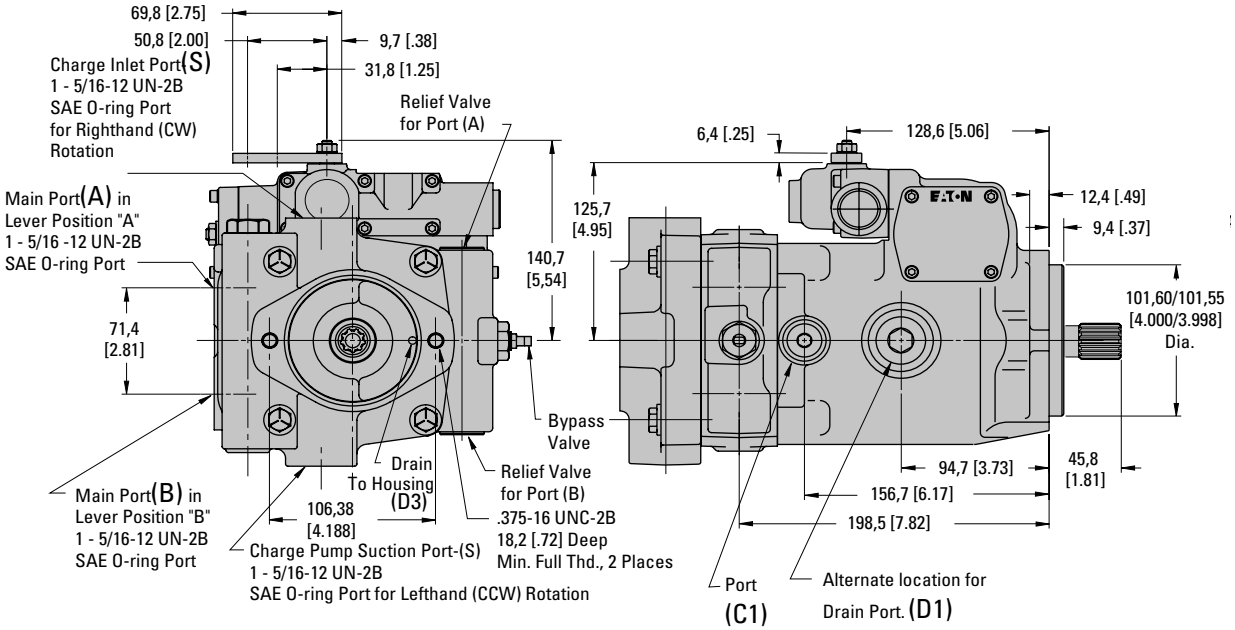
Single Piston Pump

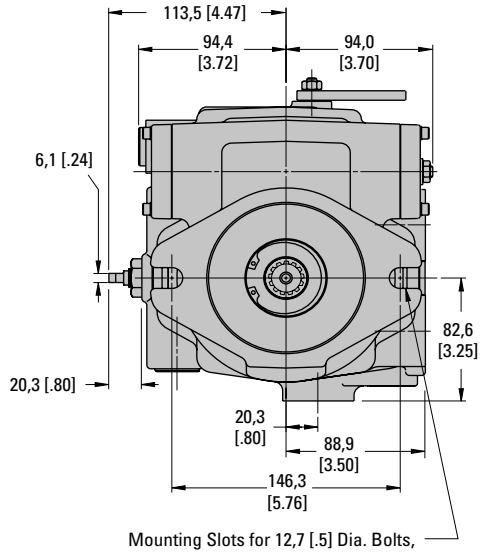
Lever Position vs. Pressurized Port
Righthand (CW) Rotation
Lever position "A"--- Port (A) is Pressurized
Lever position "B"--- Port (B) is Pressurized
Lefthand (CCW) Rotation
Lever position "A"--- Port (B) is Pressurized
Lever position "B"--- Port (A) is Pressurized

This unit will accept another unit with an SAE "A" Auxiliary Mounting Flange and 15,7 [.62] Dia. 9 Tooth, 16/32 DP 30 involute flat root, class 1, side fit spline SAE J498b. Additional units driven by this spline must not require more than 54 N·m [480 lbf·in] of torque.



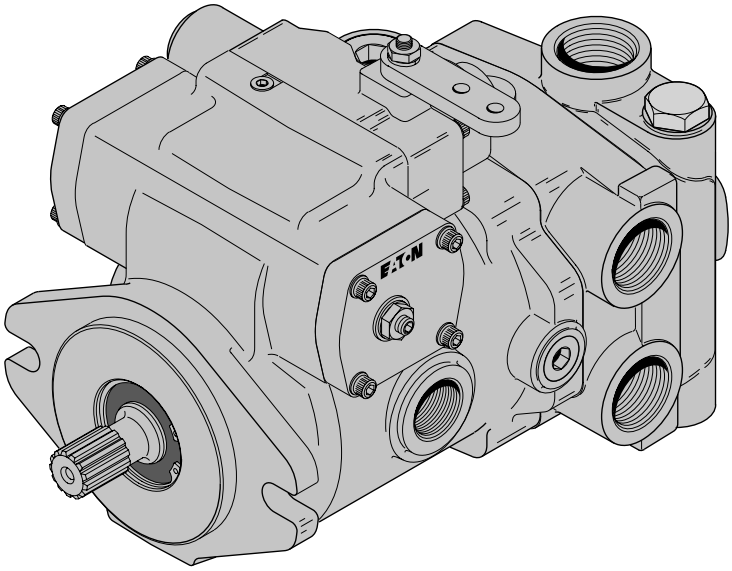
Righthand (CW) Rotation Shown
Dimensions are in mm [in] unless noted otherwise.

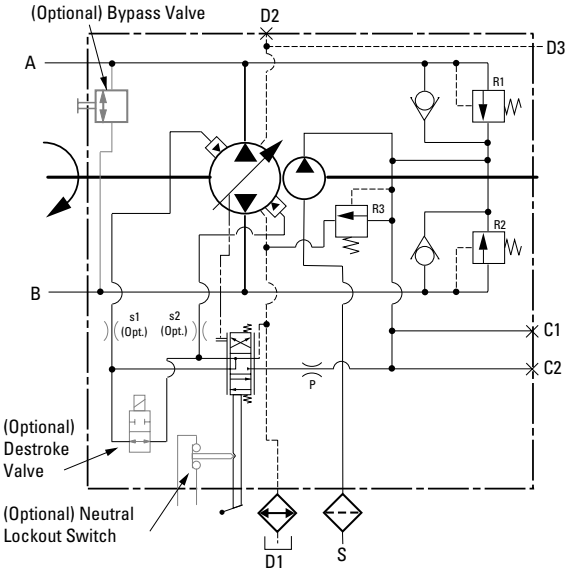




Model 72400 Servo Controlled

Single Piston Pump





Description of Unit on Opposite Page:

Righthand (CW) Rotation

Input Shaft: 15 tooth

Output Shaft: 9 tooth

Auxiliary Rear Mounting: SAE "A" Series 82-2

Charge Pump: 6,9 cm3/r [.42 in3/r] disp. with Inlet Port 1 - 5/16-12 UN-2B, SAE O-ring Port

Charge Pump Relief Setting: 17 to 21 bar [250 to 300 PSI], relieved to case.

Auxiliary Port: 3/4-16 UNF-2B, SAE O-ring Port, plugged on both sides.

Drain Port: 1 - 1/16-12 UN-2B, SAE O-ring Port, on right side and rear flange drained into housing

Main Ports:1 - 5/16-12 UN-2B, SAE O-ring Port, same side on right

Relief Valves: Available in a range of settings to 379 bar [5500 PSI]

Additional Functions: Bypass Valve

Control Assembly: Manual with no additional features

Supply Orifice: ,71 mm [.028 in]

Paint: Black

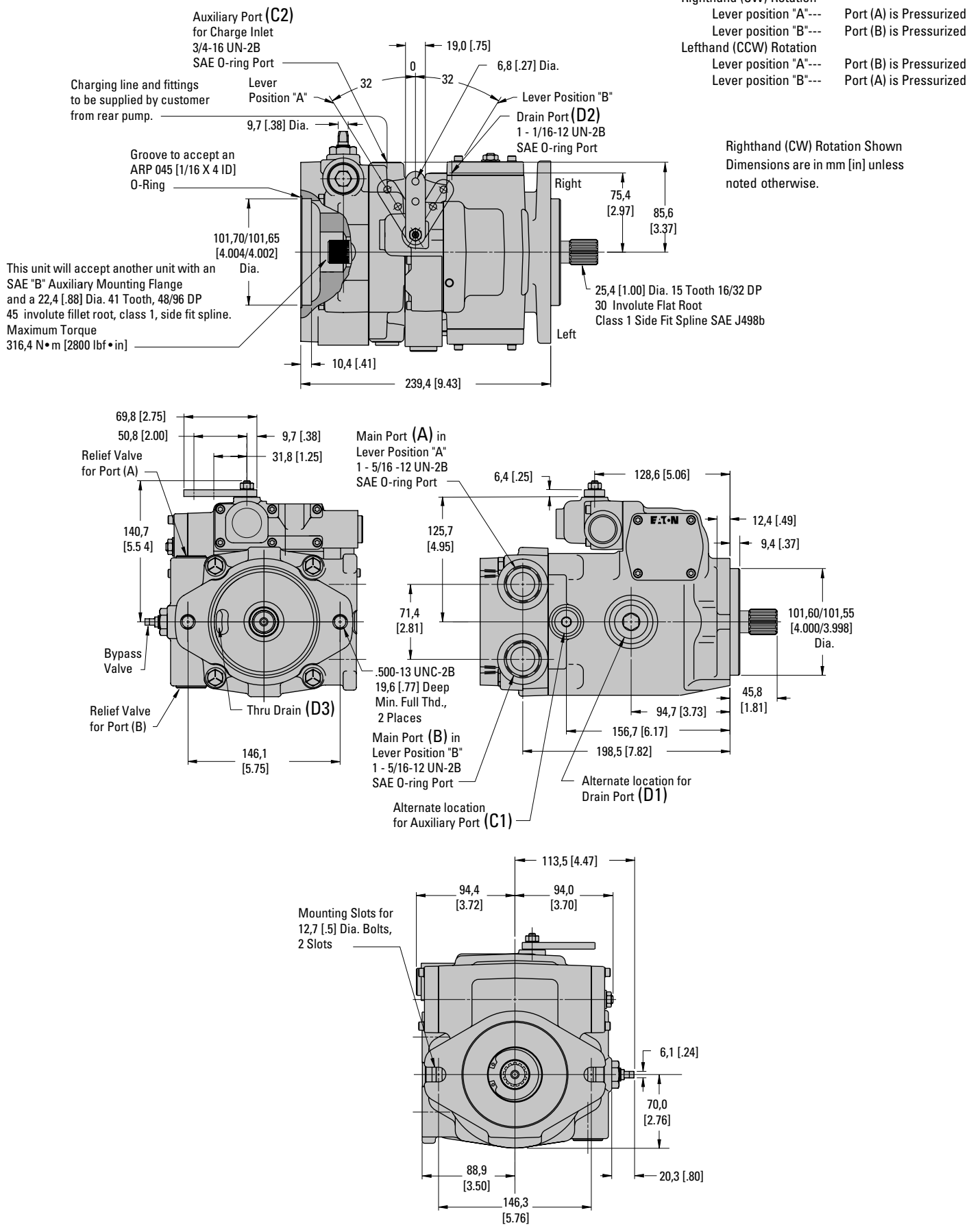
Additional options are available by using the Model Code and Details.

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Model 72400 Servo Controlled Installation Drawing

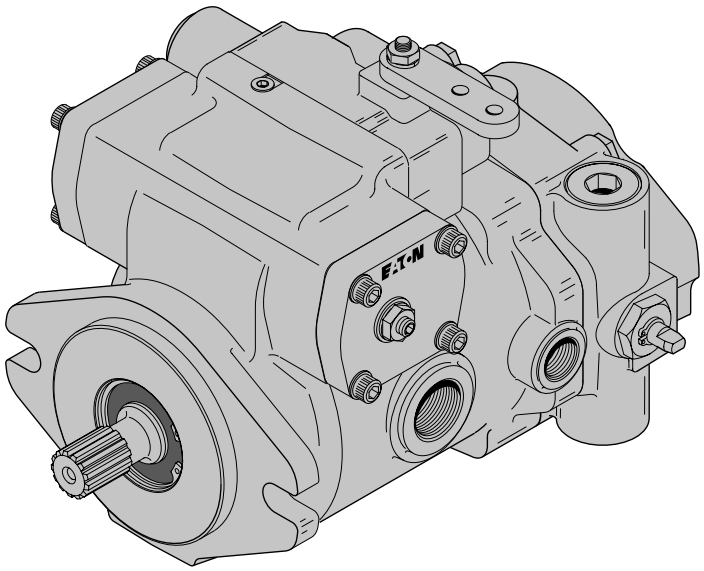
Front Piston Pump of Tandem Pumps

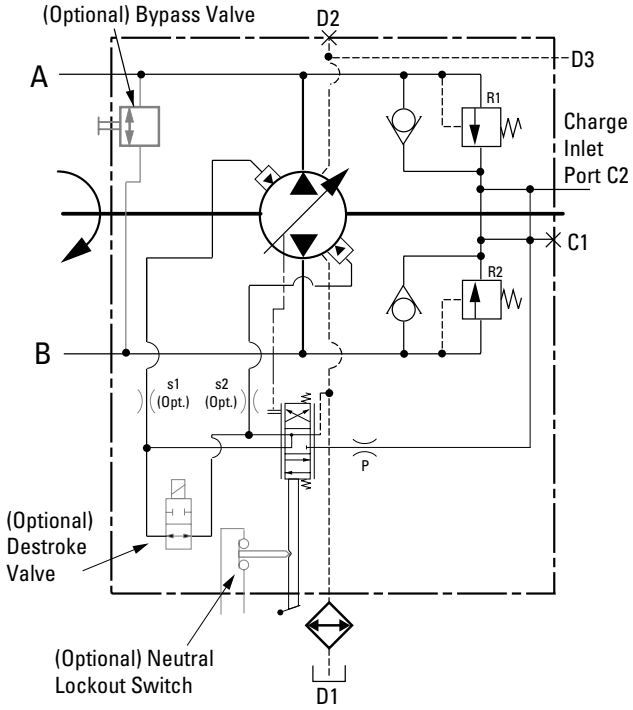
Lever Position vs. Pressurized Port
Righthand (CW) Rotation
Lever position "A"--- Port (A) is Pressurized
Lever position "B"--- Port (B) is Pressurized
Lefthand (CCW) Rotation
Lever position "A"--- Port (B) is Pressurized
Lever position "B"--- Port (A) is Pressurized



Model 72400 Servo Controlled

Front Piston Pump of Tandem Pumps





Description of Unit on Opposite Page:

Righthand (CW) Rotation

Input Shaft: 15 tooth

Output Shaft: 41 tooth

Auxiliary Rear Mounting: SAE 2 bolt "B" Series 101-2

Charge Pump: Not included

Auxiliary Port: 3/4-16 UNF-2B SAE O-ring Port on right side

Drain Port: 1 - 1/16-12 UN-2B SAE O-ring Port on right side and rear flange drained into housing

Main Ports: 1 - 5/16-12 UN-2B SAE O-ring Port on same side (left side of pump)

Relief Valves: Available in a range of settings to 379 bar [5500 PSI]

Additional Functions: Bypass Valve

Control Assembly: Manual with no additional features

Supply Orifice: ,71 mm [.028 in]

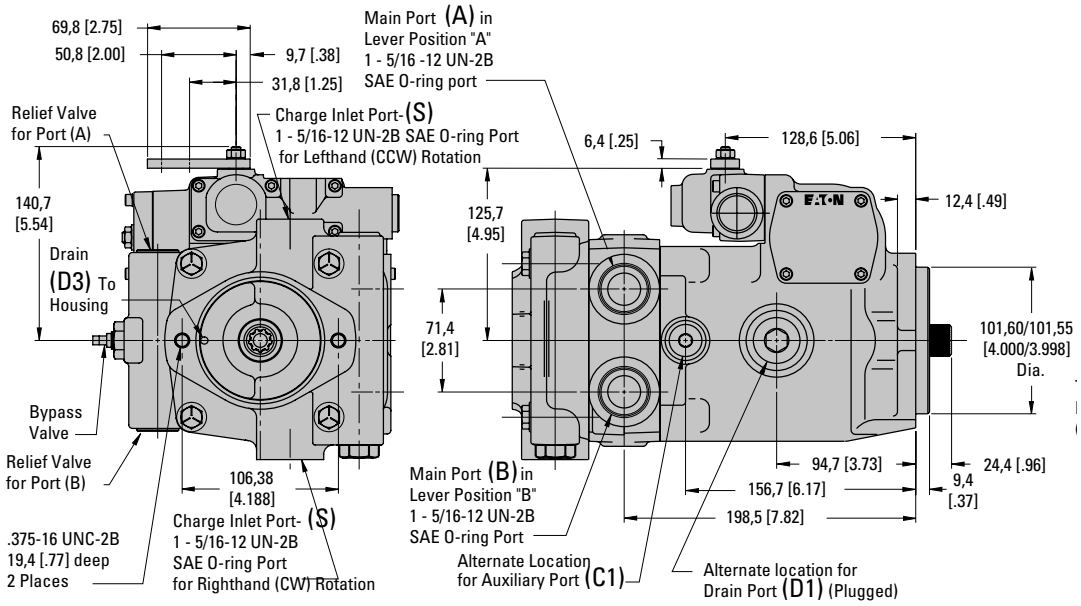
Paint: Black

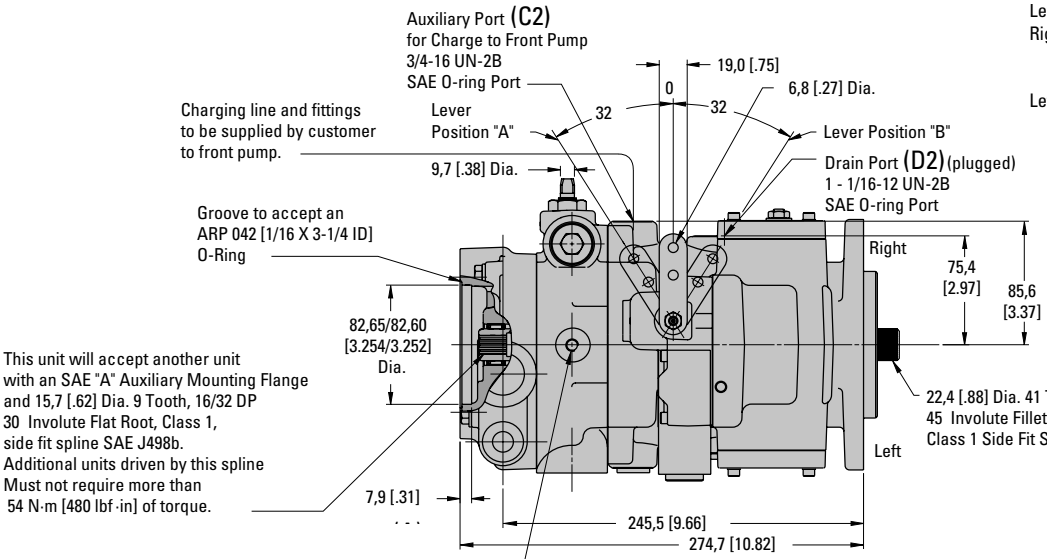
Additional options are available by using the Model Code and Details.

