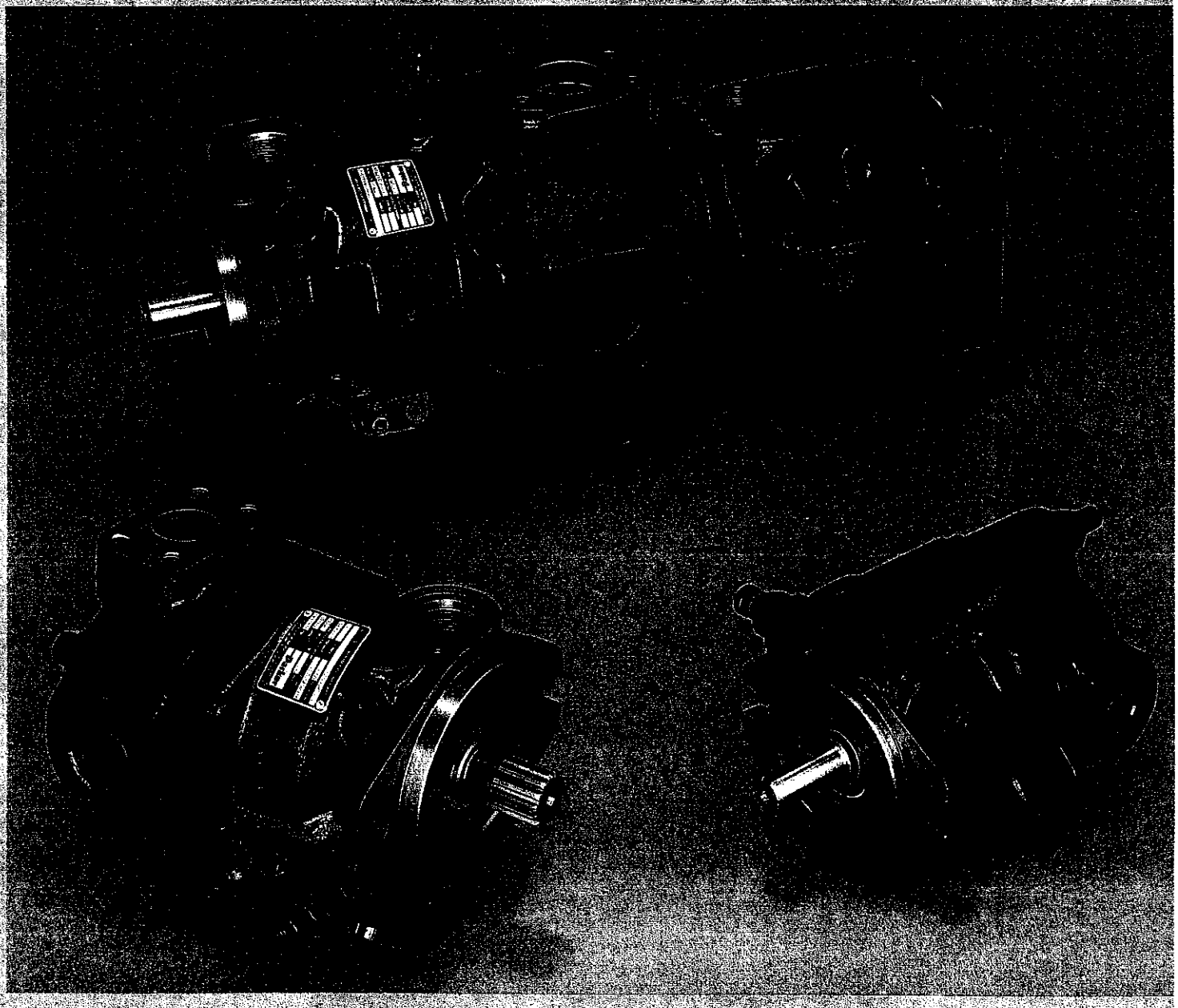
Parker Hydraulics

Series PAVC Variable Volume, Piston Pumps

Catalog 2600-101/USA



⚠ WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application including consequences of any failure, and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

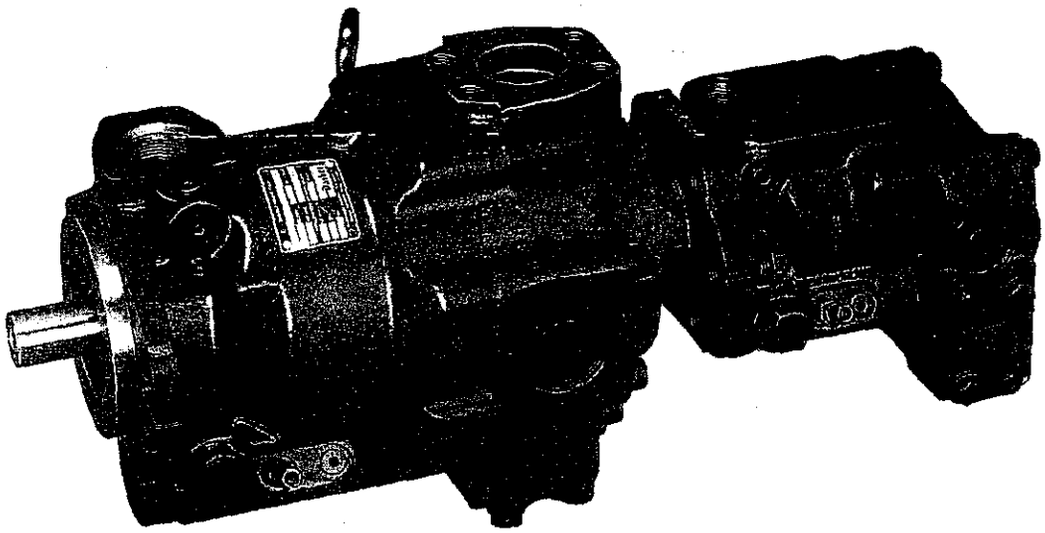
Offer of Sale

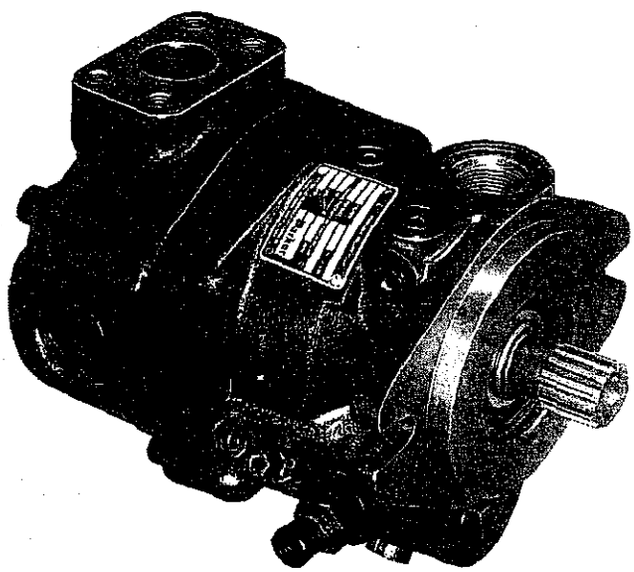
The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated on the separate page of this document entitled "Offer of Sale".

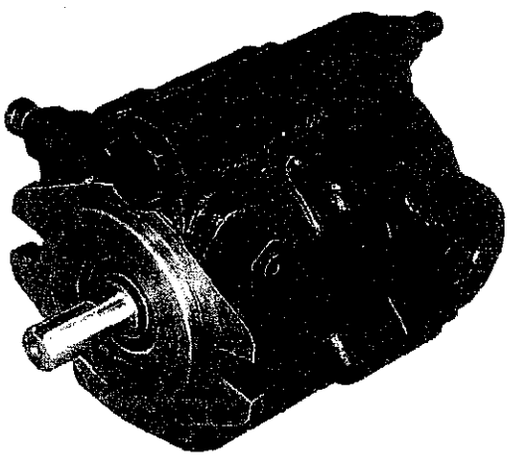
Parker Hannifin Corporation
Hydraulic Pump/Motor Division
Otsego, MI 49078