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Model 72400 Servo Controlled Installation Drawing

Rear Piston Pump of Tandem Pumps





Lever Position vs. Pressurized Port

Righthand (CW) Rotation

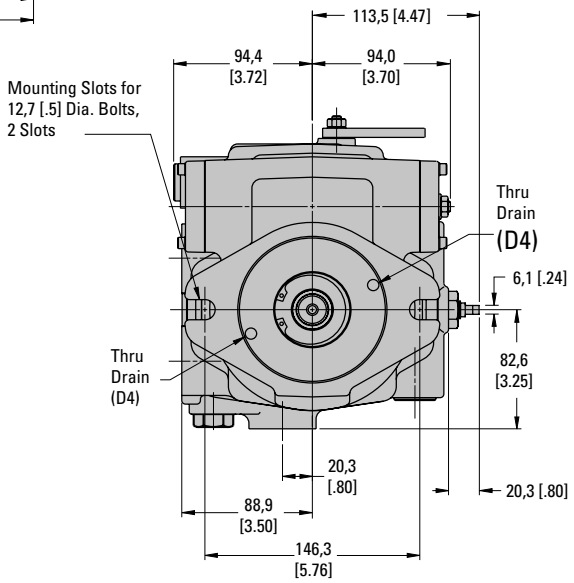
Lever position "A"---	Port (A) is Pressurized
Lever position "B"---	Port (B) is Pressurized

Lefthand (CCW) Rotation

Lever position "A"---	Port (B) is Pressurized
Lever position "B"---	Port (A) is Pressurized

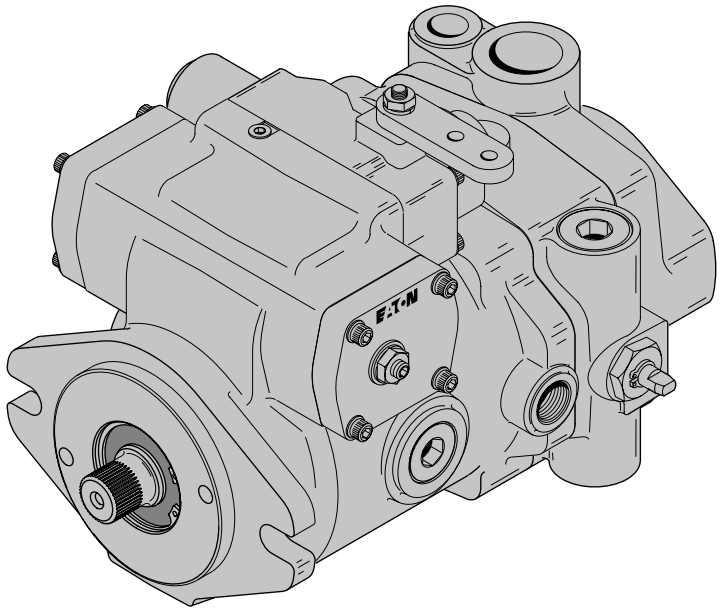
Righthand (CW) Rotation Shown

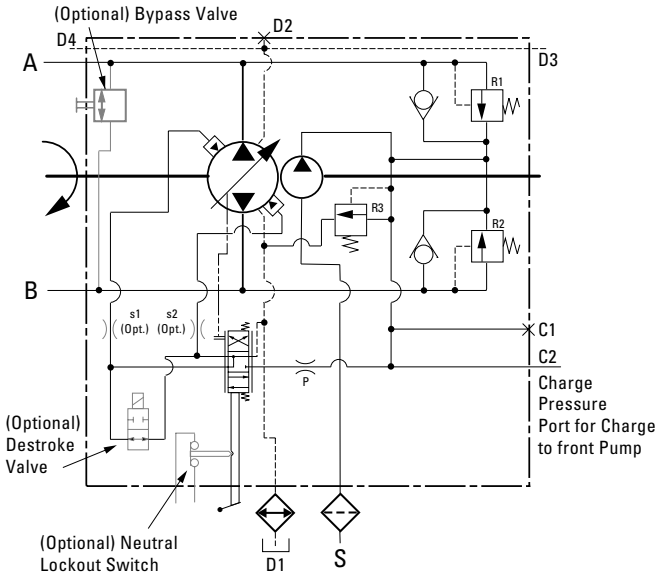
Dimensions are in mm [in] unless noted otherwise.



Model 72400 Servo Controlled

Rear Piston Pump of Tandem Pumps





Description of Unit on Opposite Page:

Righthand (CW) Rotation

Input Shaft: 41 tooth

Output Shaft: 9 tooth

Auxiliary Rear Mounting: SAE "A" Series 82-2 w/mounting support hole

Charge Pump: 13,8 cm3/r [.84 in3/r] disp. with Inlet Port, 1 - 5/16-12 UN-2B SAE O-ring Port

Charge Pump Relief Setting: 17 to 21 bar [250 to 300 PSI], Relieved to Case.

Auxiliary Port: 3/4-16 UNF-2B SAE O-ring Port on right side

Drain Port: 1 - 1/16-12 UN-2B SAE O-ring Port on both sides, plugged, and drain hole thru housing to front pump.

Main Ports: 1 - 5/16-12 UN-2B SAE O-ring Port same side on left

Relief Valves: Available in a range of settings to 379 bar [5500 PSI]

Additional Functions: Bypass Valve

Control Assembly: Manual with no additional features

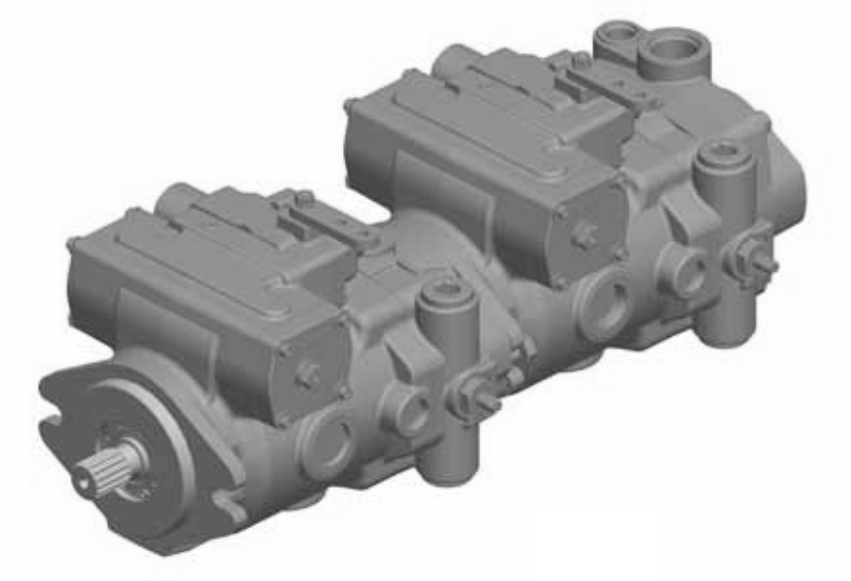
Supply Orifice: ,71 mm [.028 in]

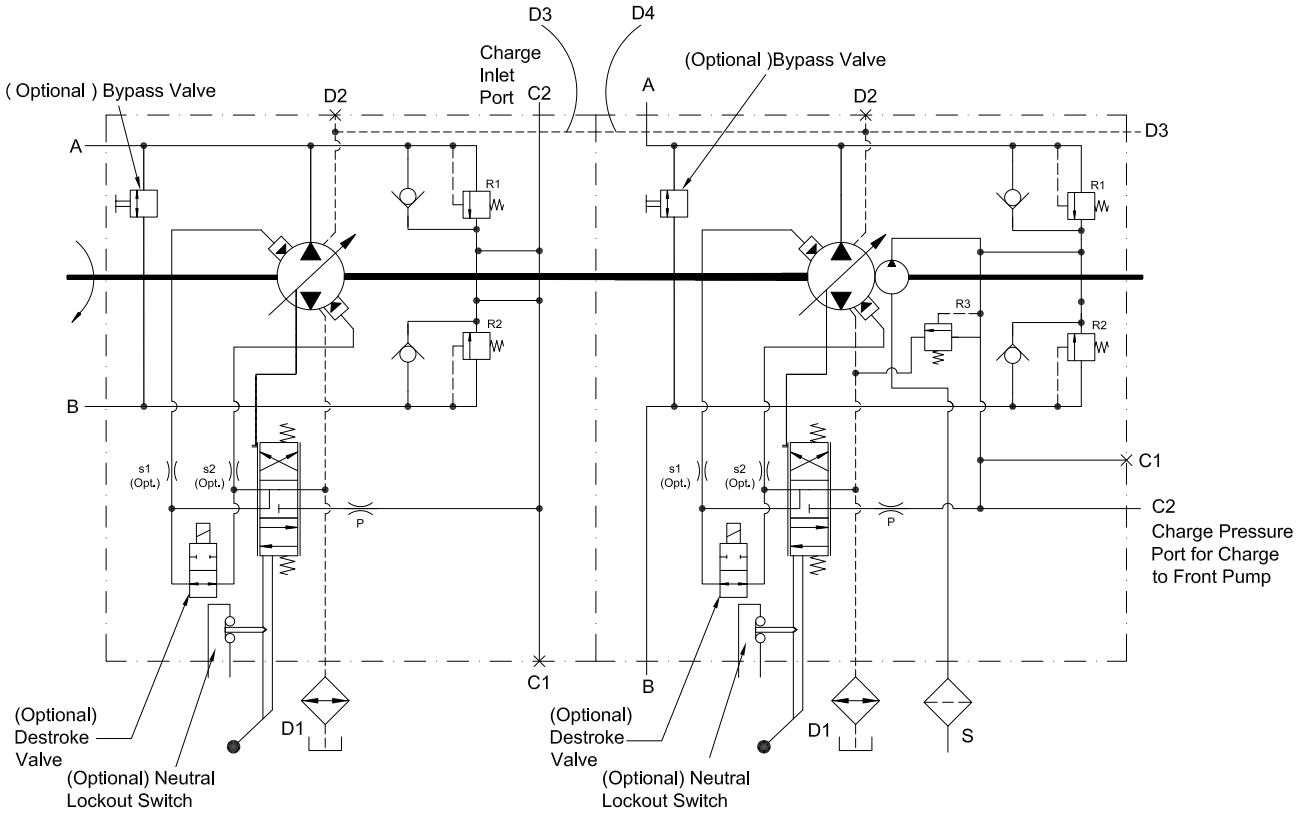
Paint: Black

Additional options are available by using the Model Code and Details.

All left (CCW) or right (CW) directions given are viewed from the input shaft end of the pump.

Model 72400 Servo Controlled
Tandem Pump





Model 72400 Servo Controlled
Features, Benefits & Specifications

Specifications - Piston Pump

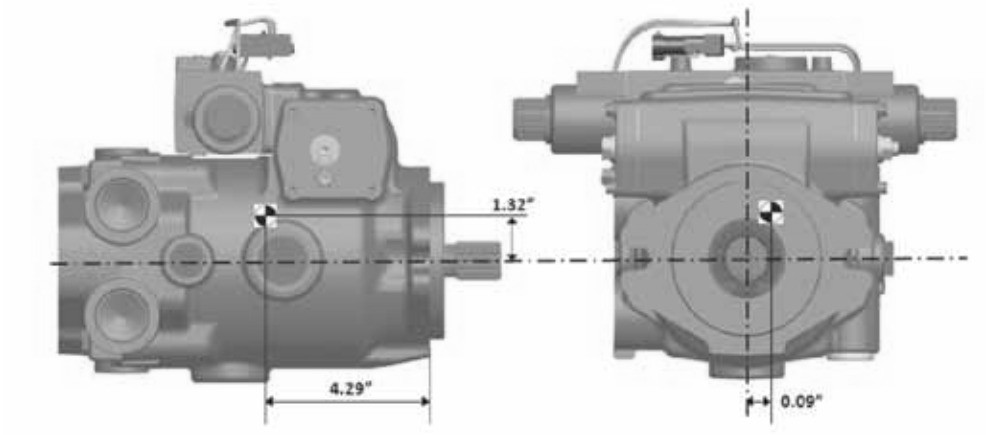
Maximum Displacement	40,6 cm^3/r [2.48 in^3/r]	49,2 cm^3/r [3.00 in^3/r]
Input Mounting Flange	SAE "B" or "BB"	SAE "B" or "BB"
Flow @ Rated Speed & PSI	140 l/min [37.0 gal/min]	169 l/min [44.8 gal/min]
Maximum Rated Speed	3600 RPM	3600 RPM
Nominal Pressure Rating*	345 bar [5000 PSI]	345 bar [5000 PSI]
Peak Pressure Rating**	380 bar [5500 PSI]	380 bar [5500 PSI]
Max Input Power	84 kw (113 HP)	102 kw (137 HP)
Max Input Torque	237 N-m (2099 lbf-in)	286 N-m (2528 lbf-in)
Continuous Allowable Case Pressure	2 bar [25 PSI]	2 bar [25 PSI]
Maximum Case Drain Temperature	107° C [225° F]	107° C [225° F]
Weight Per Single Pump	27 to 28 kg [59 to 62 lbs]	27 to 29 kg [59 to 62 lbs]

Specifications - Internal Gerotor Charge Pump

Displacement Options	
	6,9 cm^3/r [.42 in^3/r] 13,8 cm^3/r [.84 in^3/r] 17.2 cm3/r [1.05 in3/r] 20.7 cm3/r [1.26 in3/r]
Operating Pressure Range (std.)	14 to 21 bar [200 to 300 PSI]
Maximum Charge Inlet Vacuum	0,80 bar Abs. [6 inHg]

* Nominal Pressure: Max delta system pressure at which component fatigue does not occur (pump life estimated by bearing life).
** Peak Pressure: Max operation pressure which is permissible for a short duration of time (t < 1 sec).

Centre of Gravity of EP Controlled Pump***

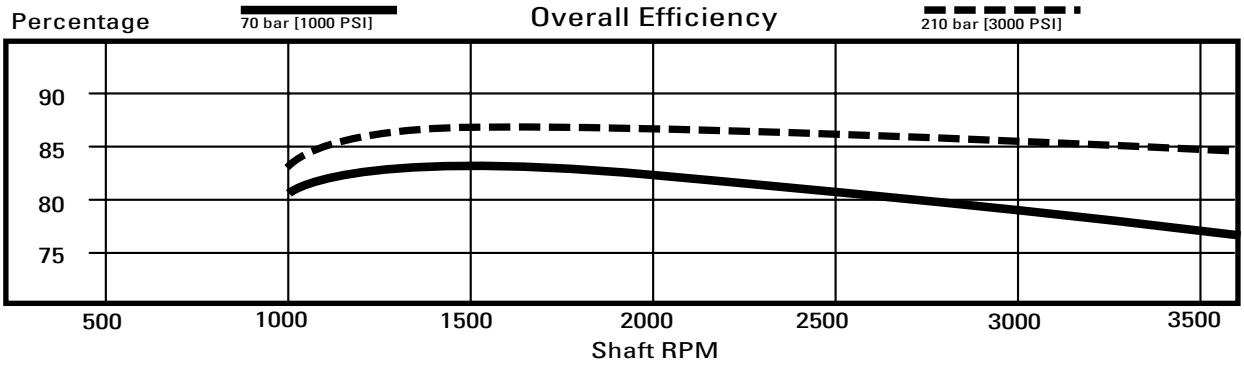


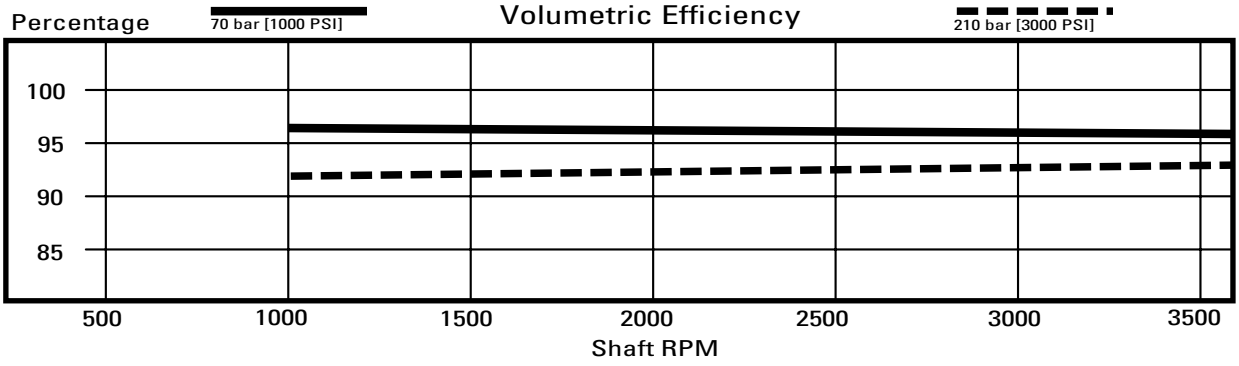
***Contact Eaton representative for specific requirements.

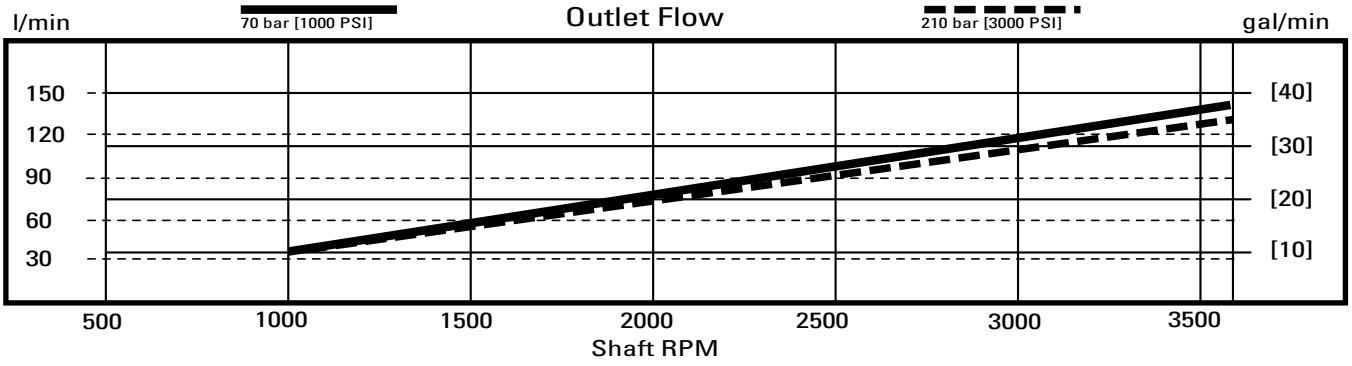
Model 72400 Servo Controlled Performance Data

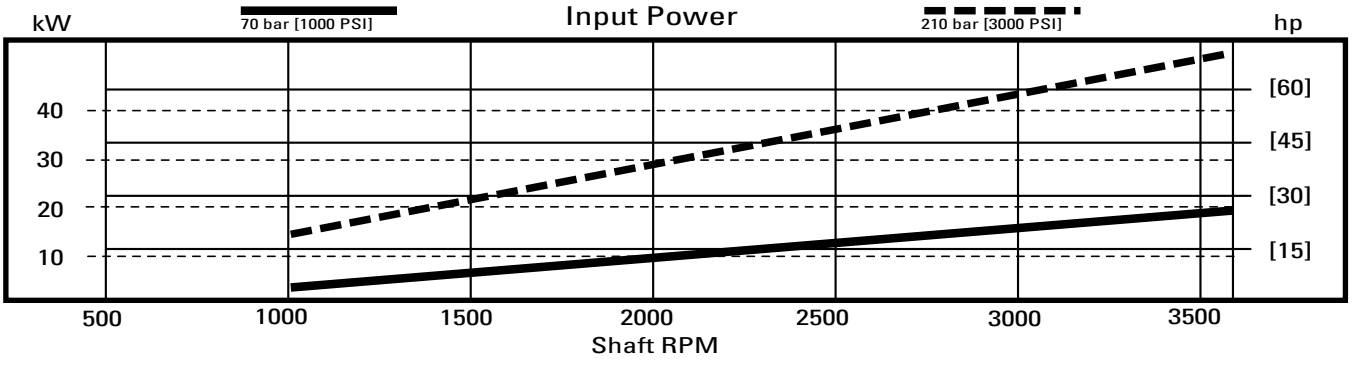
40,6 cm³/r [2.48 in³/r]

The charts below are representative of a single 40,6 cm³/r [2.48 in³/r] Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity at 9 - 12 cSt [54 - 66 SUS] and the pump at maximum displacement.





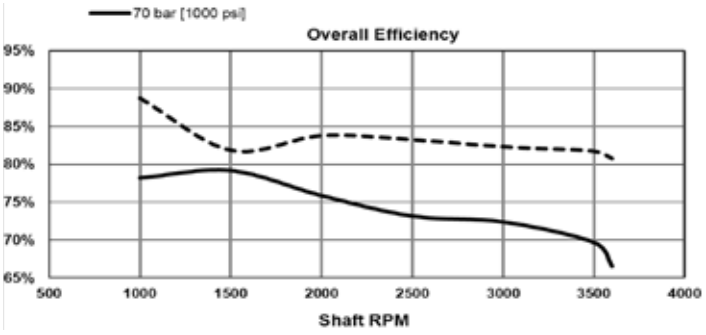


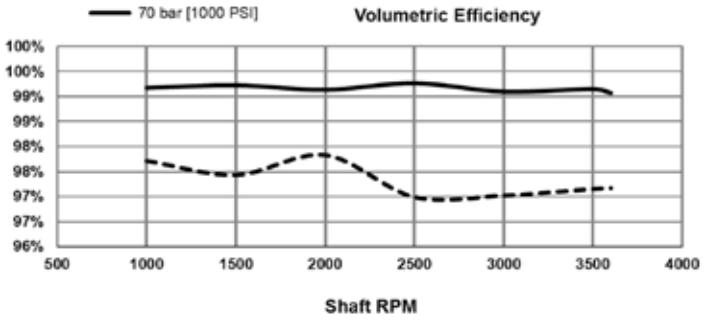


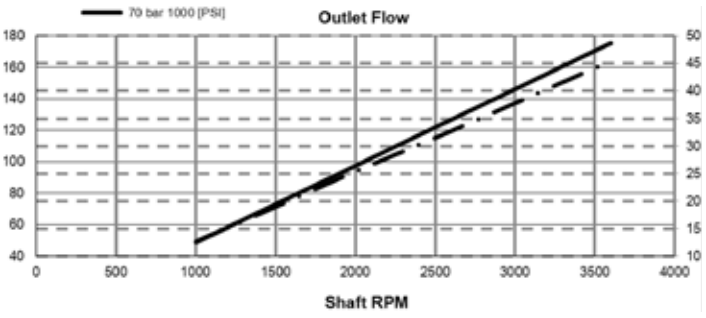
Model 72400 Servo Controlled Performance Data

49.2 cm3/r [3.00 in3/r]

The charts below are representative of a single 49.2 cm3/r [3.00 in3/r] Variable Displacement Piston Pump. The tests were run at an oil temperature of 82°C [180°F] with viscosity at 9 - 12 cSt [54 - 66 SUS] and the pump at maximum displacement.

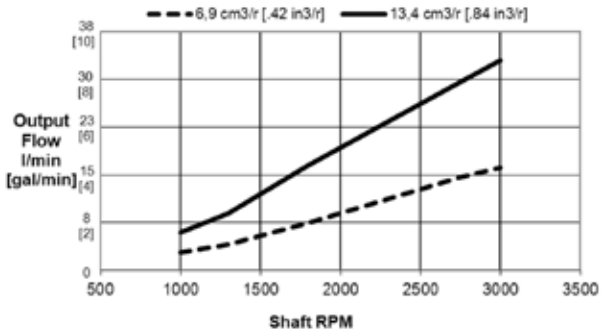






Charge Pump Performance - Flow vs Speed

The chart at right is representative of a 6,9 cm^3/r [.42 in^3/r] cm^3/r and 13,4 [.84 in^3/r] displacement charge pumps. The test was run at an oil temperature of 60°C [150°F] with viscosity 13 cSt [65 SUS].



Model 72400 Servo Controlled Code

Ordering Instructions: The Model 72400 Servo Controlled piston pumps are selected by using the following Model Code System tailoring the pump configuration to the requirement. Once a pump is built from the model code, a product number will be assigned to that configuration and the pump identified.

Make sure all positions are selected within the 27-digit code for each pump ordered.

Code Example:	**AAD**	**R**	**A**	**A**	**A**	**1**	**3**	**E**	**E**	**1**	**TT**	**A**	**M 0**	**0**	**A**	**0**	**0**	**0A**	**0 0**	**0**	**0**
Position -	1, 2, 3	4	5	6	7	8	9	10	11	12	13, 14	15	16, 17	18	19	20	21	22, 23	24, 25	26	27
																	0	**0A**		**0**	**D**

Position 1, 2, 3 - **Code Title**

AAD = 40,6 cm³/r [2.48 in³/r] Servo Controlled Variable Displacement Pump

AAE = 40,6 cm³/r [2.48 in³/r] Servo Controlled Variable Displacement Pump (Tandem Front Pump)

AAF = 40,6 cm³/r [2.48 in³/r] Servo Controlled Variable Displacement Pump (Tandem Rear Pump)

ACG = 49,2 cm³/r [3.00 in³/r] Servo Controlled Variable Displacement Pump

ACH = 49,2 cm³/r [3.00 in³/r] Servo Controlled Variable Displacement Pump (Tandem Front Pump)

ACJ = 49,2 cm³/r [3.00 in³/r] Servo Controlled Variable Displacement Pump (Tandem Rear Pump)

	Code	Single Unit	Tandem Unit Front	Tandem Unit Rear
Position 4 - Input Shaft Rotation				
R = Lefthand Rotation (CCW)	L	Std.	Std.	Std.
L = Right-hand Rotation (CW)	R	Std.	Std.	Std.
Position 5- Input Shaft				
A = 15 Tooth, 16/32 External Spline, 46 [1.81] Shaft Extension	A	Std	Std	NA
B = 41 Tooth, 48/96 External Spline, 24,4 [.96] Shaft Extension	B	NA	NA	Std
C = 13 Tooth, 16/32 External Spline, 41,1 [1.62] Shaft Extension	C	Opt	NA	NA
D = Taper 1.502:12, 6,4 [.25] x 19,8 [.78] keyway, 3/8 - 24 UNF Int. Thread, 35,1[1.38] Shaft Extension	D	Opt.	Opt.	NA
G = 25.4 [1.00] Dia. Str., 6,4 [.25] x 28,4 [1.12] keyway, 46 [1.81] Shaft Extension (Key Included)	G	Opt.	NA	NA
Position 6 - Output Shaft				
0 = No Output Shaft				
A = 9 Tooth, 16/32 Internal Spline, Accepts 31,8 [1.25] Shaft Extension (for SAE "A" mount only)	A	Std.	NA	Std.
B = 41 Tooth, 48/96 External Spline, Accepts 24,4 [.96] Shaft Extension (for SAE "B" mount only)	B	NA	Std.	NA
F = 11 Tooth, 16/32 Internal Spline, Accepts 31,8 [1.25] Shaft Extension (for SAE "A" mount only)	F	Opt.	NA	Opt.
J = 11 Tooth, 16/32 External Spline, Accepts 31,8 [1.25] Shaft Extension (for SAE "B" mount only) (To be used with 36,8 [1.45] spacer)	J	Opt.	NA	Opt.
Position 7 - Auxiliary Rear Mounting				
A = "A" SAE Flange Series 82-2	A	Std.	NA	Opt.
B = 2 Bolt "B" SAE Flange Series 101-2	B	Opt.	Std.	Opt.
C = "A" SAE Flange Series 82-2 w/ Cover Plate	C	Opt.	NA	Opt.
D = "A" SAE Flange Series 82-2 w/ Cover Plate and Mounting Support Holes	D	Opt.	NA	Opt.
E = "A" SAE Flange Series 82-2 w/ Mounting Support Holes	E	Opt.	NA	Std.
F = 2 Bolt "B" SAE Flange Series 101-2 w/ Mounting Support Holes	F	Opt.	Opt.	Opt.
Position 8 - Charge Pump				
0 = No charge pump	0	Opt.	Std.	Opt.
1 = 6,9 cm³/r [.42 in³/r] disp. w/1-5/16 - 12 UN-2B SAE O-ring straight thread inlet port (S)	1	Std.	NA	NA
2 = 13,8 cm³/r [.84 in³/r] disp. w/1-5/16 - 12 UN-2B SAE O-ring straight thread inlet port (S)	2	Opt.	NA	Std.
8 = 17.2 cm3/r [1.05 in3/r]; with 1 5/16-12 UN - 2B SAE O-ring port for suction inlet (S)	8	Std.	NA	Std.
9 = 20.7 cm3/r [1.26 in3/r]; with 1 5/16-12 UN - 2B SAE O-ring port for suction inlet (S)	9	Std.	NA	Std.
Position 9 - Charge Pump Relief Setting and Routing				
0 = No charge pump				
0 = No Auxiliary Port	0	Opt.	Std.	Opt.
3 = 17- 21 bar [250-300 PSI] (Relieved to Case)	3	Std.	NA	Std.
4 = 17- 21 bar [250-300 PSI], 1- 5/16 - 12 UN-2B SAE O-ring straight thread Outlet port (C3), 3/4 - 16 UNF-2B SAE O-ring straight thread Return Port (C4), (Remote filter and/or heat exchanger, relieved to case)	4	Opt.	NA	Opt.
Position 10 - Auxiliary Port, Size and Location (left C1 and right C2)				
D = On both sides w/left side plugged (housing), 3/4 - 16 UNF-2B SAE O-ring straight thread port	D	Opt.	Std.	Std.
E = On both sides and both plugged (housing), 3/4 - 16 UNF-2B SAE O-ring straight thread port	E	Std.	NA	NA
Position 11 - Drain Port Size and Location (left D1 and right D2)				
D = On both sides w/ right side plugged & rear flange drained into housing, 1-1/16 - 12 UN-2B SAE O-ring straight thread port	D	Opt.	Opt.	NA
E = On both Sides w/ left side plugged & rear flange drained into housing, 1-1/16 - 12 UN-2B SAE O-ring straight thread port	E	Std.	Std.	NA
M = On both sides w/ left side plugged & thru drain into mount (front), 1-1/16 - 12 UN-2B SAE O-ring straight thread port	M	NA	NA	Opt.
S = On both sides w/ both sides plugged & thru drain into mount (front), 1-1/16 - 12 UN-2B SAE O-ring straight thread port	S	NA	NA	Std.

Model 72400 Servo Controlled Code

Continued

Position 12 - Main Ports,Size and Location (port A and B)				
1 = 1- 5/16 - 12 UN-2B O-ring straight thread port, Same Side (Right Side)	1	Std.	Opt.	Opt.
2 = 1- 5/16 - 12 UN-2B O-ring straight thread port, Same Side (Left Side)	2	Opt.	Std.	Std.
Positions 13, 14 - Relief Valve Setting for Main Ports (Select a Setting for port "A" in position 13 and port "B" in Position 14)				
0 = Check Valve Only	0	Opt.	Opt.	Opt.
B = 140 bar [2000 PSI]	B	Opt.	Opt.	Opt.
E = 175 bar [2500 PSI]	E	Opt.	Opt.	Opt.
H = 210 bar [3000 PSI]	H	Opt.	Opt.	Opt.
L = 240 bar [3500 PSI]	L	Opt.	Opt.	Opt.
N = 275 bar [4000 PSI]	N	Opt.	Opt.	Opt.
Q = 310 bar [4500 PSI]	Q	Opt.	Opt.	Opt.
T = 345 bar [5000 PSI]	T	Std.	Std.	Std.
Y = 379 bar [5500 PSI]	Y	Opt.	Opt.	Opt.
Position 15 - Additional Functions				
0 = No Additional Functions	0	Std.	Std.	Std.
A = Bypass Valve	A	Opt.	Opt.	Opt.
C= Bleed-off valve in port B	C	Opt.	Opt.	Opt.
Positions 16, 17 - Pump Controls				
M0 = No Additional Features	M0	Std.	Std.	Std.
MA = Neutral Lockout Switch (Includes Wide Band Neutral)	MA	Opt.	Opt.	Opt.
MB = Neutral Detent (Includes Wide Band Neutral)	MB	Opt.	Opt.	Opt.
MC = Wide Band Neutral	MC	Opt.	Opt.	Opt.
Port Plate				
P0 = No Additional Features	P0	Opt.	Opt.	Opt.
Hydraulic Remote Control				
HA = 5-15 bar [72-217 PSI] Pilot Pressure range, 2X Port .4375-20 UNF-2B SAE O-ring Port	HA	Opt.	Opt.	Opt.
Electrohydraulic Control				
EC = Electronic Proportional Control 12 Vdc without Electronic Driver	EC	Opt.	Opt.	Opt.
ED = Electronic Proportional Control 24 Vdc without Electronic Driver	ED	Opt.	Opt.	Opt.
EE = Electronic Proportional Control 12/24 Vdc and Electronic Driver with 1 to 6 Vdc Potentiometric Command Input	EE	Opt.	Opt.	Opt.
EG = Electronic Proportional Control 12/24 Vdc and Electronic Driver with 4 to 20 mA Command Input	EG	Opt.	Opt.	Opt.
EL = Electronic Proportional Control 12 Vdc and Electronic Driver with ± 100 mA Command Input	EL	Opt.	Opt.	Opt.
Solenoid Operated				
SA = 3 pos (FNR) 12 Vdc solenoids with Weather Pack Connectors (locations at port s1 and s2)	SA	Opt.	Opt.	Opt.
SB = 2 pos 12 Vdc solenoid with Weather Pack Connectors (location at port s1)	SB	Opt.	Opt.	Opt.
SC = 2 pos 12 Vdc solenoid with Weather Pack Connectors (location at port s2)	SC	Opt.	Opt.	Opt.
SK=Proportion Solenoid Control 12V with Non-Contact Swash Feedback Sensor with 4-Pin Metripack Connector	SK	Std.	Std.	Std.
Position 18 - Destroke Valve				
0 = Not required	0	Std.	Std.	Std.
1 = with 12 VDC Coil and Weather Pack Connector	1	Opt.	Opt.	Opt.
2 = with 24 VDC Coil and Weather Pack Connector	2	Opt.	Opt.	Opt.
3 = with 12 VDC Coil and DIN 43650 Connector	3	Opt.	Opt.	Opt.
4 = with 24 VDC Coil and DIN 43650 Connector	4	Opt.	Opt.	Opt.
Position 19 - Supply Orifice (location p)				
0 = No Supply Orifice (NA for pumps w/ destroke)	0	Opt.	Opt.	Opt.
A = 0,71 mm [.028 in]	A	Opt.	Opt.	Opt.
B = 0,81 mm [.032 in]	B	Opt.	Opt.	Opt.
C = 0,91 mm [.036 in]	C	Std.	Std.	Std.
D = 1,02 mm [.040 in]	D	Opt.	Opt.	Opt.
E = 1,12 mm [.044 in]	E	Opt.	Opt.	Opt.
F = 1,32 mm [.052 in] (Maximum orifice size if position 18 selection is 1 thru 4)	F	Opt.	Opt.	Opt.
G = 1,45 mm [.057 in] (NA for pumps w/ destroke)	G	Opt.	Opt.	Opt.
H = 1,65 mm [.065 in] (NA for pumps w/ destroke)	H	Opt.	Opt.	Opt.
J = 1,85 mm [.073 in] (NA for pumps w/ destroke)	J	Opt.	Opt.	Opt.

Model 72400 Servo Controlled
Code

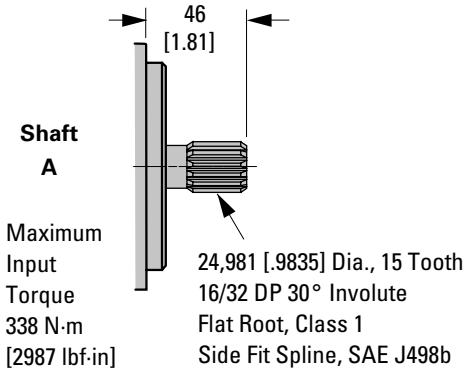
Continued

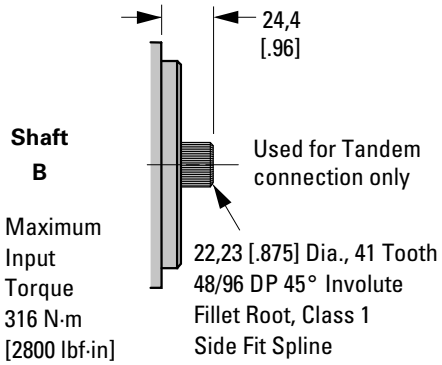
Position 20 - Control Orifice (location s1 & s2)				
0 = No Control Orifice	0	Std.	Std.	Std.
A = 0,71 mm [.028 in]	A	Opt.	Opt.	Opt.
B = 0,81 mm [.032 in]	B	Opt.	Opt.	Opt.
C = 0,91 mm [.036 in]	C	Opt.	Opt.	Opt.
D = 1,02 mm [.040 in]	D	Opt.	Opt.	Opt.
E = 1,12 mm [.044 in]	E	Opt.	Opt.	Opt.
F = 1,32 mm [.052 in]	F	Opt.	Opt.	Opt.
G = 1,45 mm [.057 in]	G	Opt.	Opt.	Opt.
Position 21 - Special Control Option				
Manual Control (only)				
0 = No Special Control Options (Standard Control Lever Position)	0	Std.	Std.	Std.
Positions 22, 23 - Paint				
0A = Primer	0A	Std.	Std.	Std.
0B = Black	0B	Opt.	Opt.	Opt.
Positions 24, 25 - Special Features				
00 = No Special Features	00	Std.	Std.	Std.
BB = Adjustable Displacement Limiter, Both Sides	BB	Opt.	Opt.	Opt.
CK = Speed Sensor				
Position 26 - Identification				
0 = Standard	0	Std.	Std.	Std.
Position 27 - Design Code				
D = Eaton - assigned design code				

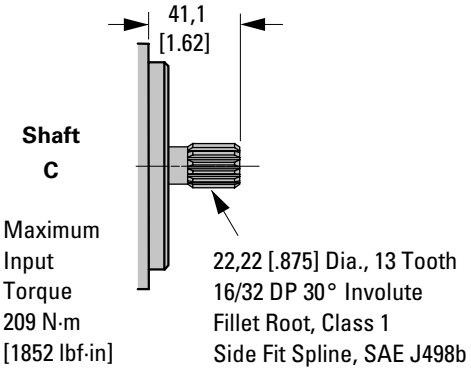
Model 72400 Servo Controlled Input Shafts

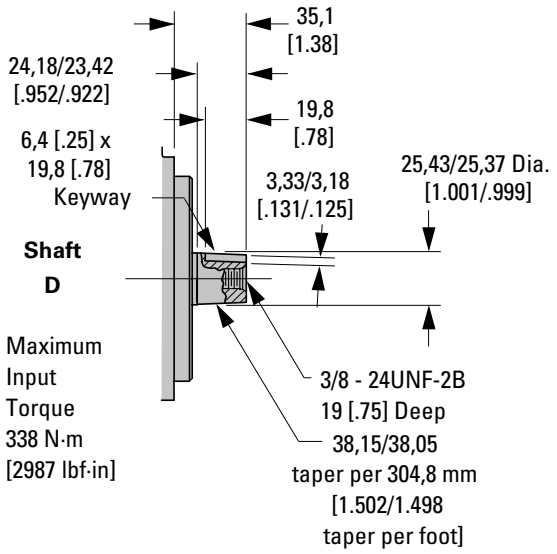
Code Position 5

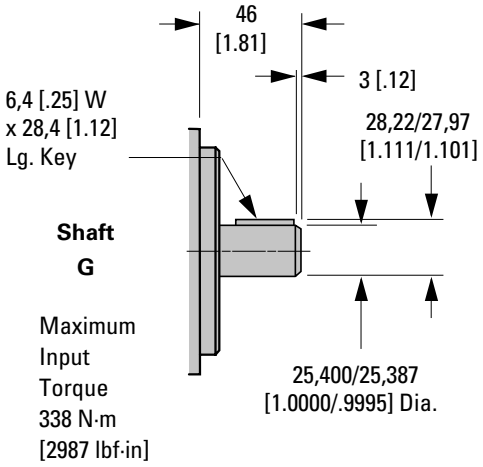
Dimensions are in millimeters [inches], unless otherwise specified.