Index

Introduction





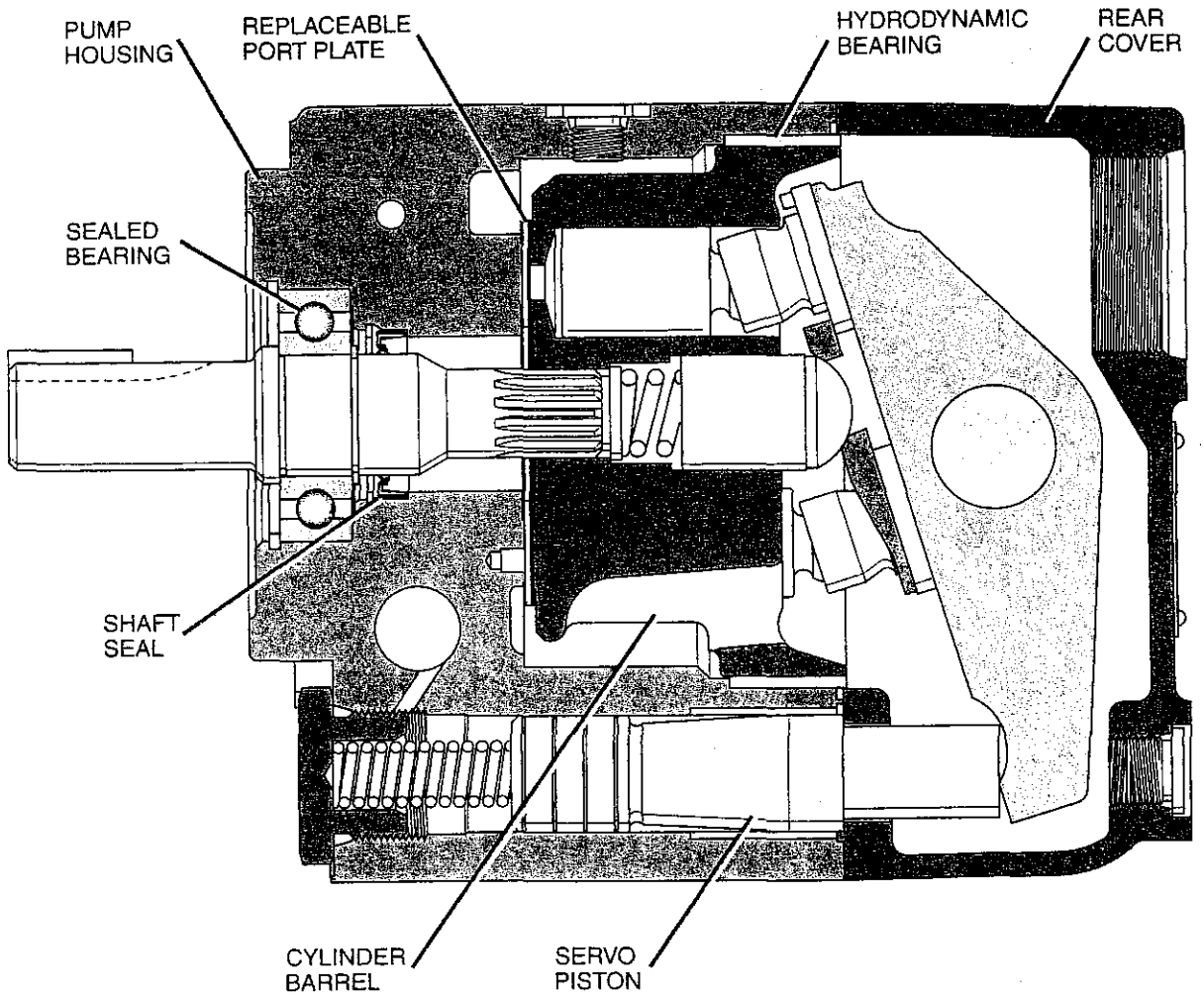


Quick Reference Data Chart

Pump Model	Displacement CM³/REV (IN³/REV)	Pump Delivery @ 300 PSI (21 bar) in GPM (LPM)		*Approx. Noise Levels dB(A) @ Full Flow 1800 RPM (1200 RPM)				Horsepower At 1800 RPM, and At Maximum Pressure & Displacement	Operating Speed RPM (Maximum)	Pressure PSI (bar) Continuous (Maximum)
		1200 RPM	1800 RPM	500 PSI (34 bar)	1000 PSI (69 bar)	2000 PSI (138 bar)	3000 PSI (207 bar)			
PAVC33	33 (2.0)	10.4 (39.4)	15.6 (59.0)	75 (69)	76 (72)	78 (75)	79 (77)	28.5	3000	3000 (207)
PAVC38	38 (2.3)	11.9 (45.0)	17.9 (67.8)	75 (69)	76 (72)	78 (75)	79 (77)	33.0	3000	3000 (207)
PAVC65	65 (4.0)	20.8 (78.7)	31.2 (118.1)	77 (75)	78 (76)	80 (78)	81 (79)	56.5	3000	3000 (207)
PAVC100	100 (6.1)	31.6 (119.6)	47.5 (179.8)	83 (77)	82 (78)	82 (79)	85 (80)	95.5	2600	3000 (207)

* Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.

Introduction



Features

- High Strength Cast-Iron Housing
- Built-In Supercharger
- High Speed Capability - 3000 RPM (2600 RPM PAVC100)
- Sealed Shaft Bearing
- Two Piece Design For Ease of Service
- Cartridge Type Controls - Field Changeable
- Replaceable Bronze Clad Port Plate
- Airbleed Standard for Quick Priming
- Hydrodynamic Cylinder Barrel Bearing
- Thru-Shaft (PAVC100 Only)
- Full Pressure Rating On Water Glycol Fluids
- Pump Case and Shaft Seal - See Inlet Pressure Only
- Filter And/Or Cool Drain Line (100 PSI Max.)

Controls

- Pressure Compensation
- Load Sensing
- Horsepower (Torque) Limiting
- Horsepower and Load Sensing
- Remote Pressure Compensation
- Adjustable Maximum Volume Stop
- Electrohydraulic Pressure
- Electrohydraulic Flow & Pressure (Servo Control)
- Low Pressure Standby

General Description

All control is achieved by the proper positioning of the swash plate. This is achieved by a servo piston acting on one end of the swash plate working against the combined effect of the off-setting forces of the pistons and centering spring on the other end. The control spool acts as a metering valve which varies the pressure behind the servo piston.

As shown in Figure 1, the amount of flow produced by the Parker Piston Pump is dependent upon the length of stroke of the pumping pistons. This length of stroke, in turn, is determined by the position of the swash plate. Maximum flow is achieved at an angle of 17°.

The rotating piston barrel, driven by the prime mover, moves the pistons in a circular path and the piston slippers are supported hydrostatically against the face of the swash plate. When the swash plate is in a vertical position, perpendicular to the centerline of the piston barrel, there is no piston stroke and consequently no fluid displacement. When the swash plate is positioned at an angle, the pistons are forced in and out of the barrel and fluid displacement takes place. The greater the angle of the swash plate, the greater the piston stroke.

The centerline of the pumping piston assembly is offset from the centerline of the swash plate. Therefore, as shown on the accompanying Figure 1A, the pistons' effective summation force tends to destroke the swash plate to a vertical (neutral) position. This destroking force is balanced as the swash plate is angled by the force of the servo piston.

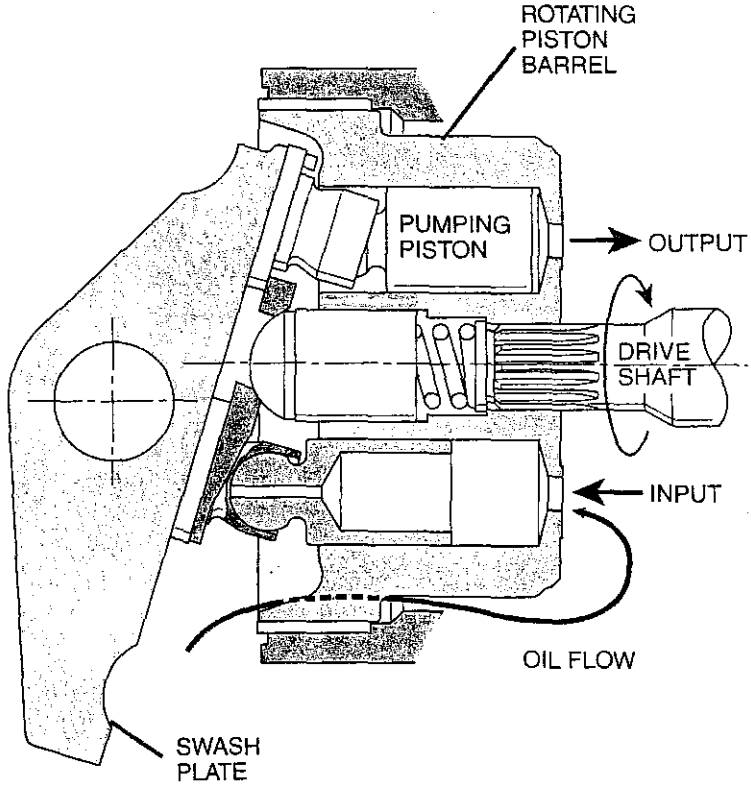


FIGURE 1. Pumping Action

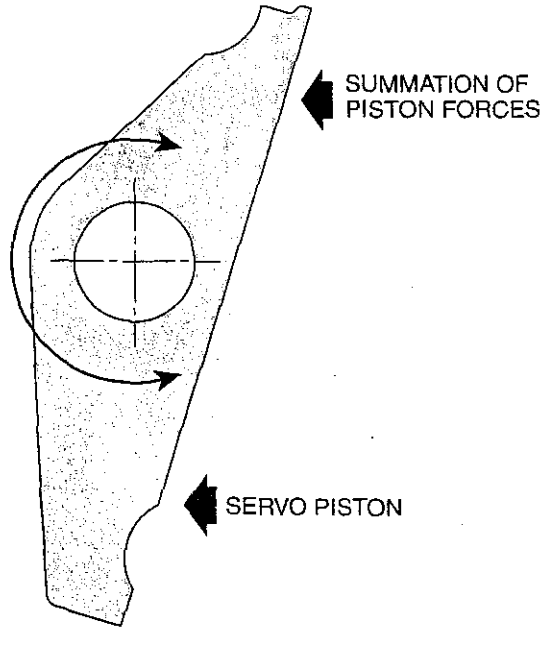


FIGURE 1A.

Pressure Compensated Control

Swash plate angle controls the output flow of the pump. Swash plate angle is controlled by the force generated against the swash plate by the pumping pistons and by the force of the servo piston. The force of the servo piston is greater than the force of the pumping pistons when both are at the same pressure.

By means of internal porting, pressure is connected from the output port to the servo piston via orifice (E), and to the control spool via passage (D). Also pressure is applied to the control spool chamber thru orifice (F). As long as the pressures at both ends of the control spool remain equal, the spool will remain offset upward, due to the added force of the spring.

When pressure reaches the setting of the compensator control, the dart leaves its seat causing the pressure in the spool chamber to be reduced. The spool now moves downward causing pressure in the servo piston cavity to vent via port "A". The reduced pressure at the servo piston allows the servo piston to move to the right. This movement reduces the angle of the swash plate and thereby reduces the pumps output flow.

As pump pressure on the control spool drops below pressure and spring force in the spool chamber, the control spool moves upward to maintain an equilibrium on both sides of the spool. If pump pressure falls below compensator control setting, the control spool moves up, bringing the pump to maximum displacement.

ΔP Adjustment of PAVC Pumps

PROCEDURE:

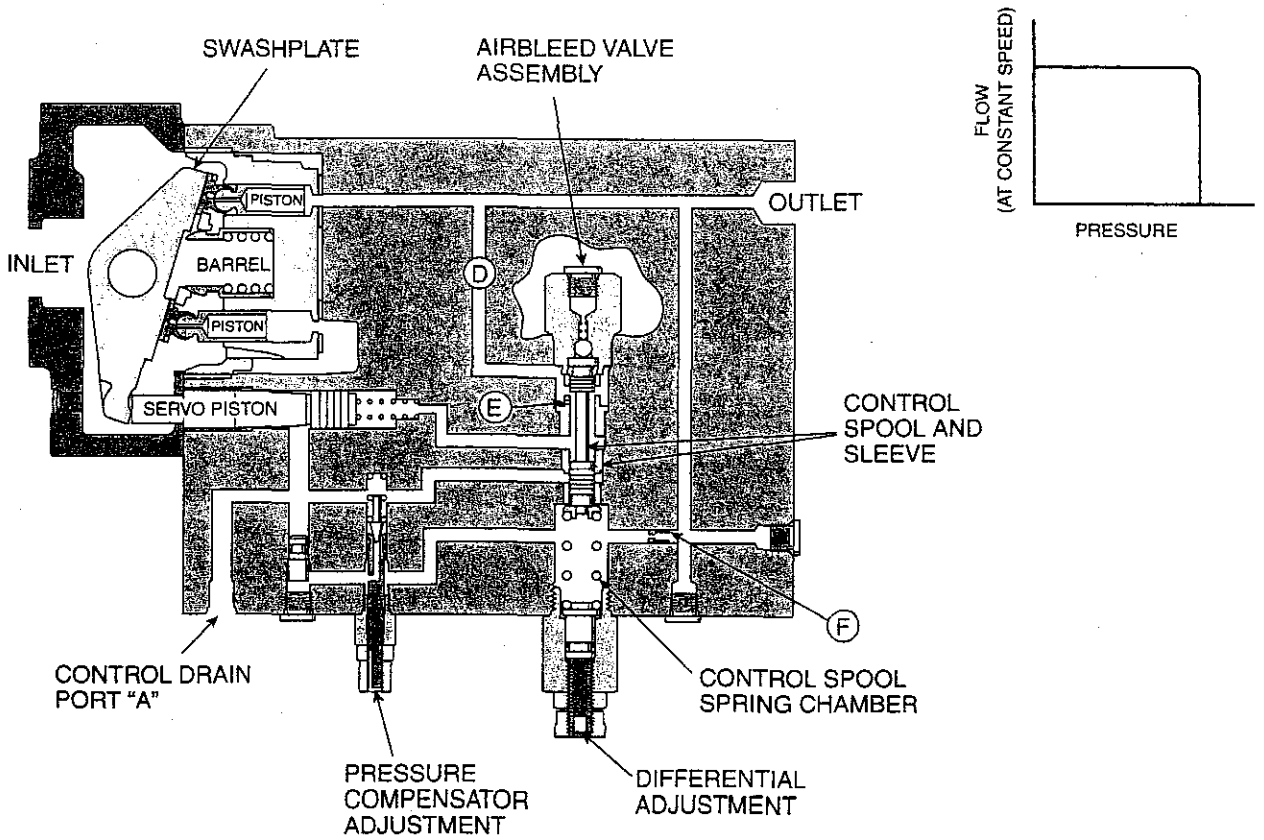
a. Standard Pressure Compensated Pump

Pumps are shipped from factory with a differential pressure of approximately 150 PSI (10 bar) on PAVC 33/38/65, PAVC 100 is 300 PSI (21 bar) at 50% of maximum swash angle. Differential pressure will not normally change through the life of the pump. If this control has been tampered with, a close **approximation** of the correct setting can be made as follows:

Dead head the pump (no flow) with a 0-3000 PSI (0-207 bar) gauge in the **OUTLET** (not the low signal "B" port), back the pressure compensator adjustment out (full counterclockwise).

The gauge should read between 325-375 PSI (22-26 bar) PAVC 33, 38 & 65, 500-575 PSI (34-40 bar) PAVC 100. If the gauge reads different than this, turn the differential adjustment knob (Differential Option 4) or add/remove shims (Omit Option) until correct PSI figure is reached.

CONTROL OPTION - 'OMIT'



Remote Pressure Control

Control Type (M)

Remote control of the PAVC output pressure can be achieved by controlling the pressure in the low signal "B" port when the pump is set up for Control Type (M). A manual, hydraulically piloted, electrical or electro-proportionally controlled pressure control device is installed in the line from the low signal "B" port to tank. The pump will then maintain pressure approximately equal to the pressure in the "B" port plus the pump differential setting.

Low Pressure Standby

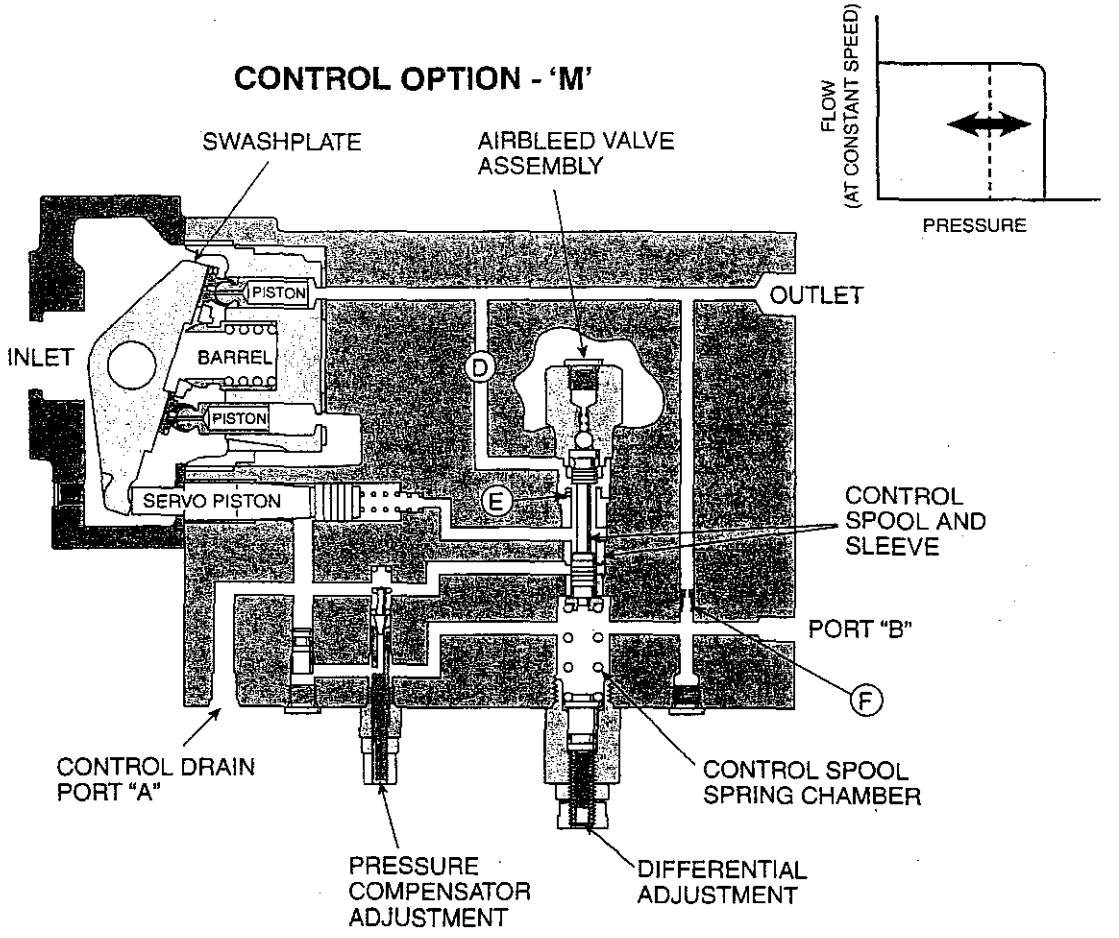
This option can be used as an alternative to the load sensing option (A) to achieve low pressure standby. Minimum standby pressure is somewhat higher than that achieved using option (A). In the compensating mode there is approximately .3 GPM (1.14 LPM) flow from the low signal "B" port in addition to .9 GPM (3.4 LPM) flow from the control drain port "A".

Multiple Pressure Standby

If the pressure level in the low signal "B" port is limited by a relief valve, as the desired pump outlet pressure is reached, the relief valve in the "B" port will allow the pump to standby at a preset pressure. Adding to this concept, multiple, remotely piloted relief valves plumbed in parallel in the "B" port line can yield multiple, sequential pressure settings.

Electrohydraulic Pressure & Flow Control

A proportional pressure control valve can be used in place of relief valves to give variable pressure control proportional to an electrical input signal to the valve. By combining this arrangement with a swash plate position sensing device, amplifier, and logic circuit, servo control of pressure and/or flow is achieved. **NOTE:** In most systems, a load equivalent to the minimum operating pressure of the pump cannot be guaranteed. Because of this, a sequence valve is required in the discharge line to maintain servo flow control. Please refer to ordering information section for servo components.



Pressure & Flow Control (Load Sensing)

Control Type (A)

Flow control is achieved by placing an orifice (fixed or adjustable) in the pump outlet port. The pressure drop (ΔP) across this flow control is the governing signal that controls the pump's output, as explained below.

Whenever the pressure drop at the flow control increases (indicating an increase in output flow), the pump attempts to compensate by decreasing the output flow. It does this by sensing the lower pressure on the downstream side of the flow control via line (C), which is balanced against the pump pressure via passage (D), on the control spool. The control spool is forced down against the control spool spring by differential pressure. This vents the servo piston cavity, destroking the pump to a point where the set pressure drop across the orifice is maintained and the flow is obtained.

The converse of this is also true whenever the pressure drop decreases (indicating a decrease in output flow). In this case, the control spool is forced up. This increases pump displacement in an attempt to maintain the predetermined pressure drop or constant flow.

It should be noted that the pump is still pressure compensated and destrokes at the selected pressure setting. The pressure compensator control will override the flow control whenever the pressure compensator control setting is reached.

Low Pressure Standby

This arrangement can also be used to provide low pressure standby by venting the "B" port through a simple on/off valve suitable for flows of 1-2 GPM (3.8-7.6 LPM). When flow or pressure is required, this valve is closed allowing system pressure to build behind the control spool and bringing the pump on-stroke.