Torque Note:

The combined torque required to turn multiple pumps must not exceed the torque rating of the input drive shaft of the front piston pump.

Consult an Eaton representative and/or Eaton engineering on side load recommendations.

Ordering Note:

Input and output shafts (code position 5 & 6) must be selected in relationship to pump code (position 1, 2, & 3).

Model 72400 Servo Controlled Output Shafts

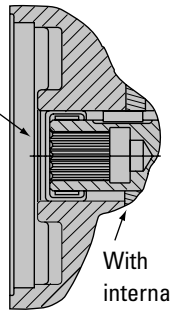
Code Position 6

9 Tooth , 16/32 DP Int., 15,875 [.6250] O.D., Accepts 31,8 [1.25] Shaft Extension, "A" Mount SAE J498b

Position 6

Shaft A

Torque limit on internal rear spline of piston pump with internal charge pump must not exceed 54 N·m [480 lbf· in]. Piston pump without internal charge pump must not exceed 76 N·m [672 lbf·in].



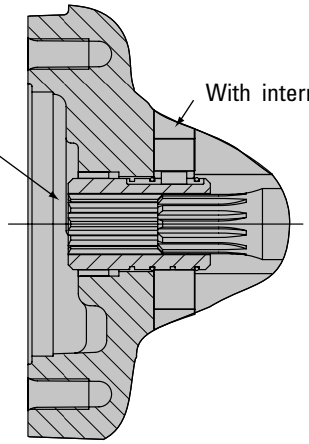
11 Tooth , 16/32 DP Int., 19,33 [.761] O.D., Accepts 31,8 [1.25] Shaft Extension, "A" Mount SAE J498b

Position 6

Shaft F

Maximum Torque

119 N·m [1050 lbf·in]



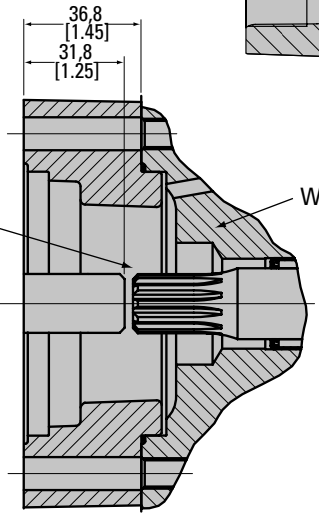
11 Tooth , 16/32 DP Ext., 19,05 [.750] O.D., Accepts 31,8 [1.25] Shaft Extension, "A" Mount SAE J498b (Used with spacer)

Position 6

Shaft J

Maximum Torque

119 N·m [1050 lbf·in]



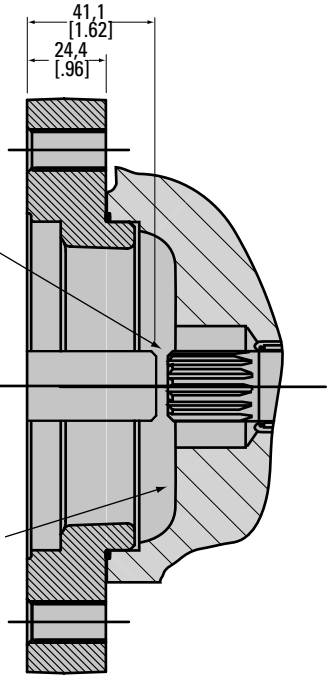
13 Tooth , 16/32 DP External, 21,81 [.8585] O.D., Accepts 41,1 [1.62] Shaft Extension "B" Auxiliary Mount , SAE J744

Position 6

Shaft L

Maximum Torque

209 N·m [1852 lbf·in]



41 Tooth , 48/96 DP Extension, 22,225 [.8750] O.D., Accepts 24,4 [.96] Shaft Extension "B" Auxiliary Mount, SAE J498b

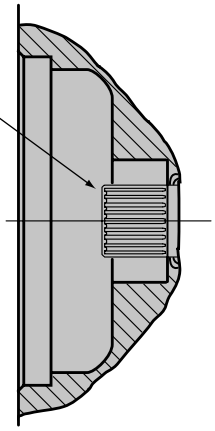
Position 6

Shaft B

Maximum Torque

316 N·m [2,800 lbf·in]

41 Tooth for tandem connections on rear of front pump.



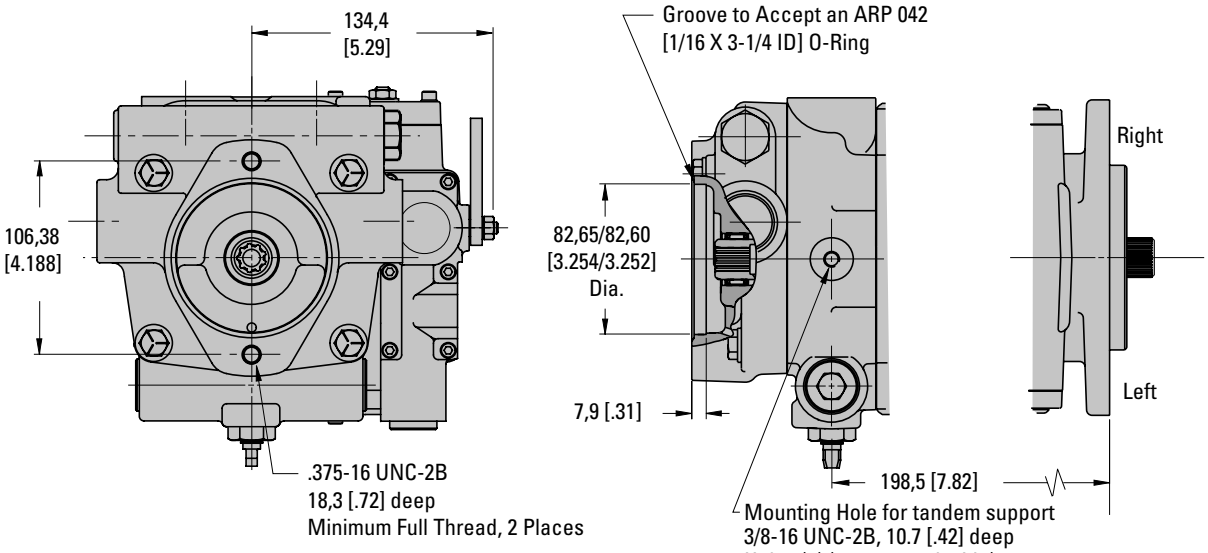
Tandem Servo Piston Pump SAE "B" Mounting Kit #72400-902: Includes 41T coupling, o-ring, cap screws (2), and washer.

Model 72400 Servo Controlled Auxiliary Rear Mounting

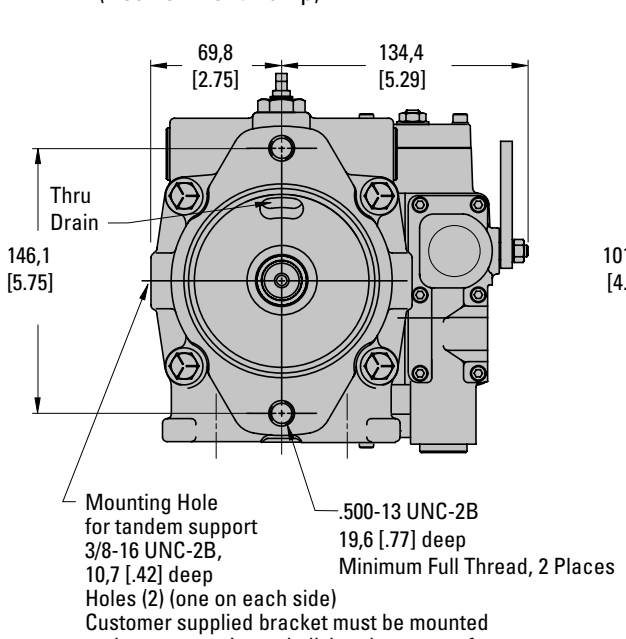
Code Position 7

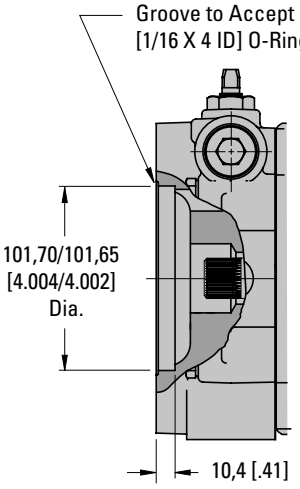
Dimensions are in millimeters [inches], unless otherwise specified.

2 Bolt "A" Auxiliary Mounting Flange (Rear of Single or Tandem Rear Pump)



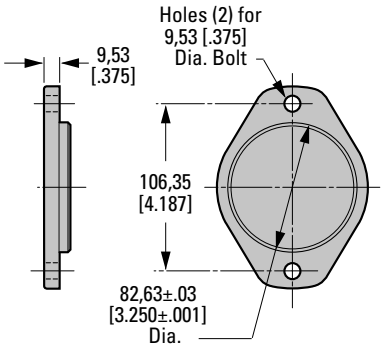
2 Bolt "B" Auxiliary Mounting Flange (Rear of Front Pump)





Cover Plate

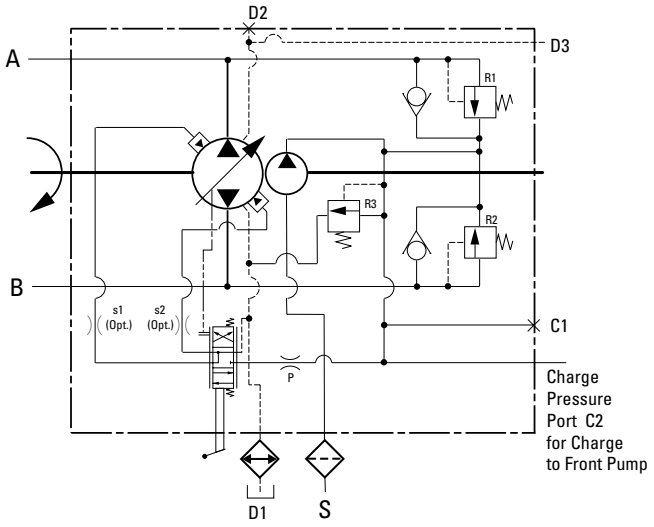
Fits "A" SAE Auxiliary Mounting Flange.
Cover Plate Kit #70142-915: Includes plate, cap screws (2), and o-ring.



Model 72400 Servo Controlled Charge Pump Routing and Location

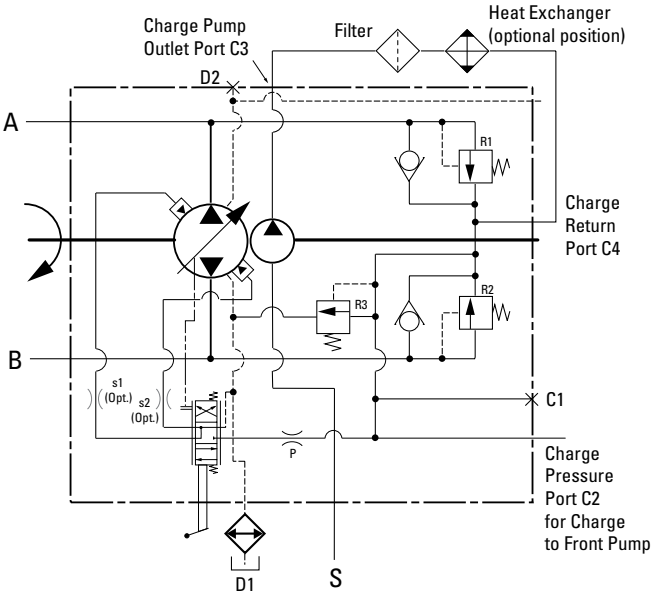
Code Position 9

Standard Pump



Charge Pump with Remote Filter/ Heat Exchanger Ports

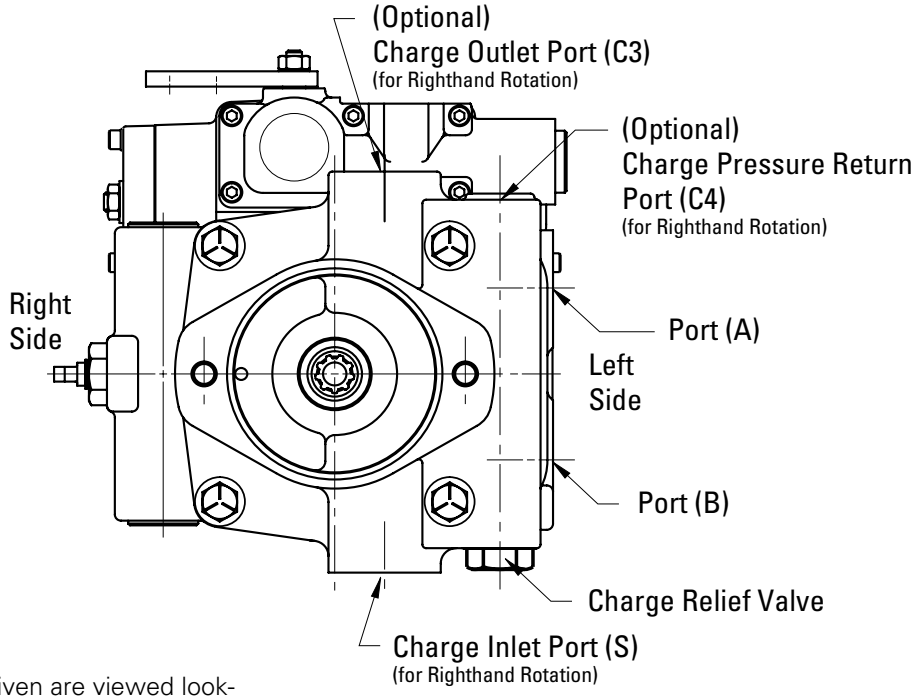
(Filter and heat exchanger supplied by customer.)



Charge Outlet Port Location

The charge outlet and return port is located in the charge pump housing, opposite of the suction port and charge relief valve.

For further detail on port relationship to rotation and position, refer to installation drawings.



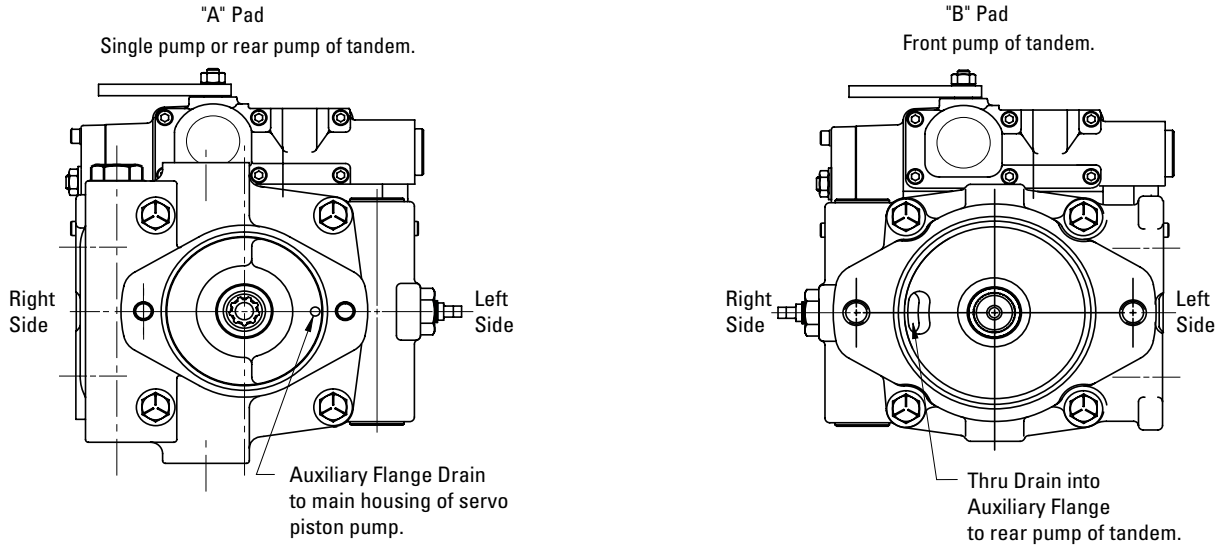
All left (CCW) or right (CW) directions given are viewed looking at the input shaft end of the pump.