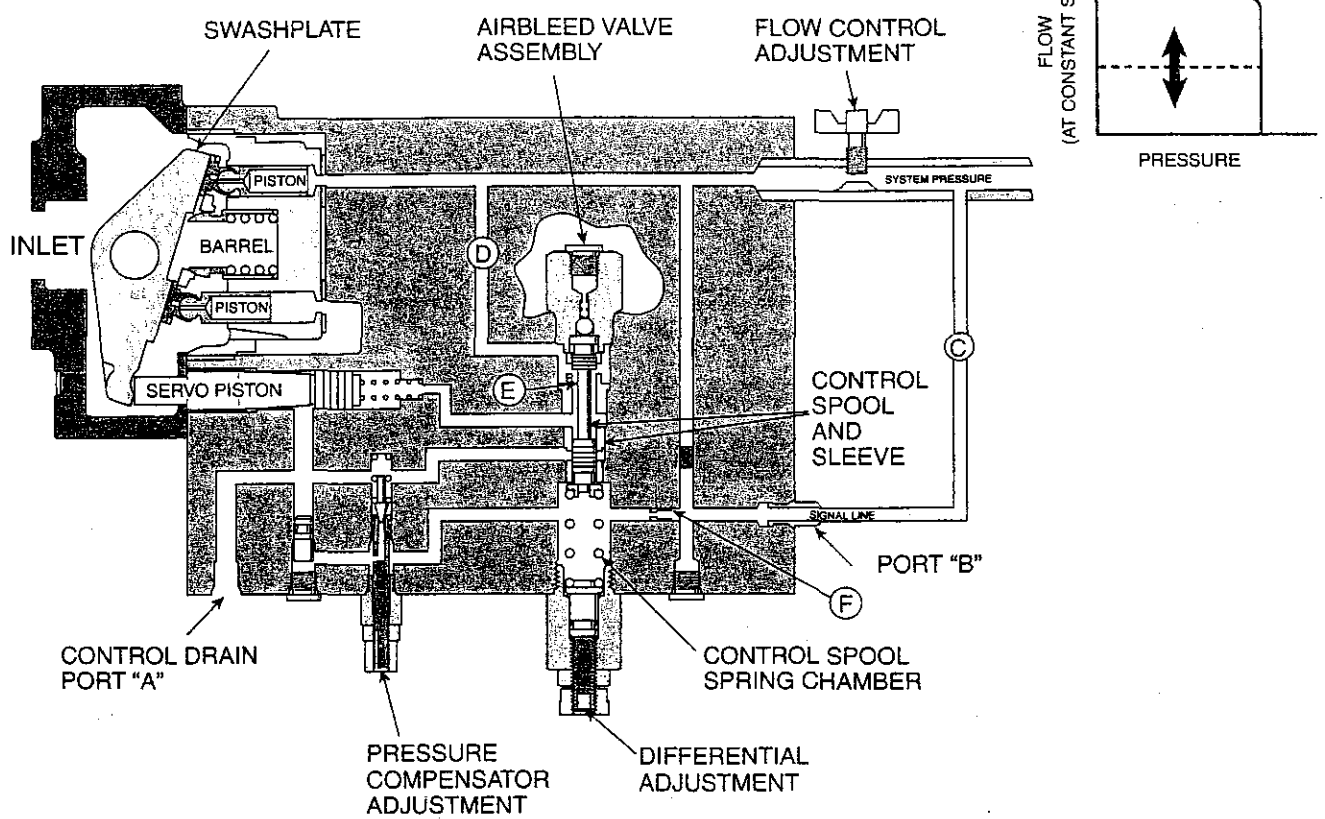
Load Sensing

If, instead of measuring the pressure drop across the orifice in the pump outlet port, it is measured downstream of a directional control valve, a constant pressure drop will be maintained across the valve spool. This results in a constant flow for any given opening of the directional control valve regardless of the work load downstream or the operating speed of the pump.

The pump "senses" the amount of pressure necessary to move the load and adjusts output flow to match the valve opening selected and pressure to overcome the load plus the preset ΔP across the valve spool.

The benefits of this arrangement are that excellent, repeatable flow characteristics are achieved, and considerable energy savings are realized while metering, compared to using a straight pressure compensated system.

CONTROL OPTION - 'A'

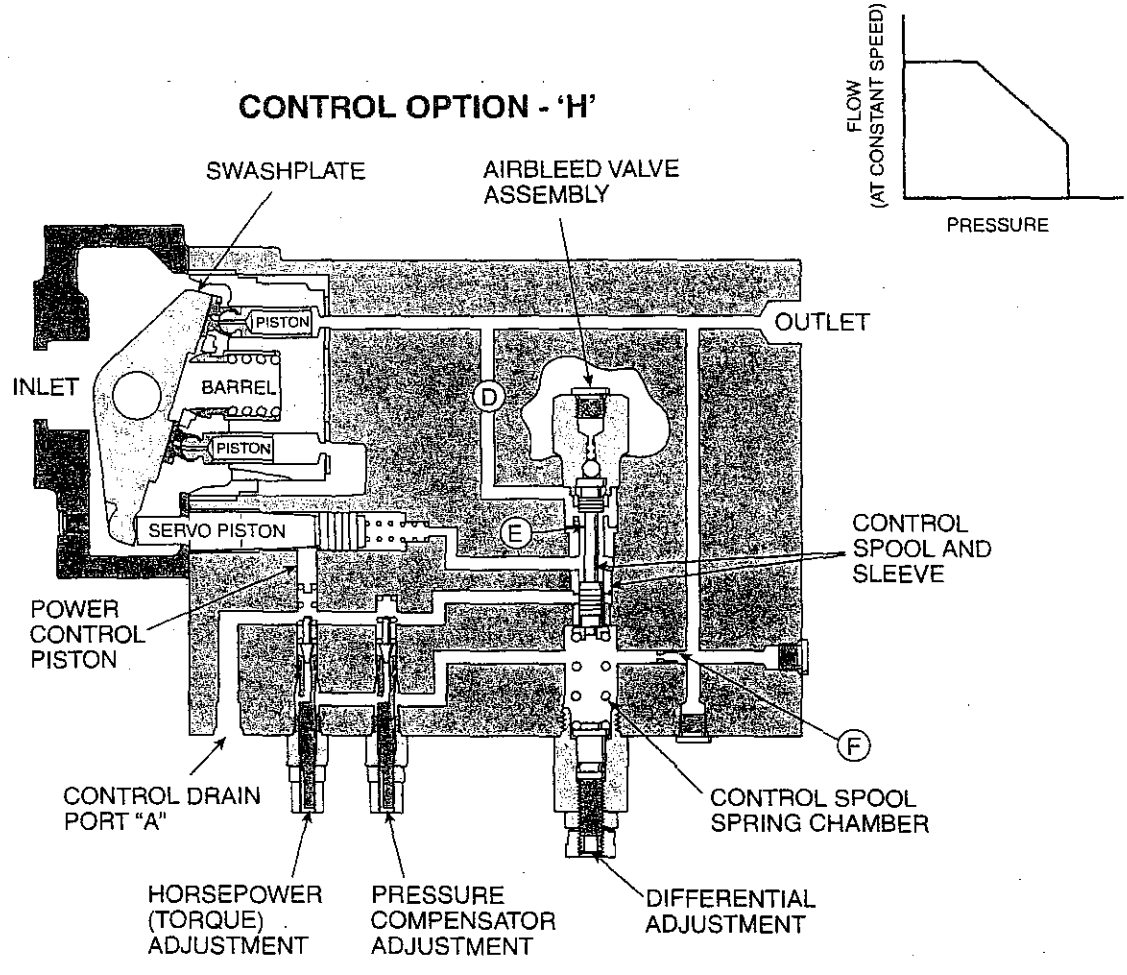


Pressure & Horsepower Control

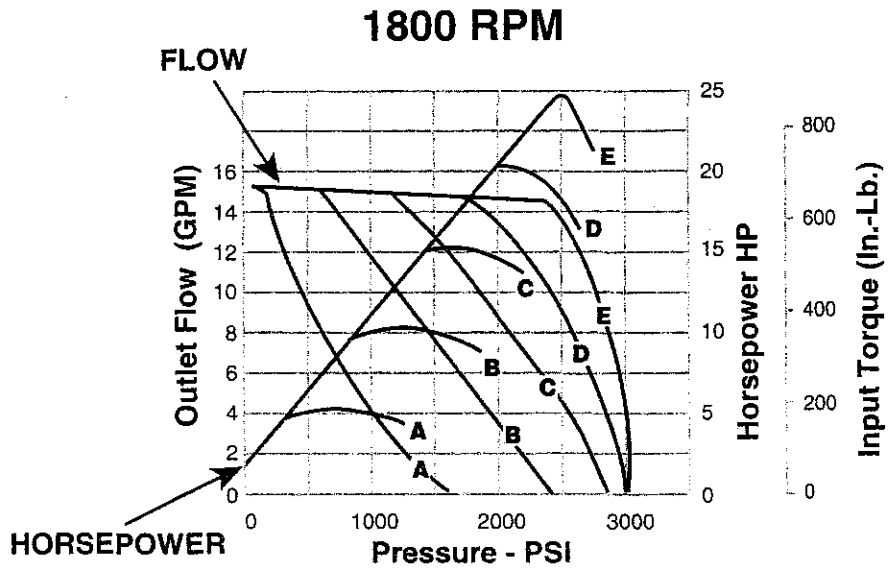
Control Type (H)

The horsepower control is sensitive to the position of the servo piston. When the servo piston is to the right, the swash plate causes low flow and the power control piston develops maximum spring pressure on its companion poppet (mechanical feedback). When the servo piston is left and the flow is high, the power control piston reduces spring pressure on the poppet. This allows it to open under less pressure in the control spool chamber, thereby venting some of the pressure in the control spool chamber. As with the operation of the pressure compensator control, this allows the control spool to move downward, venting the servo piston cavity and causing the servo piston to move to the right. This reduces output flow and thereby power.

As indicated in the pictorial drawing, pressure in the control spool chamber is affected by both the pressure compensator control and the power control. The resultant pressure in this chamber is a function of the set points of these two controls. Both set points are adjustable.



How to read horsepower control curve data

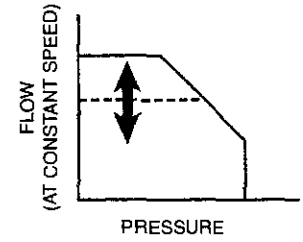


1. Horsepower "**A**" curve corresponds to flow "**A**" curve. This represents a particular setting of the torque control.
2. With this setting the maximum horsepower required will be as shown at the apex (maximum point) of the horsepower curve.
3. The flow at this setting will follow the flow vs. pressure curve shown.
4. Example – 1800 RPM, curve labeled "**C**":
   A. Flow will follow curve "**C**" and pump will deadhead at 2750 PSI.
   B. Full flow will not be realized above 1200 PSI.
   C. Flow at 1500 PSI will be approximately 12.7 GPM.
   D. Maximum horsepower (15 HP) occurs at approximately 1700 PSI.
5. Torque values are shown to correspond to horsepowers at speed shown.