Model 72400 Servo Controlled Auxiliary and Drain Port Locations

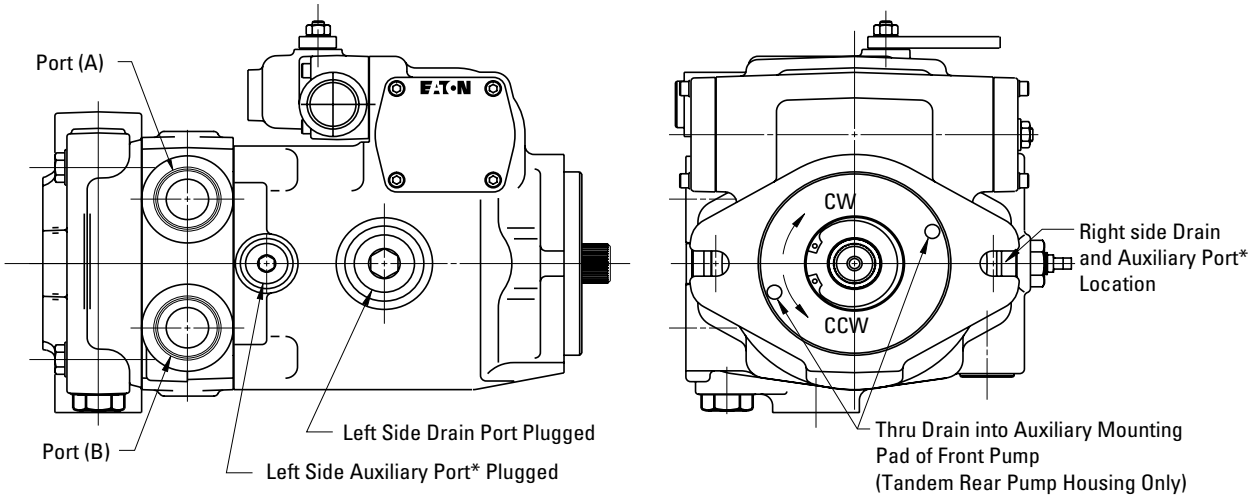
Code Position 10 and 11

(For dimensions, refer to installation drawings.)

Drain Locations in Rear of Pumps



Side and Front of Pump



*Note: Auxiliary port required in rear and front pump of tandem to provide charge flow and pressure to front pump.

All left (CCW) or right (CW) directions given are viewed looking at the input shaft end of the pump.

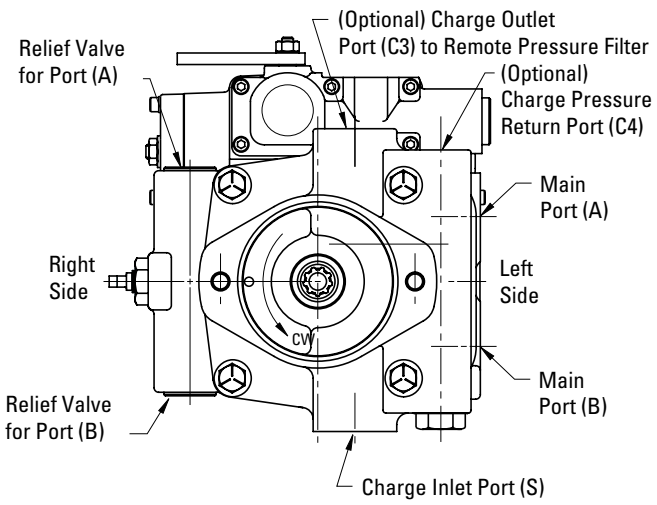
Model 72400 Servo Controlled
Main Ports and Relief Valve Location

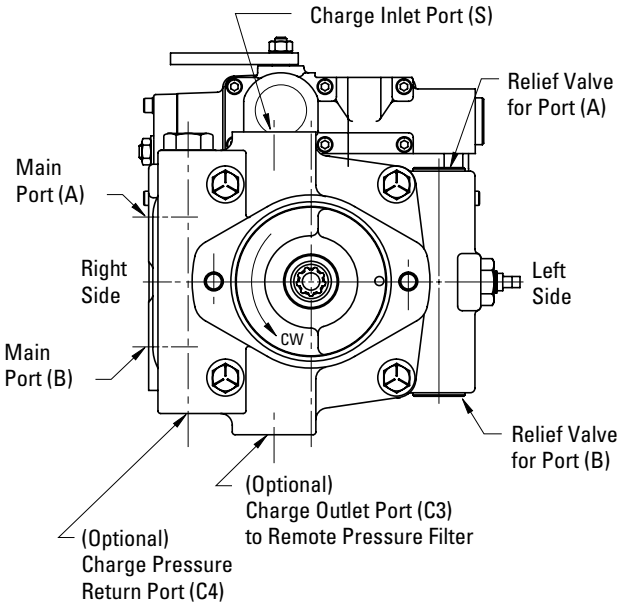
Code Position 12, 13 and 14

(For dimensions, refer to Installation drawings.)

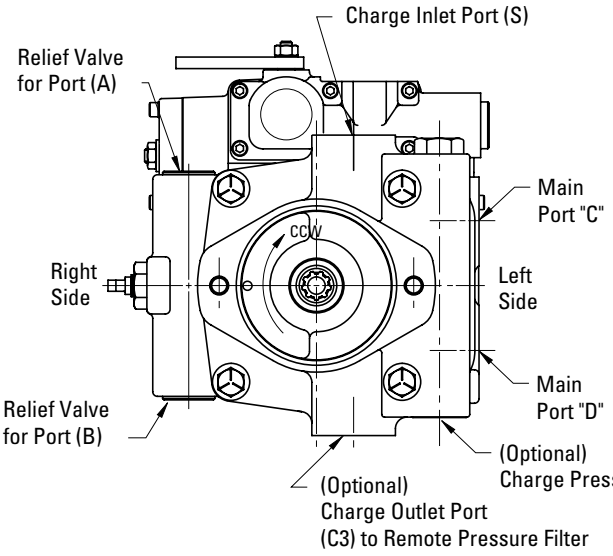
Charge pump position must stay in relationship to backplate as pictured below.

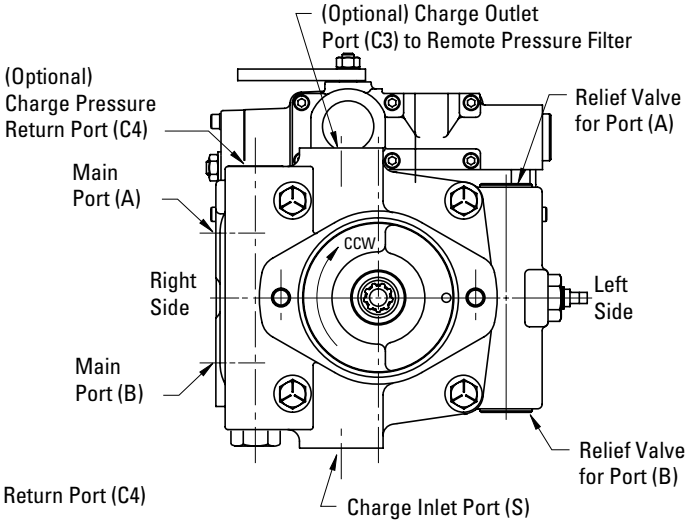
***Righthand Rotation (CW)**





***Lefthand Rotation (CCW)**





*All left (CCW) or right (CW) directions given are viewed looking at the input shaft end of the pump.

Model 72400 Servo Controlled Additional Functions

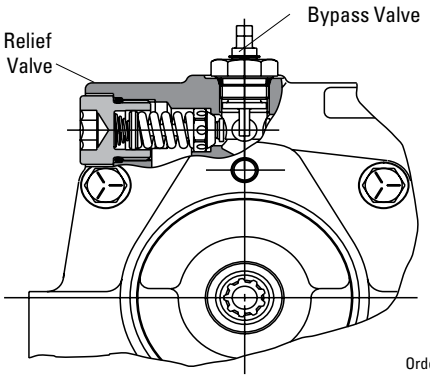
Code Position 15

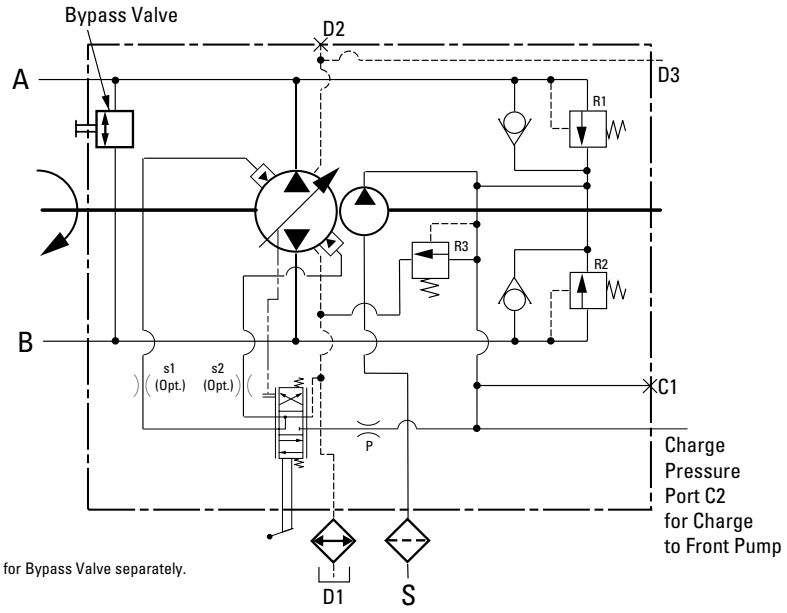
(For dimensions, refer to installation drawings.)

Dimensions are in millimeters [inches], unless otherwise specfied.

Bypass Valve

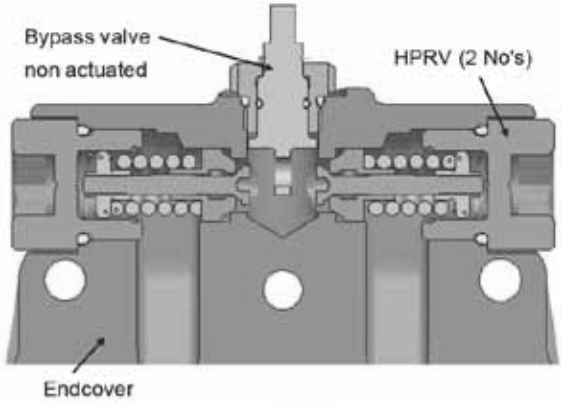
Opens the closed loop hydraulic circuit, allowing limited movement of a machine.





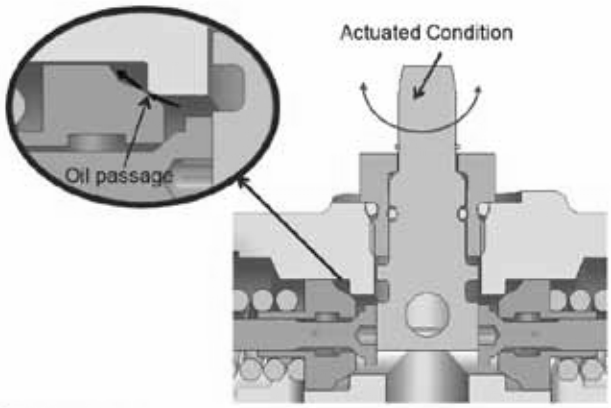
Order #72400-900 kit for Bypass Valve separately.

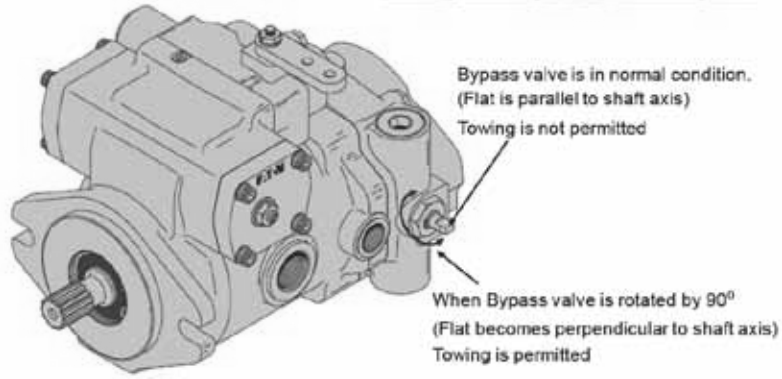
Case 1: Bypass Valve in normal condition (Towing is not permitted)



Case 2: Bypass valve in actuated condition.

ie valve is turned to 90° (either side) which allows to open two HPRV spool & hence both the ports are connected to each other and towing to a short distance is permitted in this condition.



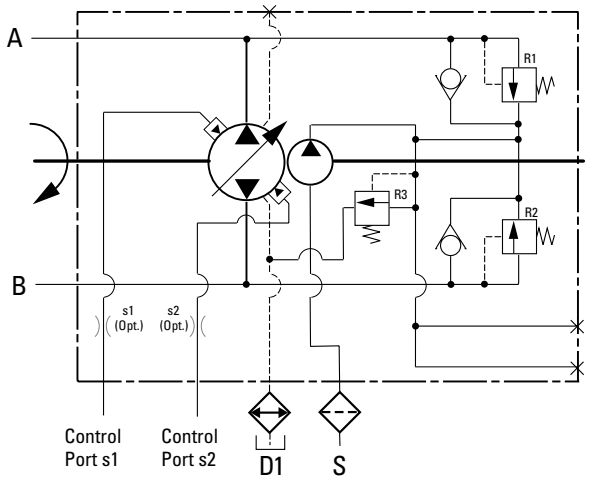


Note: Valve could be rotated by 360°. For towing operation 90° (either side) rotation is required.

Model 72400 Servo Controlled Pump Controls - Control Assembly

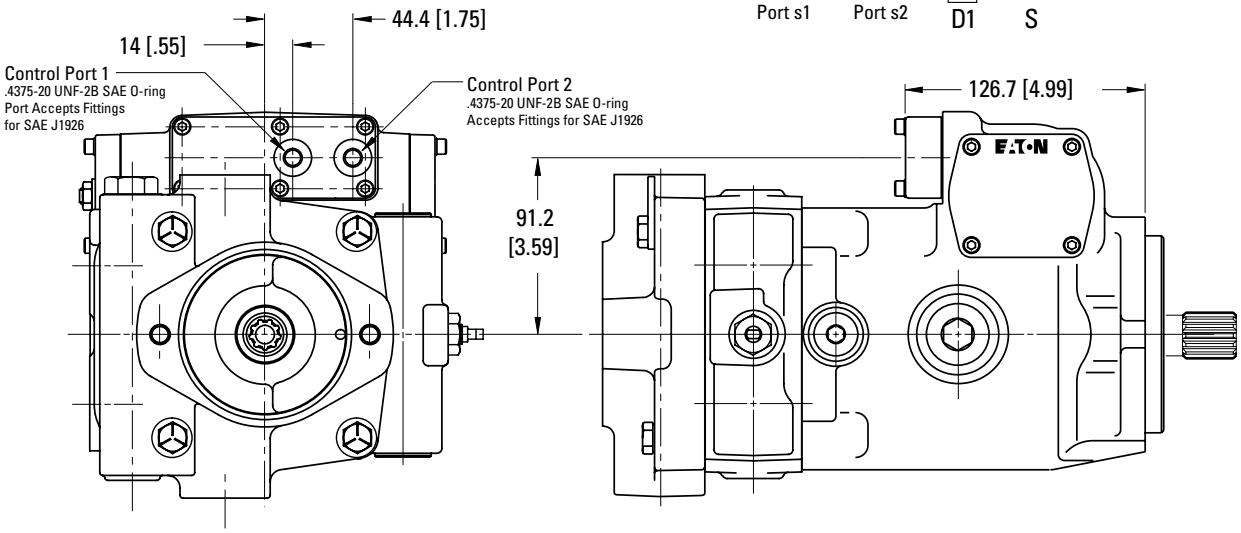
Code Position 16 and 17

The port plate is commonly used as a slave control that receives commands from other controls in the same system.



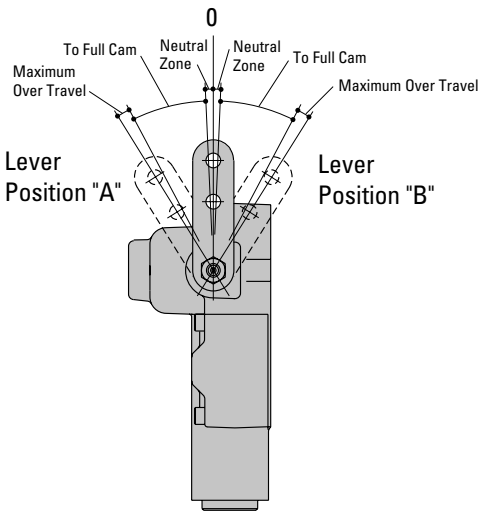
Minimum required control-pressure is 17 bar [250 PSI]

Righthand (CW) Input Rotation	Output Flow
Pressure to Control Port 1	Port (B)
Pressure to Control Port 2	Port (A)
Lefthand (CCW) Input Rotation	Output Flow
Pressure to Control Port 1	Port (A)
Pressure to Control Port 2	Port (B)



Model 72400 Servo Controlled Pump Controls - Manual Control

Code Position 16, 17 and 18



Control Lever Travel	Standard Band	Wide Band	High Gain
Neutral Zone	2.5°	4.0°	3°
Maximum Displacement	25.5°	25.5°	17°
Maximum Over Travel	4.0°	2.5°	10°

***Neutral Detent Feature**

The neutral detent provides a positive, centered feeling to the handle, signaling the operator when the pump is in neutral position.

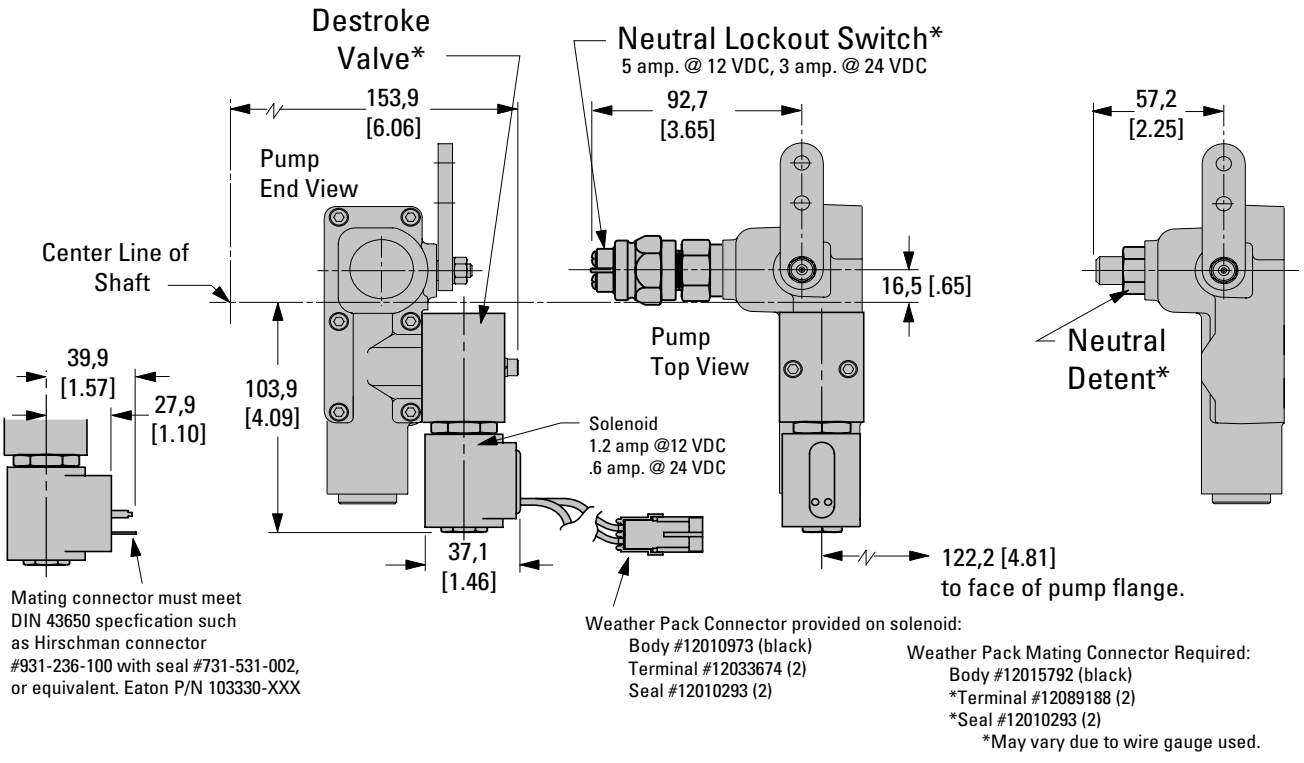
***Neutral Lockout Feature**

The neutral lockout switch consists of an electrical switch installed on the controller. This switch closes at the neutral position of the input lever and opens if lever is rotated either direction. The electronic "lockout" prevents the operator from starting any auxiliary functions unless the pump is in neutral position.

Dimensions are in millimeters [inches], unless otherwise specified.

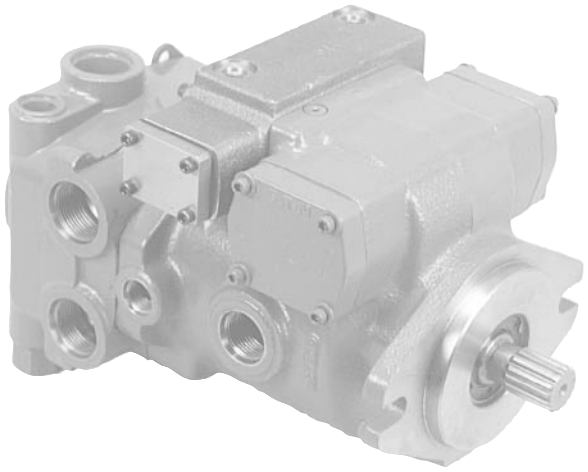
***Destroke Valve Feature**

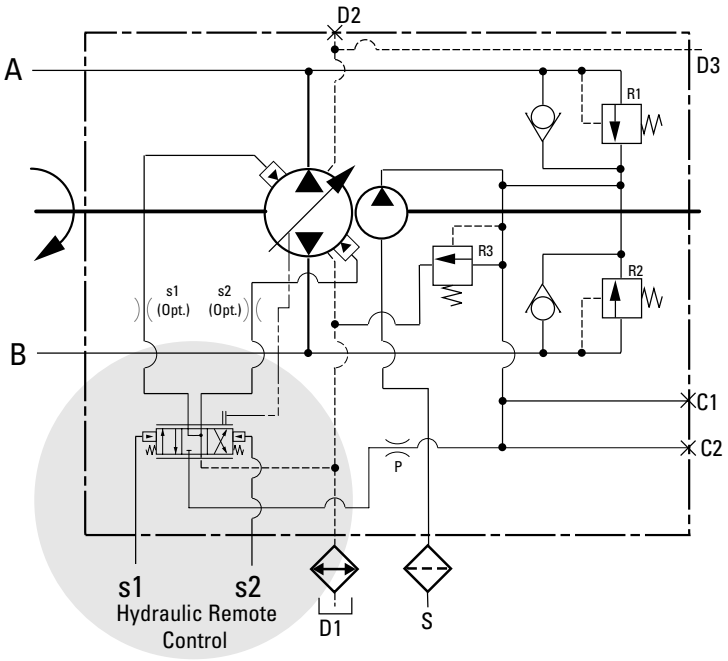
The destroke valve provides an emergency return to neutral and must be energized in order for the pump to stroke. If at any time power is interrupted to the solenoid, the pump will destroke to neutral.

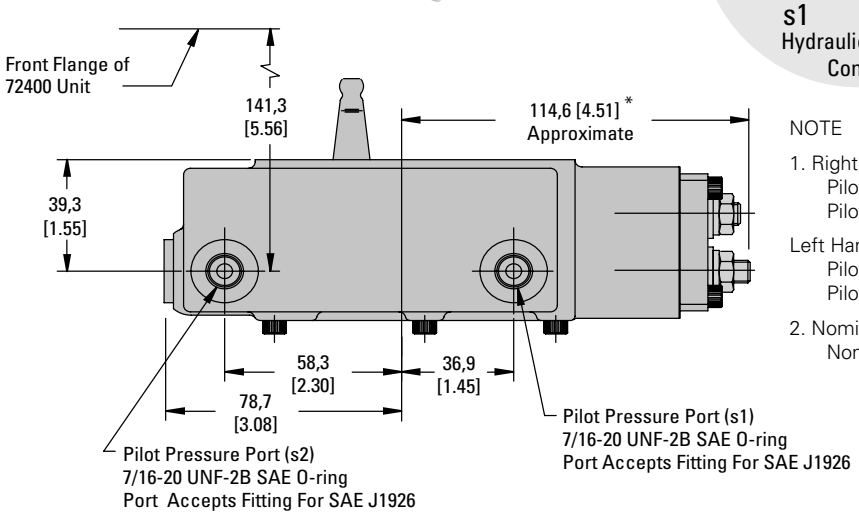


Model 72400 Servo Controlled
Pump Controls - Hydraulic Remote Control

Code Position 16 and 17





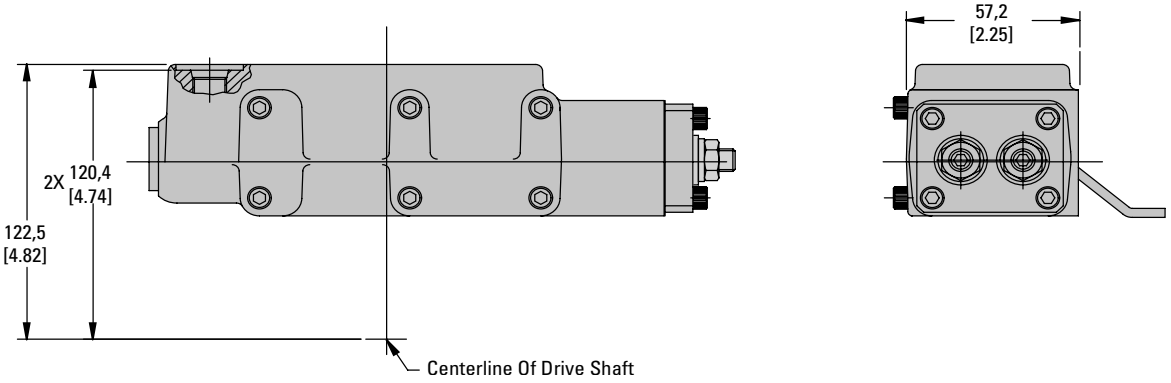


NOTE

1. Right Hand (Clockwise) Rotation
   Pilot Press Port -1 Pressurized...flow From System Press Port -B
   Pilot Press Port -2 Pressurized...flow From System Press Port -A

   Left Hand (Counter Clockwise) Rotation
   Pilot Press Port -1 Pressurized...flow From System Press Port -A
   Pilot Press Port -2 Pressurized...flow From System Press Port -B

2. Nominal Threshold Pressure ..... 5 bar [72.5 PSI]
   Nominal Max Displacement Pressure ..... 15 bar [217.6 PSI]



* Do not touch any of the Control adjustment nuts which are factory set.

Hydraulic Remote Control Conversion Kit

Order Part Number 72400-919

Includes: Control sub-assembly (1pc), Socket head cap screws (6 pc), Control housing gasket (1pc)

Model 72400 Servo Controlled
Pump Controls - Electronic Proportional Displacement Control

Code Position 16 and 17

Model Code	Model Code Description Command Input Signal	Typical Input Devices	Nominal Command Input Impedance of Electronics Module
EE	1 to 6 Vdc Potentiometric	Joysticks or Potentiometers with a resistance between 160 ohms and 50K ohms.	500K Ohms
EG	± 20 mA Current loop (4-20 mA)	Programmable Logic Controllers (PLC)	250 Ohms
EL	± 100 mA differential	Torque motor servo valve current drivers	28 Ohms
EC	12 Volts	Requires customer supplied electronics	
ED	24 Volts		

The Electronic Proportional (EP) displacement control is ideal for applications requiring electronic pump displacement control. The EP displacement control provides the flexibility of three command input choices. Control components include a proportional solenoid actuated valve assembly and an electronic solenoid driver module mounted on the pump.

The control driver module converts a command input signal to a proportional current output to the proportional solenoids resulting in a proportional pump displacement.

The EP displacement control has been designed to withstand the rigors of off-highway equipment environmental conditions.

EP Displacement Control Features

- Ease of installation
- Automotive style environmentally sealed Metri-Pack connectors
- Operates from 12 or 24 Vdc power supply
- External fuse (customer supplied): 3A for 12 Vdc system, 1A for 24 Vdc system
- Three choices for command input signal
- Operating temperature range -40° C to +85° C
- Control driver module encapsulated for environmental protection
- Closed loop current control compensates for resistance change of the proportional solenoids due to temperature variations
- Return to neutral for loss of power, or loss of command input signal
- Mechanical feedback of swashplate position for closed loop control
- External neutral adjustment
- Manual override capability
- Control drive module qualification per SAE J1455, SAE J1113, CISPR 25

Control Driver Module Qualification

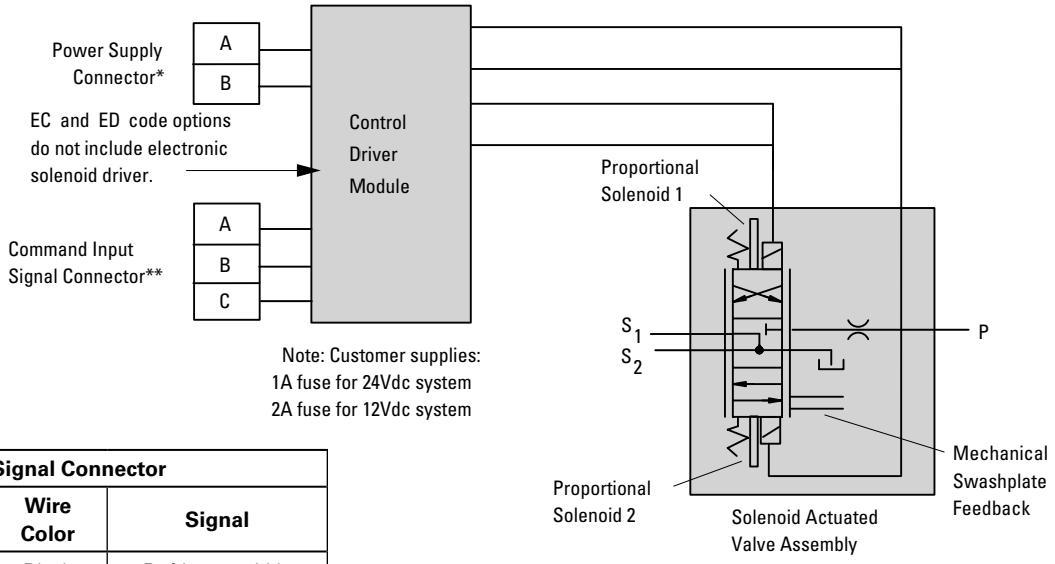
(Contact Eaton for Specific Levels)

- SAE J1455 - Recommended Environmental Practices for Electronic Equipment Design
  - Humidity/Temperature Extreme Cycling
  - Salt Spray
  - Splash & Immersion
  - Steam Cleaning/High Pressure Wash
  - Vibration
  - Mechanical Shock
  - Temperature Cycling
  - Load Dump Transients
  - Inductive Load Switching Transients
- SAE J1113 - Electromagnetic Susceptibility Measurement Procedures for Vehicle Components
  - EMI/EMC - Conducted & Radiated Immunity
- CISPR 25 - International Electrotechnical Commission "Limits and Methods of Measurement of Radio Disturbance Characteristics for the Protection of Receivers used on Board Vehicles".
  - EMI /EMC - Conducted & Radiated Emissions

Model 72400 Servo Controlled
Pump Controls - Electronic Proportional Displacement Control

Code Position 16 and 17 (EE, EG, EL) Cont.

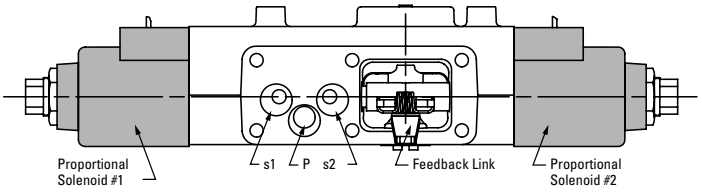
Interface Schematic



** Command Input Signal Connector			
Command Input Signal	**Pins**	**Wire Color**	**Signal**
1 to 6 Vdc Potentiometric	A	Black	Ref Low - 1 Vdc
	B	Green	Command (wiper)
	C	Red	Ref Hi - 6 Vdc
± 20 mA Current Loop (4-20 mA)	A	Orange	Loop Return
	B	White	Loop In
	C	No Connection Required*	
± 100 mA Differential	A	Blue	Loop Return
	B	White	Loop In
	C	No Connection Required*	

* Mating connector kit 990762-000 contains plug to be used to seal mating end connector.

Solenoid Actuated Valve Assembly



Model 72400 Servo Controlled
Pump Controls - Electronic Proportional Displacement Control

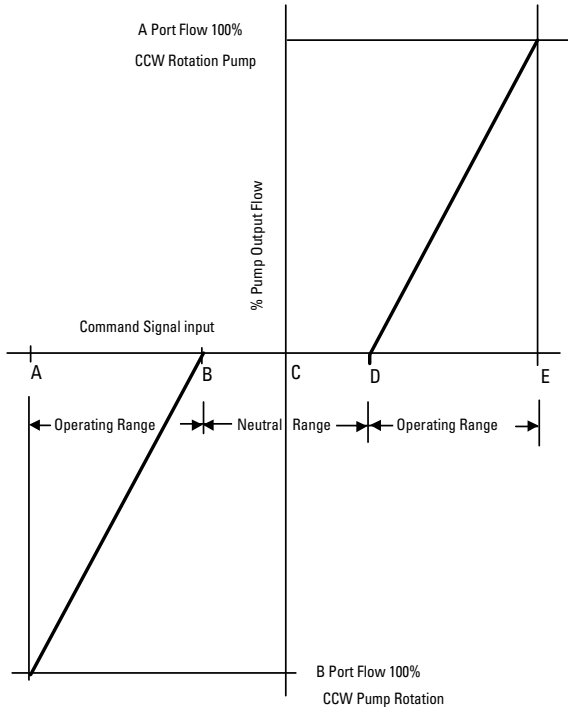
Code Position 16 and 17 (EE, EG, EL) Cont.

Note: In order to assure the most reliable installation and operation of any electronic control, proper installation methods should be followed with respect to interconnection wiring harness, command signal devices, fusing, and input power switching. Proper care should be taken to prevent damage to all electrical and electronic components due to abrasion, moving objects, heat, moisture or other environmental hazards. For safety critical applications, Eaton recommends that a switch be installed in line with (+ Battery) power to the module so that power may quickly be disconnected in case of emergency. A 2 ampere slow blow fuse should always be installed in the + battery line. It is recommended that during initial start-up and checkout, the machine be placed on jack stands to prevent inadvertent movement of the machine.

Command Input Signal	(A max)	B (min)	C	D (min)	E
1 to 6 Vdc	1.5 Vdc	3.3 Vdc	3.5 Vdc	3.7 Vdc	5.5 Vdc
4-20 mA*	-20 mA	-4.5 mA	0 mA	+4.5 mA	+20 mA
±100 mA	-100 mA	-7.5 mA	0 mA	+7.5 mA	+100 mA

*Note: The +20 mA command input signal configuration operates the pumps in one direction. The customer has to change the polarity on the -20 mA signal to operate the pump in the opposite direction.

General Relationship between Command Signal Input and Pump Flow

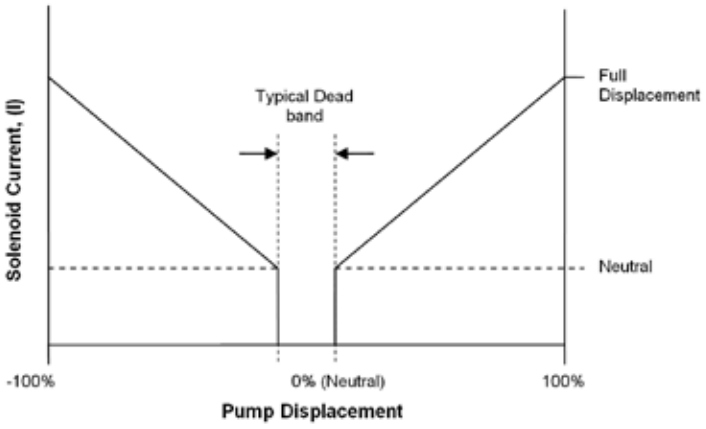


Electronic Proportional Valve Control Guidelines

	Parameter	12 VDC	24 VDC
Signal Input *	Resistance at 25°C - Ohm	5.19 ± 10%	20.80 ± 10%
	Nominal Inductance	17.5 mH	27.7 mH
	Current (I) at Neutral - Amp	< 0.4	<0.2
	Current (I) at Full Displacement – Amp (max continuous)	1.5A	0.75A
Operating Limits	Temperature Ratings	-65°F Min to 140°F Max	
	Power Consumption	28W Max	

*Coils have no internal diodes, polarity does not affect performance.

Signal Profile



PWM Configuration

Closed loop current control of the solenoid current via PWM duty-cycle variation.

Note: Coil currents must be limited to not exceed solenoid coil specifications

Frequency: 70-200Hz

(100Hz recommended when PWM driver does not have built-in dither capabilities)

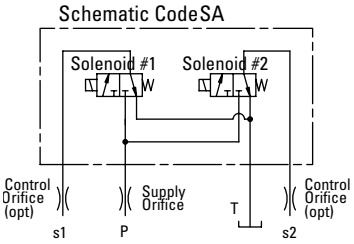
Dither Signal

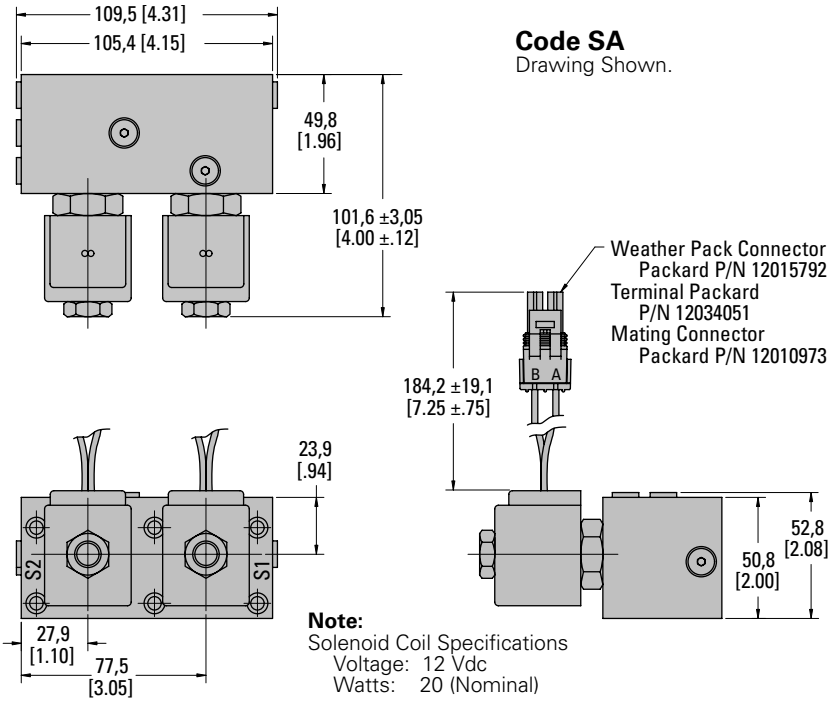
The design must provide for a separate dither signal to be added to the input command.