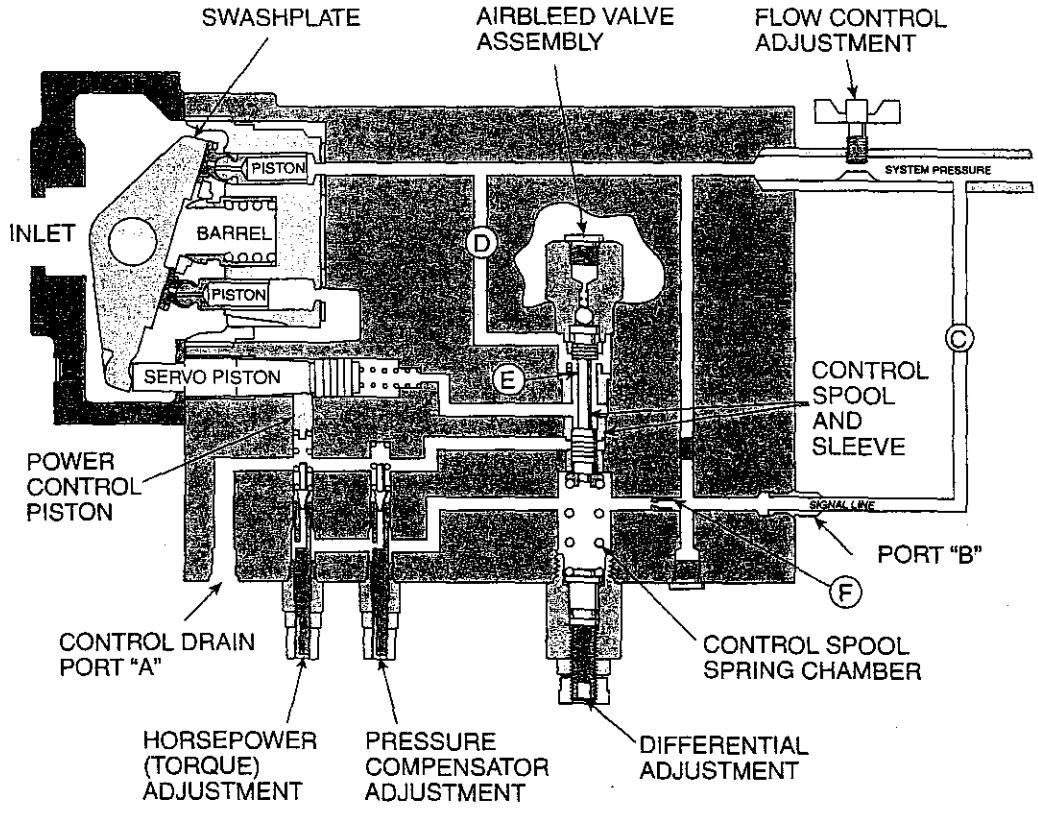
Pressure, Horsepower & Flow Control

Control Type (C)

In addition to the three control configurations just discussed, it is possible to combine all three control devices in one pump. In this mode, the position of the control spool is a function of the actions of the pressure compensator adjustment, horsepower adjustment, and flow control.



CONTROL OPTION - 'C'



Performance Information

Series PAVC 33/38 Pressure Compensated, Variable Volume, Piston Pumps

Features

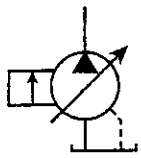
- High Strength Cast-Iron Housing
- Built-In Supercharger
- High Speed Capability – 3000 RPM
- Two Piece Design for Ease of Service
- Cartridge Type Controls – Field Changeable
- Replaceable Bronze Clad Port Plate
- Airbleed Standard for Quick Priming
- Hydrodynamic Cylinder Barrel Bearing
- Full Pressure Rating on Water Glycol Fluids
- Filtered and/or Cooled Drain Line Capable (100 PSI Max.)

Controls

- Pressure Compensation
- Remote Pressure Compensation
- Load Sensing
- Horsepower Limiting
- Horsepower and Load Sensing
- Adjustable Maximum Volume Stop
- Electrohydraulic Pressure
- Electrohydraulic Flow and Pressure (Servo Control)
- Low Pressure Standby

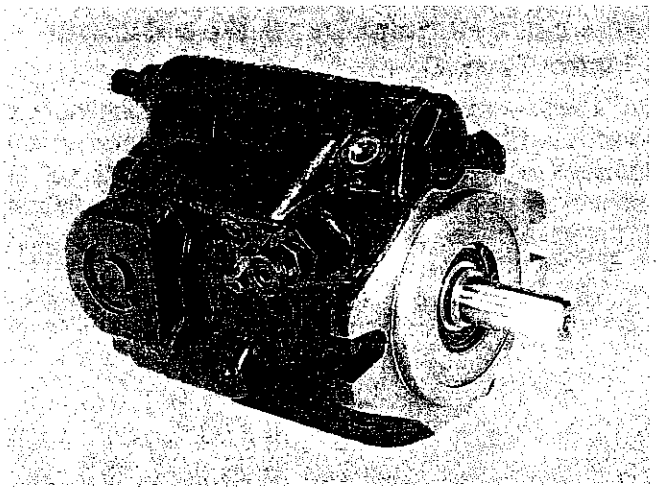
Schematic Symbol

(Basic Pump)



Weight and Package Size

Model	Weight In Pounds	Length From Mounting Face In Inches (CM)	Height in Inches (CM)	Width In Inches (CM)
PAVC 33/38	40	7.25 (18.4)	6.30 (16.0)	6.62 (16.8)



Specifications

Pressure Ratings:

Outlet Port: 3000 PSI (207 bar) Continuous (P1)
3600 PSI (248 bar) Peak (P3)

Inlet Port: 25 PSI (1.7 bar) Maximum
5 In-Hg Minimum @ 1800 RPM
(See Inlet Chart for other speeds)

Control Drain: 100 PSI (7 bar) Maximum

Speed Ratings: 600 to 3000 RPM

Operating Temperature Range: – 40°F to 160°F
(– 40°C to 71°C)

Housing Material: Cast-Iron

Filtration: Maintain SAE Class 4, ISO 16/13, ISO 18/15 Maximum Recommended

Mounting: SAE B 2-Bolt Flange Mount or Diagonally on SAE B 4-Bolt Flange Mount.

Installation Data: See page 41 of this catalog for specific recommendations pertaining to system cleanliness, fluids, start-up, inlet conditions, shaft alignment, drain line restrictions and other important factors relative to the proper installation and use of these pumps.

Quick Reference Data Chart

Pump Model	Displacement CM^3/REV (IN^3/REV)	Pump Delivery @ 300 PSI (21 bar) in GPM (LPM)		*Approximate Noise Levels dB(A) @ Full Flow 1800 RPM (1200 RPM)				Horsepower At 1800 RPM and At Maximum Pressure & Displacement
		1200 RPM	1800 RPM	500 PSI (34 bar)	1000 PSI (69 bar)	2000 PSI (138 bar)	3000 PSI (207 bar)	
PAVC33	33 (2.0)	10.4 (39.4)	15.6 (59.0)	75 (69)	76 (72)	78 (75)	79 (77)	28.5
PAVC38	38 (2.3)	11.9 (45.0)	17.9 (67.8)	75 (69)	76 (72)	78 (75)	79 (77)	33.0

* Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.

Ordering Information

Multiple Pumps	Pump	Displacement	Bearing Option	Shaft	Outlet	Inlet	Rotation	Differential Control Option	Volume Stop	Control Options	Seals	Paint	Design Series
	PAVC												

Pump: Axial Piston Variable Controllable

Code	Multiple Pumps
Omit	Single Pump
—	Factory Mounted to Rear of Another Pump

Code	CM³/REV (In³/Rev.)
33	33 (2.0)
38	38 (2.3)

Code	Bearing Option
Omit	Single Piece Shaft
9*	Dual Bearing

* For applications where side loading may be experienced. Max. side load = 230#.

Typical Applications:
Belt/chain drive
Universal joint drive
Massive couplings
Foot mount installations

Code	Shaft Option
Omit	Keyed (SAE B)
B	Spline (SAE B)
S	Keyed (Short)

Code	Outlet Port	
	Type	Location
Omit	Straight Thd.	Top

Code	Port		
	Inlet	Location	Type
Omit	Str. Thd.	Rear	SAE/Inch
2	Flange	Side	SAE/Inch
8	Flange	Side	ISO 6149/Metric

Code	Rotation
R	Right (CW)
L	Left (CCW)

Viewed from shaft end.

Code	Differential Options
Omit	Non-Adjustable Differential
4	Adjustable Differential

Code	Volume Stop Options
Omit	Volume Stop Plugged
2	Maximum Volume Stop
5	Max. Vol. Stop With O-Ring

Code	Control Options
Omit	Standard Pressure Compensated Setting Pressure 400-3000 PSI (28-207 bar)
A	Pressure & Flow (Load Sensing)
*C	Pressure, Flow & HP Limiting
*H	Pressure Compensated & HP Limiting
†M	Remote Pressure - (Master)
†ME	Remote Pressure - (Slave)
S	Servo Press. & Volume - (Master) (Requires PPC, Amplifier & Seq. Valve)
†SE	Servo Press. & Volume - (Slave) (Requires PPC, Amplifier & Seq. Valve)
†AM	Remote Press. & Flow Comp.
*†CM	Remote Press. Flow & Power Comp.
*†HM	Remote Press. & Power Comp.

Code	Seals
Omit	Buna-N (Standard)

Code	Painting
Omit	No Paint
P	Paint

Ordering Notes

Unless otherwise specified, pump is shipped at maximum GPM (1800 RPM) and set to 1000 PSI (69 bar). When factory settings are required, the items shown in Chart #1 must be included with order.

Chart #1 Item	
RPM	
PSI	
HP	
GPM	

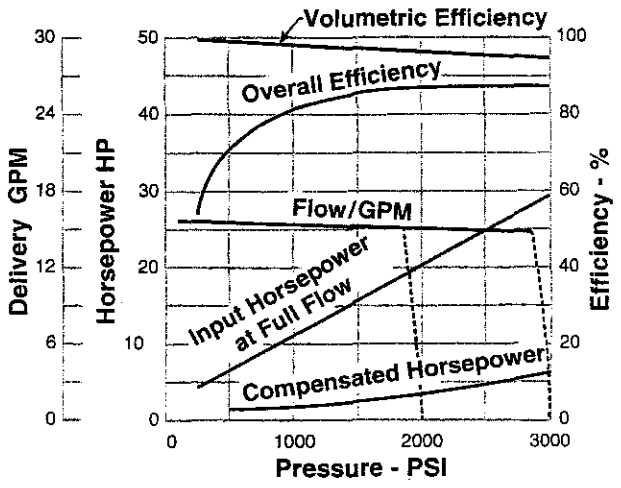
* Horsepower controlled pumps (H, C, HM or CM) must have maximum input horsepower limit specification at a particular drive speed (RPM) included with order.

† Pumps with M, ME, S or SE controls will be set to compensate at 3000 PSI (207 bar) unless Chart #1 otherwise specifies.