Waveform: Square
Frequency: 75 (+ 25,-15) Hz
Amplitude: .250 +.100 -.050A pk-pk

Model 72400 Servo Controlled
Pump Controls - Solenoid Operated Control

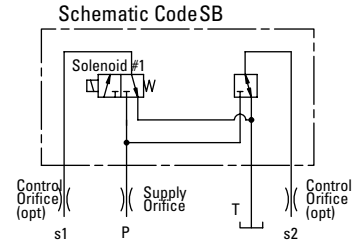
Code Position 16,17

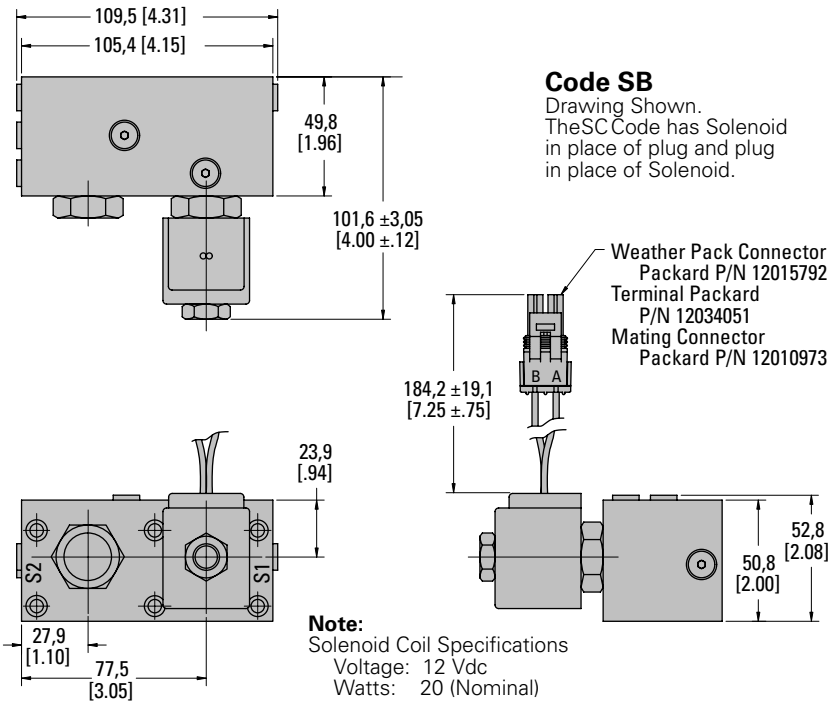




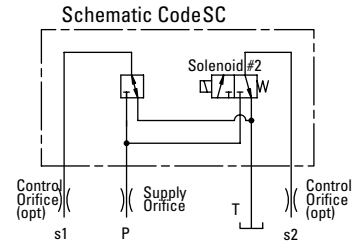
Code SA
Drawing Shown.

Note:
Solenoid Coil Specifications
Voltage: 12 Vdc
Watts: 20 (Nominal)





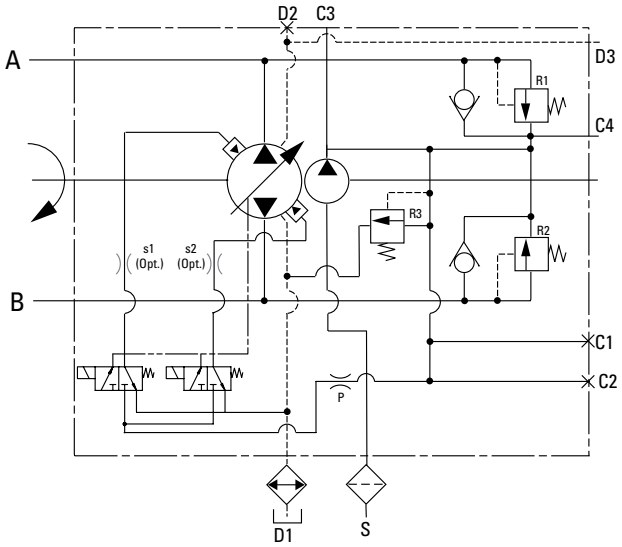
Code SB
Drawing Shown.
The SC Code has Solenoid in place of plug and plug in place of Solenoid.

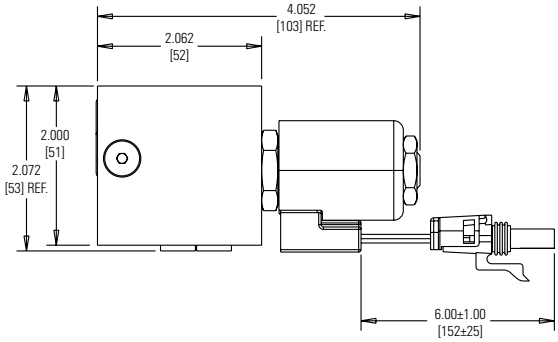


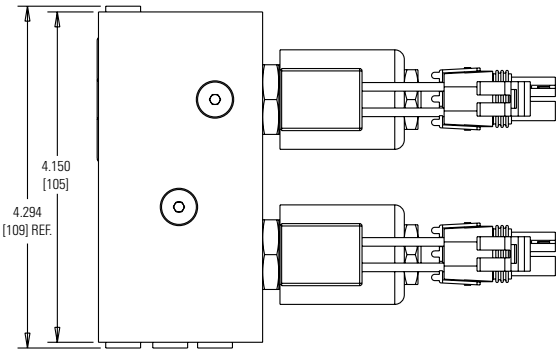
Note:
Solenoid Coil Specifications
Voltage: 12 Vdc
Watts: 20 (Nominal)

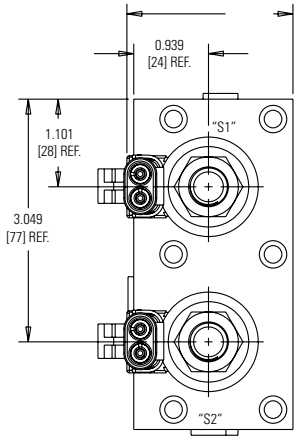
Model 72400 Servo Controlled
Pump Controls - Solenoid Control with Non-contact Swash Feedback Sensor

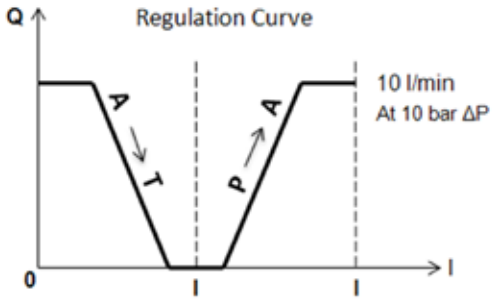
Code Position 16,17









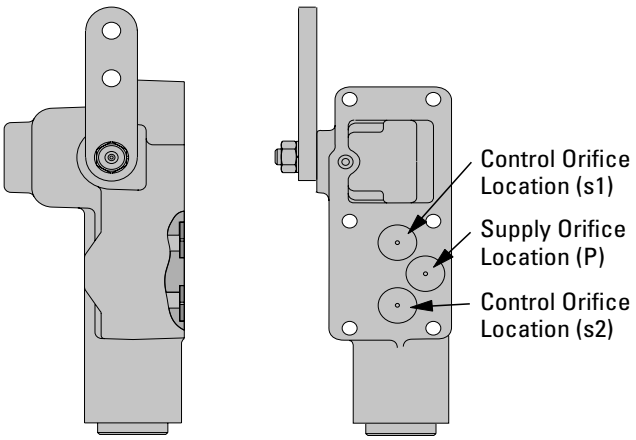


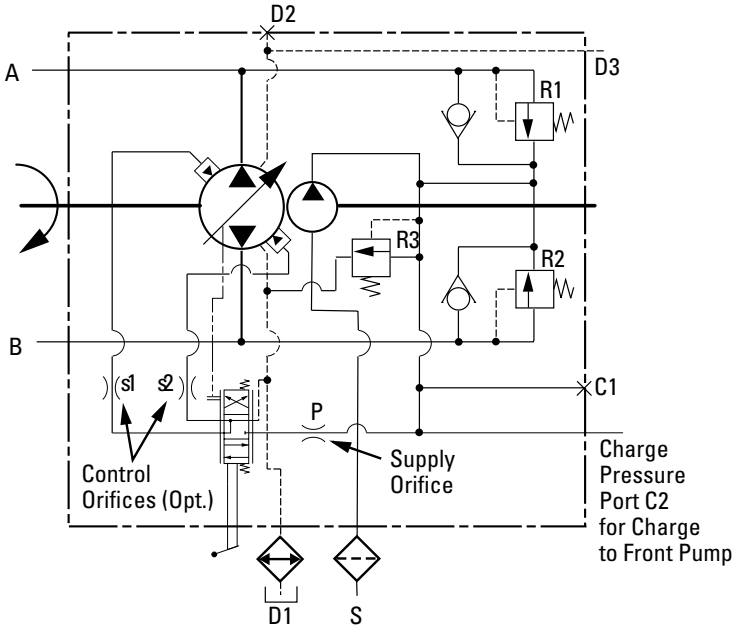
Technical Data

Max inlet pressure		100 bar
Voltage		12 V
Control current		2 A
Coil resistance		2.5 Ω
Temperature range		-30° C to +125° C
Hysteresis		< 8%
Leakage (P, A → T)	without electric supply (P = 60 bar, fluid viscosity 11 cSt)	< 10 cc/min
	With I = I average	< 30 cc/min
Response time		0 - P max < 20 ms P max - 0 < 20 ms

Model 72400 Servo Controlled
Supply and Control Orifice

Code Position 19 and 20





Calculated Time from Neutral to Full Stroke (seconds)

	Control Orifice Size, mm [in]							
Supply Orifice Size mm [in]	0,71 [0.028]	0,81 [0.032]	0,91 [0.036]	1,02 [0.040]	1,12 [0.044]	1,32 [0.052]	1,45 [0.057]	None
0,71 [0.028]	1.245	1.148	1.085	1.043	1.015	0.983	0.972	0.946
0,81 [0.032]	1.199	1.089	1.013	0.961	0.925	0.881	0.866	0.828
0,91 [0.036]	1.173	1.053	0.968	0.907	0.863	0.808	0.788	0.736
1,02 [0.040]	1.157	1.031	0.939	0.871	0.821	0.756	0.731	0.662
1,12 [0.044]	1.147	1.017	0.920	0.847	0.792	0.718	0.688	0.602
1,32 [0.052]	1.136	1.001	0.899	0.820	0.758	0.670	0.633	0.510
1,45 [0.057]	1.133	0.996	0.892	0.810	0.745	0.652	0.611	0.465
1,65 [0.065]	1.129	0.991	0.885	0.801	0.734	0.634	0.589	0.408
1,85 [0.073]	1.128	0.988	0.881	0.796	0.727	0.624	0.576	0.364
None	1.125	0.984	0.875	0.787	0.716	0.606	0.553	0.138

Note: Proper orifice selection must be determined by actual testing.

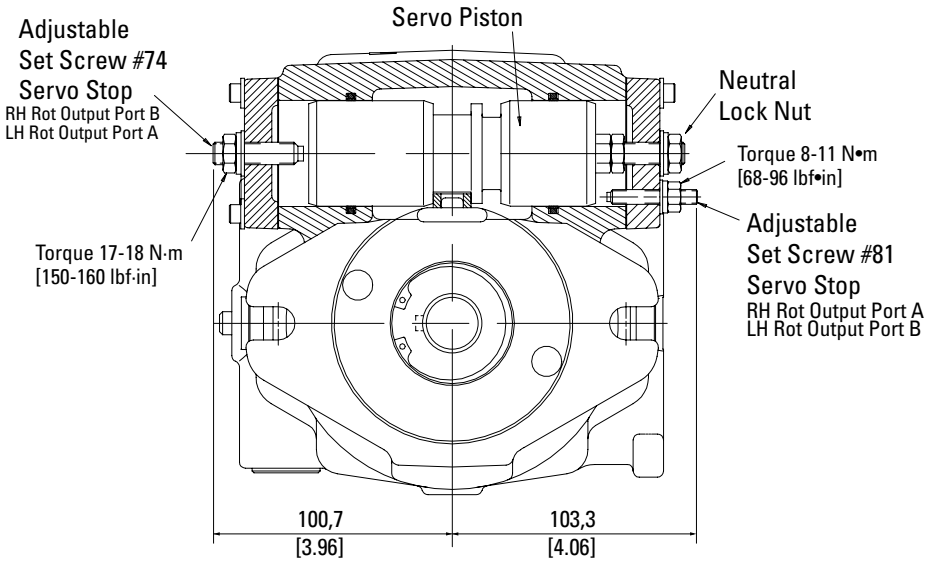
Model 72400 Servo Controlled Adjustable Displacement Limiter

Code Position 24, 25 and Selection BB

- Externally adjustable displacement
- Settings are zero to maximum pump displacement
- Independent adjustment for both main ports
- Field adjustable
- Available in Kit form (see page 62)

All factory units shipped with adjustable stops are set at maximum pump displacement.

See re-adjustment instructions below.



To Calculate Displacement Required

The displacement required divided by displacement of one turn of set screw equals the number of turns of set screw to obtain displacement.

Example for 3.00 in3/r re-adjustment:

2.0 in3/r ÷ .2854 in3/r =

7 turns of set screw

Pump Displacement per Turn		
2.48 in3/r Pump Displacement @ Full Cam		
Turns of Set Screw	**Item # 74 Stop**	**Item # 81 Stop**
0	2.48 in3/r	2.48 in3/r
1	2.22 in3/r	2.26 in3/r
2	1.98 in3/r	2.05 in3/r
3	1.73 in3/r	1.84 in3/r
4	1.49 in3/r	1.63 in3/r
5	1.26 in3/r	1.43 in3/r
6	1.03 in3/r	1.23 in3/r
7	0.80 in3/r	1.03 in3/r
8	0.57 in3/r	0.83 in3/r
9	0.34 in3/r	0.63 in3/r
10	0.12 in3/r	0.44 in3/r
10.5	**0.01 in3/r**	0.34 in3/r
11	N/A	0.25 in3/r
12.0	N/A	0.05 in3/r
12.3	N/A	**0.00 in3/r**

Pump Displacement per Turn		
3.0 in3/r Pump Displacement @ Full Cam		
Turns of Set Screw	**Item # 74 Stop**	**Item # 81 Stop**
0	3.00 in3/r	3.00 in3/r
1	2.71 in3/r	2.75 in3/r
2	2.40 in3/r	2.49 in3/r
3	2.11 in3/r	2.23 in3/r
4	1.82 in3/r	1.98 in3/r
5	1.53 in3/r	1.74 in3/r
6	1.25 in3/r	1.49 in3/r
7	0.97 in3/r	1.25 in3/r
8	0.69 in3/r	1.01 in3/r
9	0.42 in3/r	0.77 in3/r
10	0.14 in3/r	0.54 in3/r
10.5	0.01 in3/r	0.42 in3/r
11	N/A	0.30 in3/r
12.0	N/A	0.07 in3/r
12.3	N/A	**0.00 in3/r**

To Re-Adjust Displacement

- Loosen nut on adjustable see screw #81 servo stop. Screw stop in until it touches the servo piston. Back the screw out (number of turns required) to obtain the flow required.
  Refer to chart for displacements. Lock adjustment with nut. Torque nut 8 to 11 N·m [68 to 96 lbf·in].
- Loosen nut on adjustable set screw #74 servo stop. Screw stop in until it touches the servo piston. Back the screw out (number of turns required) to obtain the flow required.
  Refer to chart for displacements. Lock adjustment in place with nut. Torque nut 17 to 18 N·m [150 to 160 lbf·in].

Metric Conversion: Displacement in3/r X 16.387 = cm^3/r

Model 72400 Servo Controlled Adjustable Displacement Limiter Kits

Field Installed Kits

One side ..... Kit #72400-938
Two sides ..... Kit #72400-940

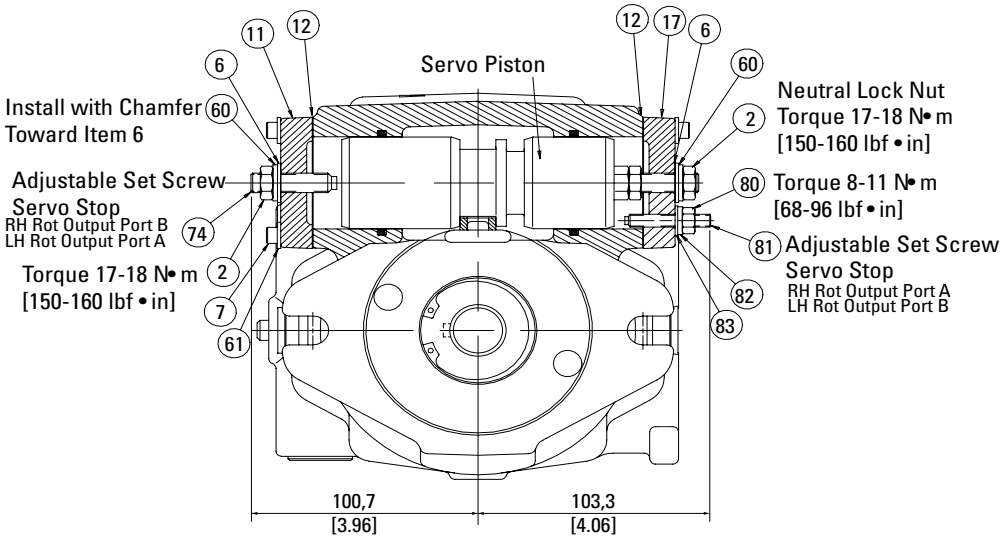
Disassembly

- Remove the four cap screws (Item #7) and washers (Item #61) retaining the existing cover plate (Item #11) opposite neutral set screw.
- After removing existing cover plate (Item #11) and cover gasket, measure the distance from the servo piston to the surface of housing for reference for neutral setting.
- Remove neutral setting nut (Item #2).
- Remove the four cap screws retaining the existing cover plate (Item #17).
- The cover plate (Item #17) is screwed onto the servo piston bolt. When removing the
- cover plate, count the amount of turns it takes to remove cover for reassembly. Also remove existing gasket (Item #12).