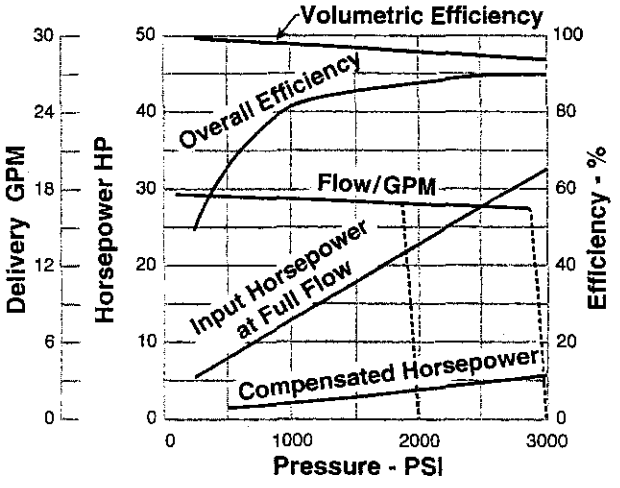
Performance Data - PAVC 33/38

Fluid: Standard Hydraulic Oil 100 SSU @ 120°F (49°C)

PAVC33 @ 1800 RPM



PAVC38 @ 1800 RPM



NOTE: The efficiencies and data in the graph are good only for pumps running at 1800 RPM and stroked to maximum. To calculate approximate horsepower for the other conditions, use the following formula:

$$HP = \left[\frac{Q \times (PSI)}{1714}\right] + (CHp)$$

Actual GPM is directly proportional to drive speed and maximum volume setting. Flow loss, however, is a function of pressure only.

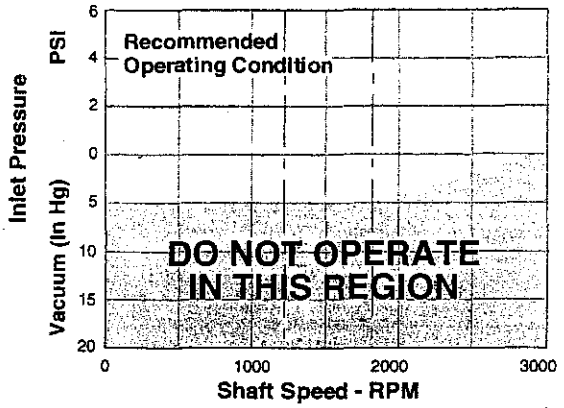
WHERE:

Q = Actual Output Flow in GPM

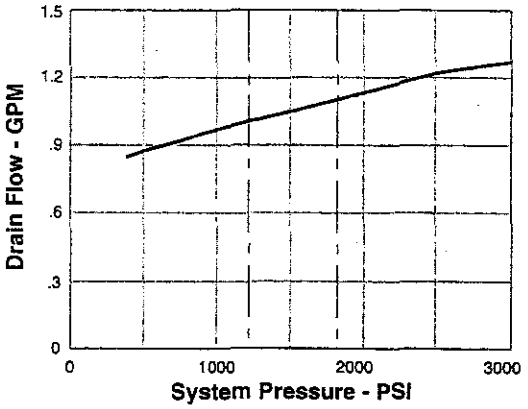
PSI = Pressure At Pump Outlet

CHp = Input Horsepower @ Full Compensation @ 1800 RPM (from graph read at operating pressure)

Inlet Characteristics

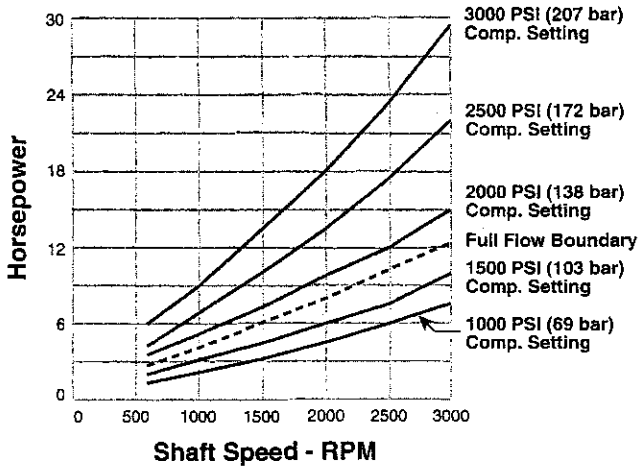


Compensated Control Drain Flow @ 1800 RPM



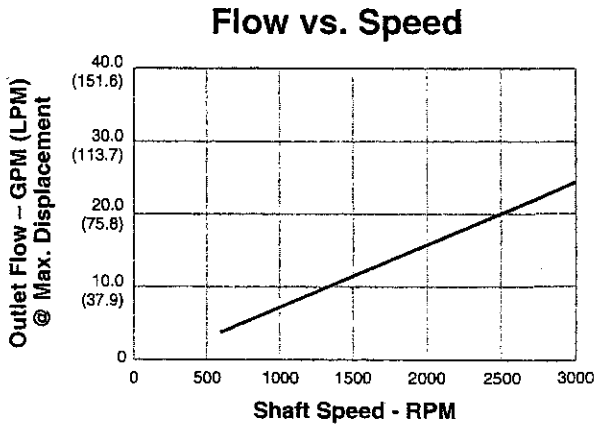
Performance Data - PAVC33

Minimum Horsepower Settings Attainable With Control Options C, H, CM & HM



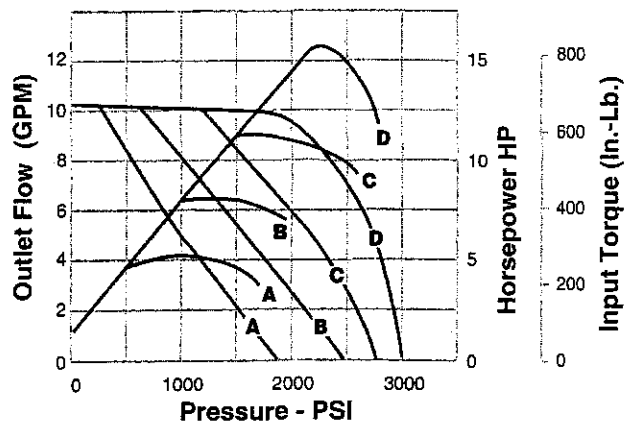
NOTE: Minimum attainable HP setting means that input horsepower will not exceed the indicated setting at the indicated RPM and that the pump will achieve full compensator pressure selected. If setting horsepower limiter below full flow boundary, full flow may not be obtained at low operating pressure.

Flow vs. Speed

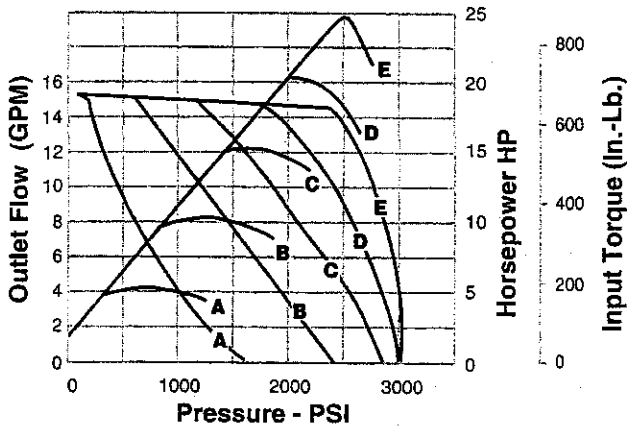


Determine maximum horsepower limitation at desired RPM. All points above desired compensator setting curve can be achieved.

PAVC33 @ 1200 RPM



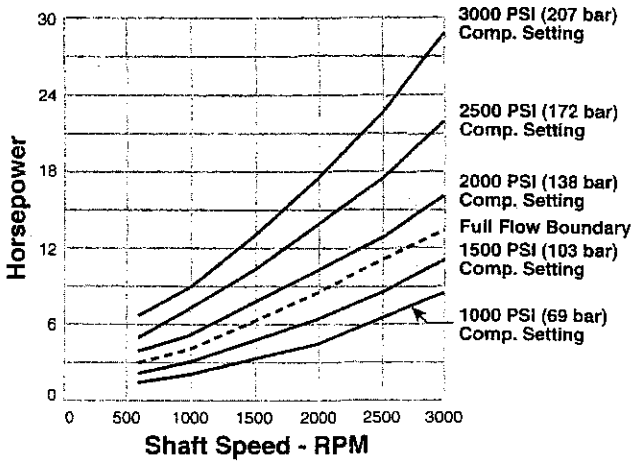
PAVC33 @ 1800 RPM

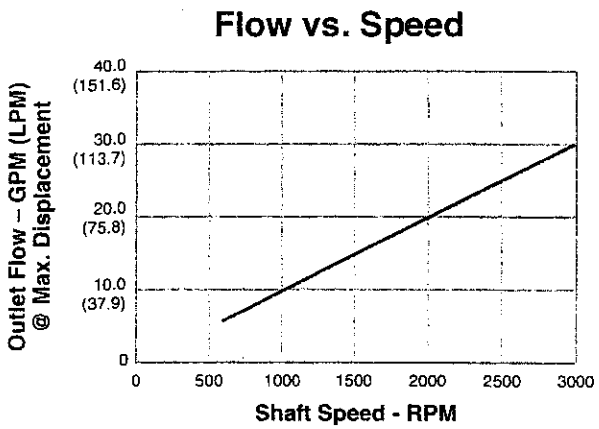


See page 8 for "How to Read Horsepower Control Curves" information.

Performance Data - PAVC38

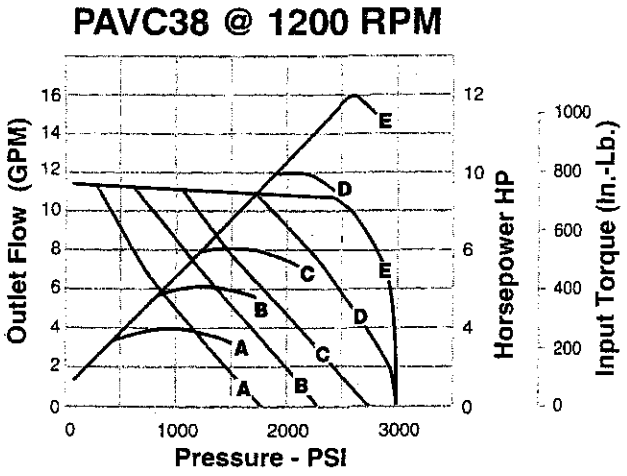
Minimum Horsepower Settings Attainable With Control Options C, H, CM & HM

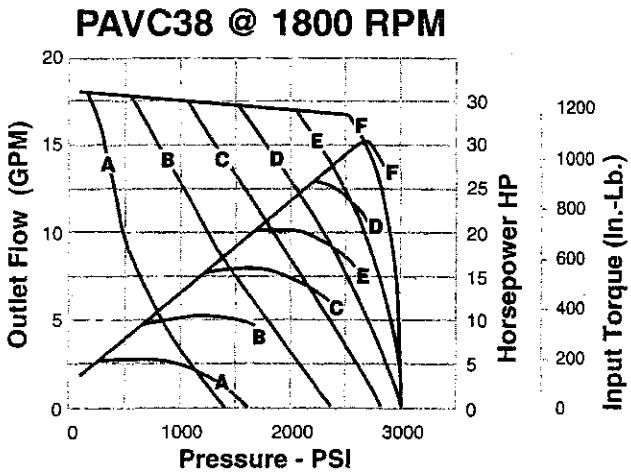




NOTE: Minimum attainable HP setting means that input horsepower will not exceed the indicated setting at the indicated RPM and that the pump will achieve full compensator pressure selected. If setting horsepower limiter below full flow boundary, full flow may not be obtained at low operating pressure.

Determine maximum horsepower limitation at desired RPM. All points above desired compensator setting curve can be achieved.





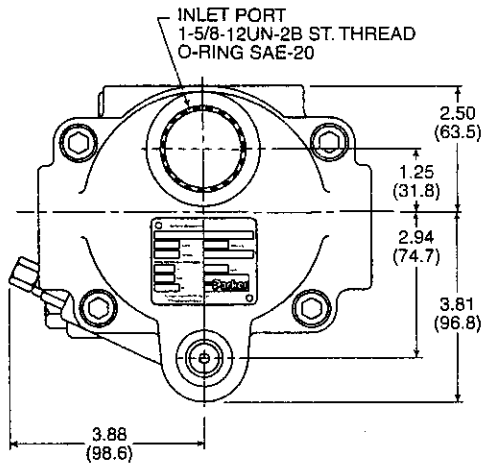
See page 8 for "How to Read Horsepower Control Curves" information.

Dimensions - Rear Port

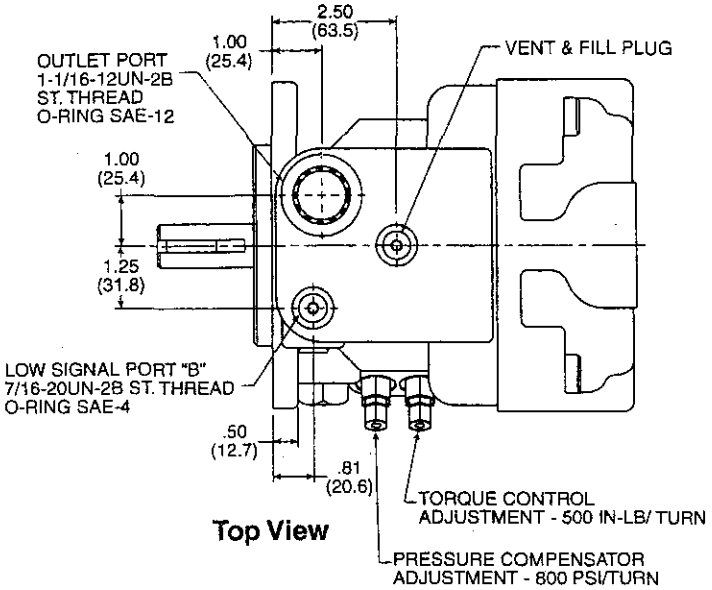
Millimeter equivalents for inch dimensions are shown in (**).

NOTE:

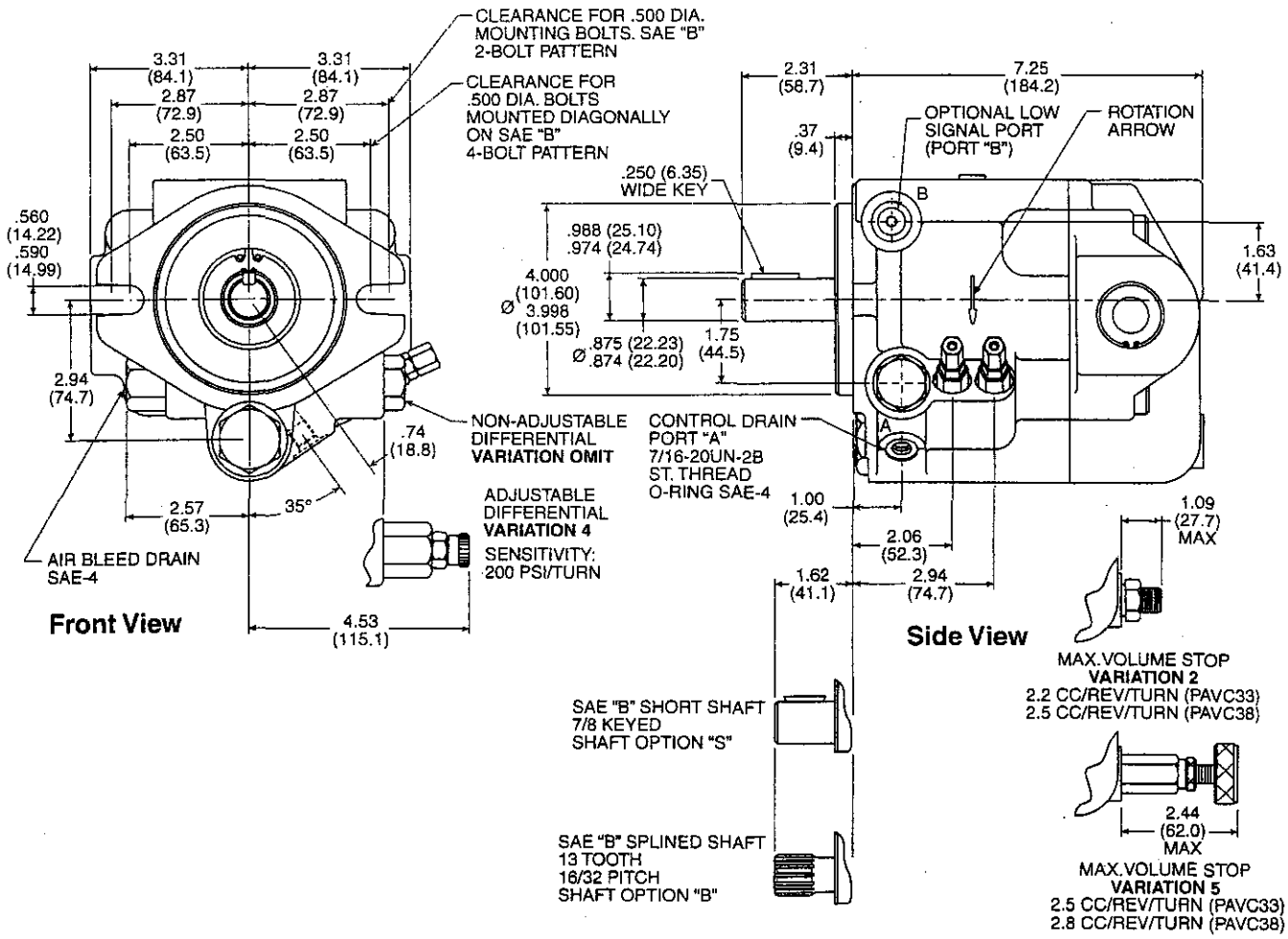
1. Pump shown and dimensioned is a clockwise rotation pump. Outlet port, A and B ports, and controls will be on opposite side for a counterclockwise rotation pump.



Rear View



Top View



Front View

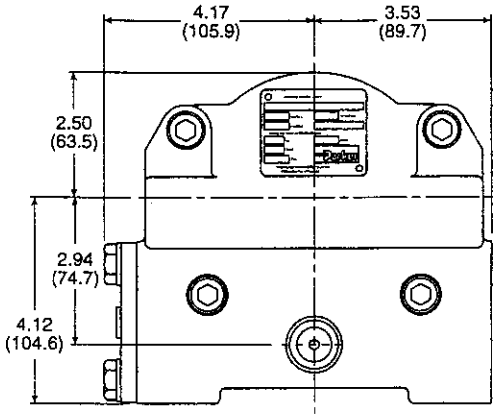
Dimensions — Side Port

Millimeter equivalents for inch dimensions are shown in (**).

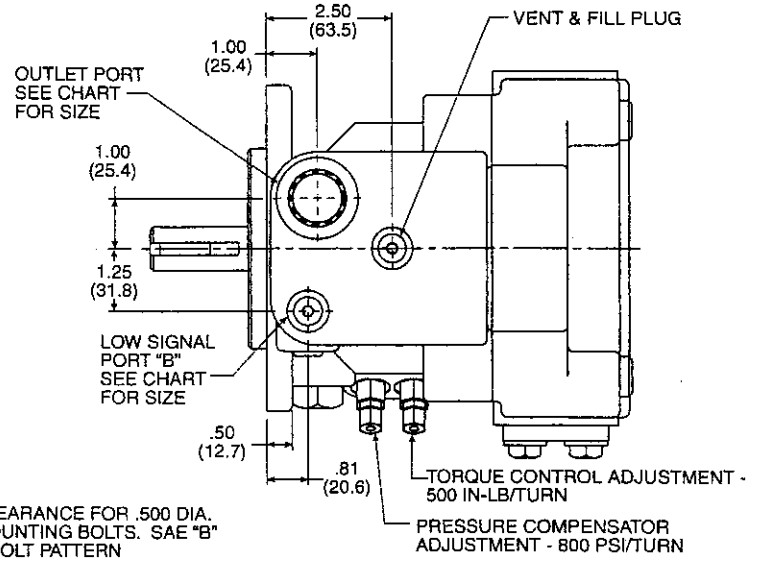
NOTE:

1. Shown and dimensioned is a clockwise pump. Ports A and B, delivery port and pump controls will be on the opposite side for a counterclockwise pump.