Adjustable Servo Stop Kit Parts			Kit #72400-938	Kit #72400-940
Item #	Part Number	Description	Qty.	Qty.
2	16024-6	Jam Nut	1	2
6	16254-6	Seal Washer	1	2
11	72400-651	Cover Plate	1	1
12	72400-621	Cover Gasket	1	2
17	72400-771	Cover Plate		1
60	16254-26	Washer	1	2
74	16139-624	Set Screw	1	1
80	16022-4	Jam Nut		1
81	16139-424	Set Screw		1
82	16254-24	Washer		1
83	16254-4	Seal Washer		1

Installing Servo Stops

- Place new gasket (Item #12) onto the housing on the neutral setting screw side of the servo piston. Hold in position with a small amount of petroleum jelly.
- Screw new cover plate (Item #17) onto servo piston bolt the same number of turns as it took to remove it. Install the four cap screws (Item #7) and washers (Item #61) to retain cover plate. Torque 4,5 to 5,4 N·m [40 to 48 lbf·in].
- Install seal washer (Item #6), washer (Item #60) and jam nut (Item #2). Torque nut 17 to 18 N·m [150 to 160 lbf·in]. At this time, check the distance from the servo piston to housing surface on opposite side. It should be the same as previously measured at disassembly. If not the same, loosen jam nut and with a hex key wrench, adjust and re-torque nut.
- Install new cover plate (Item #11) and retain with four cap screws (Item #7) and washers (Item #61). Torque 4,5 to 5,4 N·m [40 to 48 lbf·in].
- Insert adjustable servo stop set screw (Item #81) in until it touches the servo piston. Back the screw out to obtain the flow required. Refer to chart for displacements.Lock adjustment into place with seal washer (Item #83), washer (Item #82), and jam nut (Item #81). Torque nut 8 to 11 N·m [68 to 96 lbf·in].
- Insert adjustable servo stop set screw (Item #74) in until it touches the servo piston. Back the screw out to obtain the flow required. Refer to chart for displacements. Lock adjustment into place with seal washer (Item #6), washer (Item #60), and jam nut (Item #2). Torque nut 17 to 18 N·m [150 to 160 lbf·in].



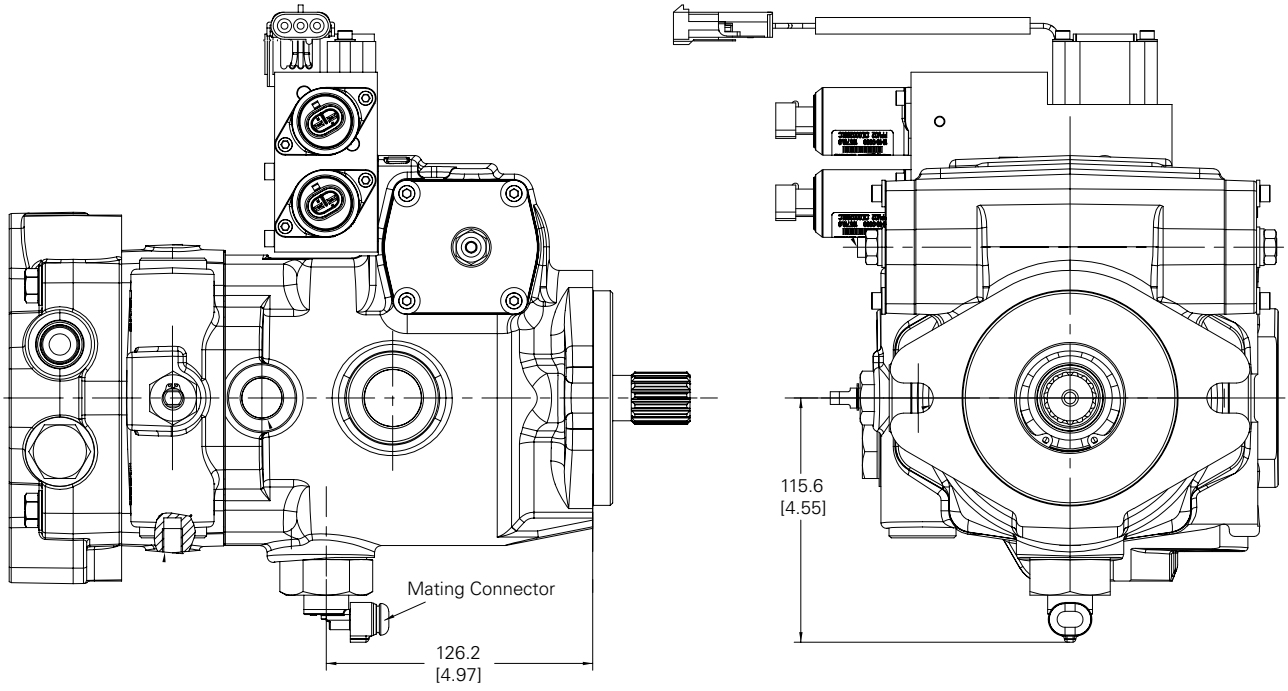
Model 72400 Servo Controlled Speed Sensor

Code Position 24, 25 and Selection CK

Magnetic speed sensor is used to measure the speed of the drive shaft. This is optional feature. Cylinder barrel has cut-outs made on its periphery. Magnetic speed sensor senses the speed of these cutouts and converts it into required RPM signal. This does not sense the direction of rotation of the pump.

Mating Packard Connector
Connector Body – 1216 2192
Connector Seal – 1204 0750
Cable Seal – 1204 0751
Socket – 1212 4075

Optional Mating Connectors
Connector Assembly (Body, Cable Seal, Seal) – 1216 2193
Socket (16 – 18 AWG) – 1212 4075
Socket (20 – 22 AWG) – 1212 4076



Parameter	Condition	Value
Operating Temperature Limit		-40 to 150°C [-40 to 302° F]
Sensor Resistance	25°C (77° F)	1.5 K To 3.5 K Ohms
Sensor Inductance	25°C (77° F)	0.6 to 3.7 H
Output Voltage	25°C (77° F) 9.3 Hz @ 2.29mm [.090 inch] Gap 300 Hz @ 0.25mm [.010 inch] Gap	400 mVpp Min 80 Vpp Max.
Air Gaps		0.26 to 2.28 [.010 to .090] mm [inch]
Vibration Voltage	15G random Vibration	0.4V P-P Max

Component Selection

The long service life of Eaton hydrostatic transmissions is largely dependent on the proper selection and installation of the compo- nents necessary for transmission operation.

The following components are necessary for transmission operation:

- Variable Displacement Pump
- Fixed or Variable Displacement Motor
- Reservoir
- Filter
- Charge Pump Inlet Line
- Pump and Motor Case Drain Lines
- High Pressure Lines
- Heat Exchanger
- Heat Exchanger Bypass Valve
- Reservoir Return Line

Variable Displacement Pump

Eaton hydrostatic variable displacement pumps are an axial piston design. They are equipped with standard SAE mounts, shafts and port connections.

Fixed or Variable Displacement Motor

Eaton hydrostatic motors are an axial piston design. They are equipped with standard SAE mounts, shafts and port connections.

Sizing Equations

For sizing / selecting the right pump for your application please carryout following basic calculations.

Flow Requirements

Pump Flow rate

$$\text{Pump Displacements (DP)} = \frac{\text{Nm X Dm}}{\text{Np X } \eta\text{p (vol.) X}\eta\text{m (Vol.)}}$$

Where,

Nmn = Necessary loaded motor speed (RPM)

Dm = Motor displacement (in3/rev)

Np = Pump input speed (RPM)

ηp (vol.) = Pump volumetric efficiency

ηm (vol.) = Motor volumetric efficiency

$$Q\ (\text{gpm}) = \frac{\text{Pump displacement (in3/rev) X Speed (rpm) X } \eta \text{ (vol. eff.)}}{231}$$

$$\text{Pump Input Power (HP)} = \frac{\text{Flow Rate Out Put (GPM) X Pressure (Psi)}}{1714 \text{ X } \eta \text{ (Overall)}}$$

Torque

$$\text{Torque (lbf.in)} = \frac{\text{Pump displacement (in3/rev) X Pressure (psi)}}{(2\text{x } \pi) \text{ x } \eta \text{ (mech. eff.)}}$$

Charge Pump Displacement

$$D = \frac{0.156\ (n_p \text{ X } D_p + n_m \text{ X } D_m)}{2}$$

Dcp = Charge Pump Displacement
np = Number of Pumps
nm= Number of Motors
Dp = Pump displacement
Dm = Motor displacement

Reservoir

The reservoir is an important part of the hydrostatic transmission system. It should provide adequate oil storage and allow easy oil maintenance.

The reservoir must hold enough oil to provide a continuous oil supply to the charge pump inlet. It must also have enough room for the hydraulic oil to expand as the system warms up. Consider charge pump flow when sizing the reservoir: One half (.5) minute times (X) the maximum charge pump flow should be the minimum oil volume in the reservoir. Maintaining this oil volume will give the oil a minimum of thirty (30) seconds in the reservoir. This will allow any entrained air to escape and contamination to settle out of the oil.

To allow for oil expansion, the reservoir's total volume should be at least six tenths (.6) minute times (X) the maximum charge pump flow.

The reservoir's internal structure should cut down turbulence and prevent oil aeration.

The line returning flow to the reservoir should be fitted with a diffuser to slow the incoming oil to 1 to 1.2 meters [3-4 feet] per second to help reduce turbulence. The return flow line should also be positioned so that returning oil enters the reservoir below the liquid surface. This will help reduce aeration and foaming of the oil.

The reservoir should have baffles between the return line and suction line. Baffles prevent return flow from immediately reenter- ing the pump.

A sixty mesh screen placed across the suction chamber of the reservoir will act as a bubble separator. The screen should be placed at a 30° angle to the horizon.

The entrance to the suction line should be located well below the fluid surface so there is no chance of air being drawn into the charge pump inlet. However, the suction line entrance should not be located on the bottom of the reservoir where there may be a buildup of sediment. The suction line entrance should be flared and covered with a screen.

The reservoir should be easily accessible. The fill port should be designed to minimize the possibility of contamination during filling and to help prevent over filling. There should be a drain plug at the lowest point of the reservoir and it should also have a clean-out

and inspection cover so the reservoir can be thoroughly cleaned after prolonged use. A vented reservoir should have a breather cap with a micronic filter.

Sealed reservoirs must be used at altitudes above 2500 feet.

These reservoirs should be fitted with a two- way micronic filter pressure cap to allow for fluid expansion and contraction.

In both cases the caps must be designed to prevent water from entering the reservoir during bad weather or machine washing.

A hydrostatic transmission with a well designed reservoir will run quieter, stay cleaner and last longer.

Filter

A filter must be used to keep the hydraulic fluid clean. Either a suction filter or a pressure side filter may be used. The filter must be a no-bypass type. System oil particle levels should not exceed ISO 18/15 per ISO 4406. Refer to Eaton Hydraulic Fluid Recommendations.

Recommended filters

Pressure line – 5 micrometer

Suction line = 3 OR 5 micrometer

When a suction filter is used, its flow capacity must be large enough to prevent an excessive pressure drop between the reservoir and charge pump inlet. The pressure at the charge pump inlet port must not be less than 0,80 bar absolute [6 in. Hg.] at normal continuous operating temperatures

Charge Pump Inlet Line

The inlet line to the charge pump should be large enough to keep the pressure drop between the reservoir and charge pump inlet within the limits described in the filter section. Fittings will increase the pressure drop, so their number should be kept to a minimum. It is best to keep fluid velocities below 1,25 meters [4 feet] per second.

Fluid and temperature compatibility must be considered when selecting the inlet line.

Pump and Motor Case Drain

The case drain lines should be large enough to limit the pump and motor case pressures (Medium Duty to 2 bar [25 PSI]) at normal operating temperatures. Fluid and temperature compatibility must also be considered when selecting the case drain lines.

High Pressure Lines

The high pressure lines that connect the pump and motor must be able to withstand the pressures generated in the high pressure loop.

Heat Exchanger

Use of a heat exchanger is dependent on the transmission's duty cycle and on machine layout. The normal continuous operating fluid temperature measured in the pump and motor cases should not exceed 80½C [180½F] for most hydraulic fluids.The maximum fluid temperature should not exceed 107½C [225½F].

The heat exchanger should be sized to dissipate 25% of the maximum input power available to the transmission. It must also be sized to prevent the case pressures in the pump and motor from getting too high. Medium duty case pressure up to 2 bar [25 psi], at normal operating temperatures, are acceptable.

Heat Exchanger Bypass Valve

The heat exchanger bypass valve is a pressure and/or temperature valve in parallel with the heat exchanger. Its purpose is to prevent case pressures from getting too high. The heat exchanger bypass valve opens when the oil is thick, especially during cold starts.

Reservoir Return Line

The same general requirements that apply to case drain lines apply to the reservoir return line.

Bearing Life estimation

Bearing life is defined as the length of time in terms of revolutions or time until a fatigue failure. Bearing load is calculated as a reaction which is derived from the moment created by the piston side load. Magnitude of the side load directly related to the speed and pressure at which a unit can be operated.

Bearing life is a function of the side loads coming on the bearings. Other factors such as fluid type, viscosity of fluid and cleanliness also affects the life of bearing.

If detail bearing life analysis is required, you can contact Eaton representative.

Installation Requirements

The mounting orientation of pumps and motors is unrestricted provided the case drain of the pump and motor remain full. Position the case drain such that it assures an oil level at or above unit center line at start-up. The case drain line that carries the flow leaving the pump or motor should be connected to the highest drain port on each of the units. This assures that the pump and motor cases remain full.

The combined torque required to turn two or more pumps must not exceed the torque rating of the input drive shaft of the front piston pump. Installer to provide centering and a secure neutral for pump swashplate control shaft. An external support is recommended for all tandems.

Open Loop Circuits

Eaton pumps and motors may be used in open loop circuits under certain operating conditions. Consult your Eaton representative for details.

Hydraulic Fluid Recommendations

Introduction

Hydraulic fluids are one of the vital components of hydraulic system. Proper selection of oil assures satisfactory life and operation of system components. The purpose of this section is to provide readers with the knowledge required to select the appropriate fluids for use in systems that employ Eaton hydraulic components

Viscosity and Temperature

Viscosity is the measure of a fluid's resistance to flow. The most important characteristics to consider when choosing a fluid to be used in a hydraulic system is viscosity. The fluid must be thin enough to flow easily but thick enough to maintain adequate lubricating film between components and to maintain proper sealing at the operating temperatures of the hydraulic system.

For viscosity requirements, see table

Viscosity of any fluid is relative to temperature, as the fluid warms the viscosity decreases and vice versa. When choosing a fluid, it is important to consider the start-up and operating temperatures of the hydraulic system. A high VI fluid shows relatively small change of viscosity with temperature.

Lubricants used for hydraulic applications may contain viscosity index improvers (VII). They refer to these fluids as viscosity index improved or multi-viscosity fluids. The viscosity of these fluids may drop down in use due to shearing of VI improvers used in the formulations.

Anti-wear hydraulic oils containing polymeric thickeners, viscosity index improvers (VII) are generally used for wide band operating temperature applications These fluids experience temporary and permanent viscosity loss during use in hydraulic system. Check the extent of viscosity loss (shear stability) to avoid hydraulic service below the recommended minimum viscosity. Oil with good shear stability is recommended for wide band temperature applications.

Multi-grade engine oils, ATFs, UTTOs, etc., also contain VIIs, and viscosity loss will be encountered during use.

Cleanliness

Cleanliness of the fluid in a hydraulic system is extremely important. More than 70% of all failures are caused by contamination Eaton recommends that the fluid used in its hydraulic components be maintained per ISO 4406. Cleanliness level requirements vary with the hydraulic components. The cleanliness of a hydraulic system is dictated by the cleanliness requirements of the most stringent component in the system.

Cleanliness requirements for specific products are given in the table.

OEM's and distributors who use Eaton hydraulic components in their hydraulic systems should provide these requirements in their designs.

Contact Eaton filter representative for filtration information.

Fluid Maintenance

The condition of a fluid has a direct effect on the performance and reliability of the system. Maintaining proper fluid viscosity, cleanliness level, water content, and additive level is essential for excellent hydraulic system performance. Routine fluid condition monitoring is recommended.

Fluid Selection

Premium grade anti-wear (AW) petroleum based hydraulic fluids will provide the best performance with Eaton hydraulic components. Fluids that meet Eaton Hydraulic Fluid Specification E-FDGN-TB002-E are considered good quality anti-wear hydraulic fluids. These fluids pass Eaton Vickers® 35VQ25A high pressure vane pump test (Eaton ATS-373 test procedure, ASTM D 6973).

Automotive crank case oils with American Petroleum Institute (API) letter designation SF, SG, SH, SJ, or higher per SAE J 183 classes of oils are recommended for applications using Eaton DG valves Automotive crankcase oils generally exhibit less shear stability compared to industrial anti-wear hydraulic fluids, which can result in higher loss of viscosity during service life.

Other mineral oil based lubricants commonly used in hydraulic systems are automatic transmission fluids (ATF) and universal tractor transmission oils (UTTO).

Synthetic hydrocarbon base stocks, such as polyalphaolefins (PAO) are also used to formulate hydraulic fluids, engine oils, ATFs and UTTOs Alternate fluids are recommended when specific properties, such as fire resistance biodegradability etc., are necessary for the application. Keep in mind that alternative fluids may differ from AW petroleum fluids in properties.

Additional Notes

When choosing a hydraulic fluid, all the components in the system must be considered. Viscosity limitations have to meet the most stringent component requirements.

For any system where the fluid is non-petroleum oil, set the target one ISO code cleaner for each particle size, than that of petroleum fluids.

Keep adequate fluid level in the reservoir. Take fluid level reading when the system is cold.

Contact your Eaton representative, if you have specific questions about the fluid requirements of Eaton hydraulic components.

Hydraulic Fluid Recommendations

Viscosity & Cleanliness Recommendation

Product	Minimum *	Optimum	Maximum	ISO Cleanliness
Medium Duty Piston Pumps and Motors Charged Systems	6.0 cSt (45 SUS)	10 – 39 cSt (60-180 SUS)	2158 cSt (10000 SUS)	21/18/13

* Minimum viscosity applies at intermittent condition of 10% of every minute.
At viscosities lower than 70 sus, additional antiwear additives must be added to prevent premature wear.
Please refer to Eaton document 03-401 for further details.

Additional Notes:

- Fluids too thick to flow in cold weather start-ups will cause pump cavitation and possible damage. Motor cavitation is not a problem during cold start-ups, except for two speed motors. Thick oil can cause high case pressures which in turn cause shaft seal problems.
- When choosing a hydraulic fluid, all the components in the system must be considered and the optimum viscosity range adjusted accordingly. For example, when a medium duty piston pump is combined with a Disk Valve Motor the optimum viscosity range becomes 100 - 180 SUS [20 - 39 cSt] and viscosity should never fall below 70 SUS [13 cSt].
- If the natural color of the fluid has become black it is possible that an overheating problem exists.
- If the fluid becomes milky, water contamination may be a problem.
- Take fluid level reading when the system is cold.
- Contact your Eaton representative if you have specific questions about the fluid requirements of Eaton hydraulic components.

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