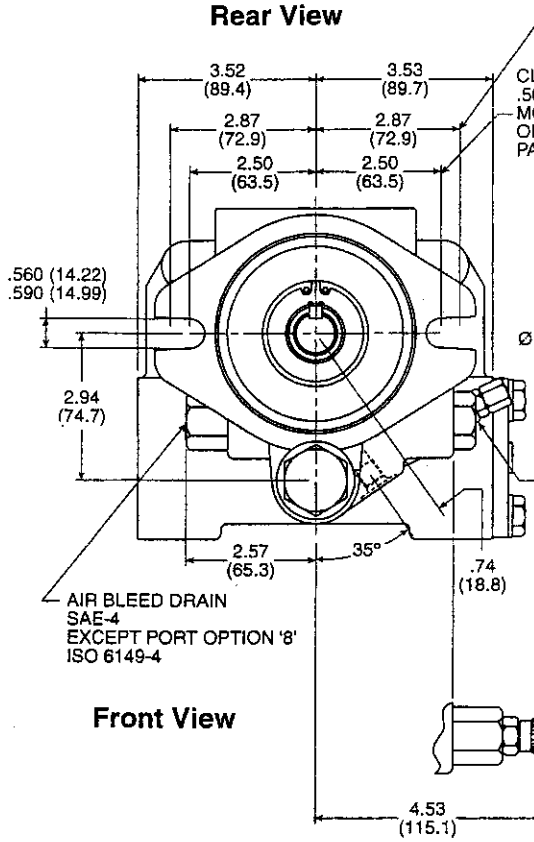
Port Location				
Option	Outlet Port	Inlet Port	Control Drain	Signal Port
2	SAE-12 Straight Thread (1-1/16-12UNC)	1-1/4 SAE 4-Bolt Flange 7/16-14 Threads Standard Pressure Series (Code 61)	SAE-4 Straight Thread (7/16-20UNC)	SAE-4 Straight Thread (7/16-20UNC)
8	ISO 6149-12 Straight Thread (M27 x 2)	1-1/4 SAE 4-Bolt Flange M10 x 1.5 Threads Standard Pressure Series (Code 61)	ISO 6149-4 Straight Thread (M12 x 1.5)	ISO 6149-4 Straight Thread (M12 x 1.5)



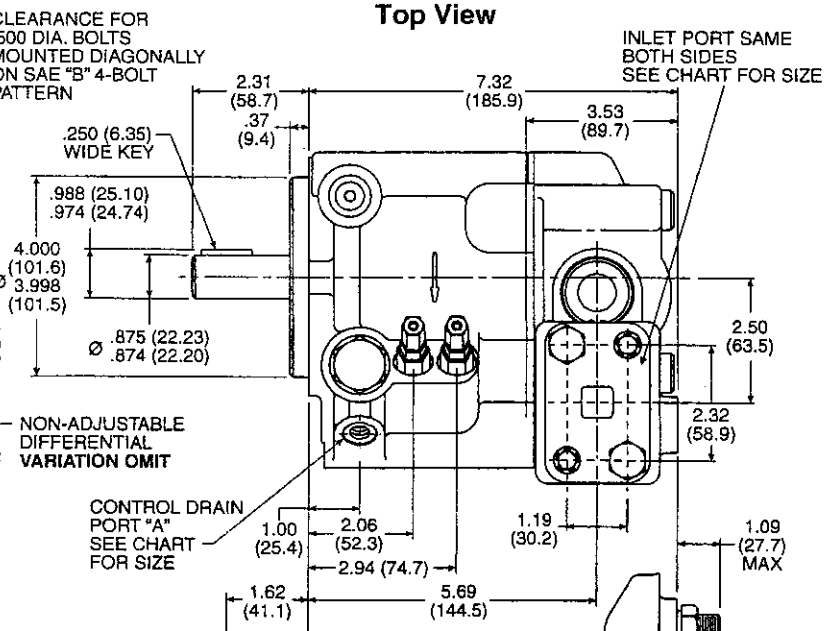
Rear View



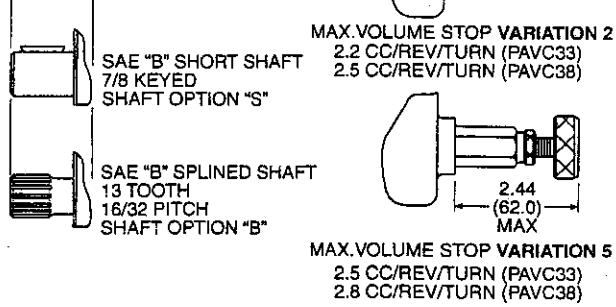
Top View



Front View



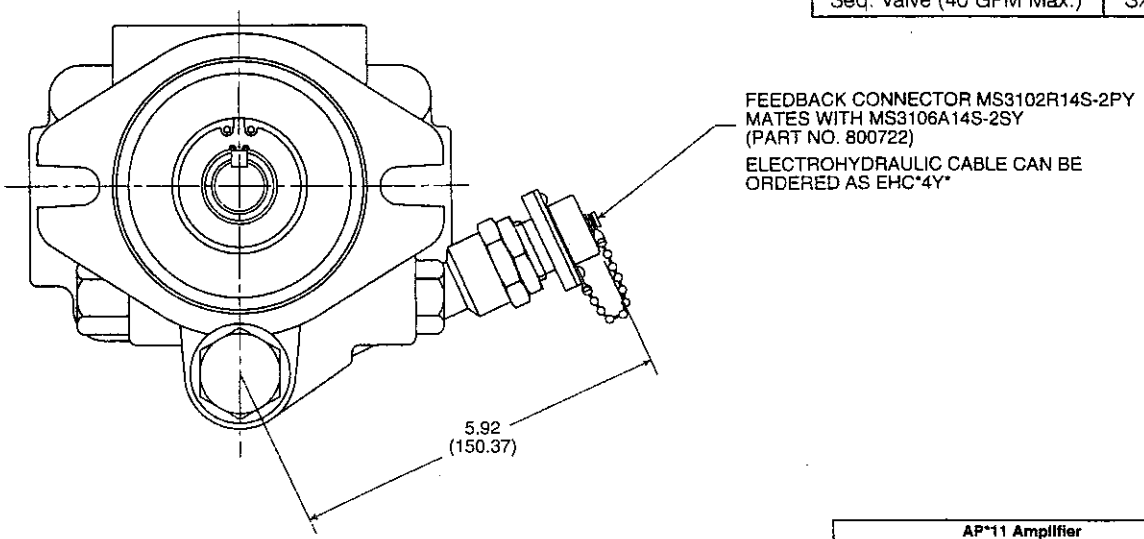
Side View



Dimensions — Electrohydraulic Pump

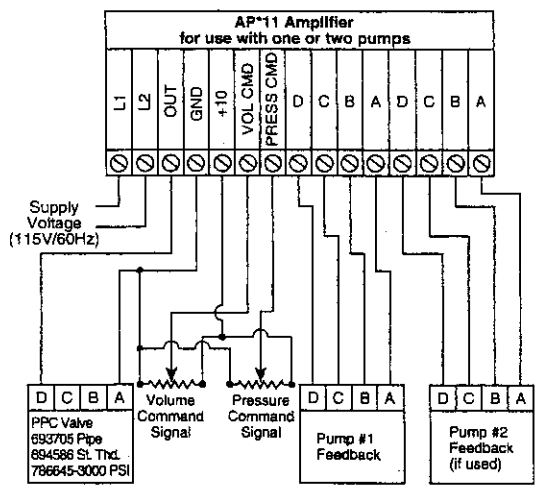
Millimeter equivalents for inch dimensions are shown in (**).

Accessories for S & SE Options	
PPC Valve	694586
Amp Single Pump	AP11
Amp Double Pump	AP211
Seq. Valve (40 GPM Max.)	SX6PM8, SX6VM8



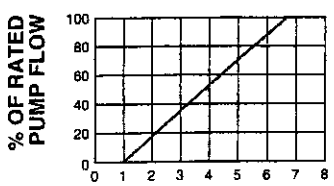
NOTES:

1. Consult factory for information relative to pump option selection and additional components required for desired pump function.
2. For electrohydraulic flow and pressure control of one or two pumps, make electrical connections per Figure IV. When one pump is used, omit connections to pump #2 feedback.
3. For electrohydraulic flow only, eliminate pressure command signal and place jumper between "Press CMD" and "+10V" terminals (compensating pressure will be controlled by maximum setting on pump or remote compensator if used).
4. For electrohydraulic pressure only, eliminate volume command signal and place jumper between "VOL CMD" and "+10V" terminals or use 801179 pressure driver card.
5. Figures I thru III show nominal input vs. output relationships. The actual values will vary with component tolerances. Full volume range will be realized with 0 to 7 volts. Full pressure range will be realized with 0 to 7 volts, or 0-500MA.
6. Pump shown is a clockwise rotation. For a counterclockwise rotation LVDT feedback is on opposite side.
7. For further detail on installation of AP11/AP211, refer to Catalog 2600-400-1/NA.



Typical Hookup for Infinitely Variable Electrohydraulic Pressure & Volume Control.

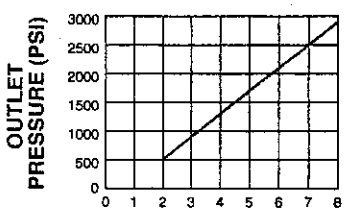
Fig. IV



Volume Command Voltage

Nominal output flow vs. input command voltage when used in conjunction with AP*11 amplifier and 786645 proportional pressure controller.

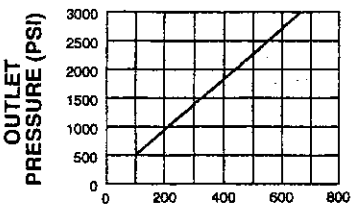
Fig. I



Pressure Command Voltage

Nominal output pressure vs. input command voltage when used in conjunction with AP*11 amplifier and 786645 proportional pressure controller.

Fig. II



Input Current (MA)

Nominal input current vs. pressure when used in conjunction with a current source and 786645 proportional pressure controller.

Fig. III

Performance Information

Series PAVC65 Pressure Compensated, Variable Volume, Piston Pump

Features

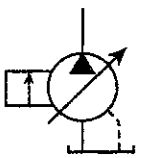
- High Strength Cast-Iron Housing
- Built-In Supercharger
- High Speed Capability - 3000 RPM
- Two Piece Housing for Ease of Service
- Cartridge Type Controls - Field Changeable
- Replaceable Bronze Clad Port Plate
- Airbleed Standard for Quick Priming
- Hydrodynamic Cylinder Barrel Bearing
- Full Pressure Rating on Water Glycol Fluids
- Filtered and/or Cooled Drain Line Capable - (100 PSI Max.)

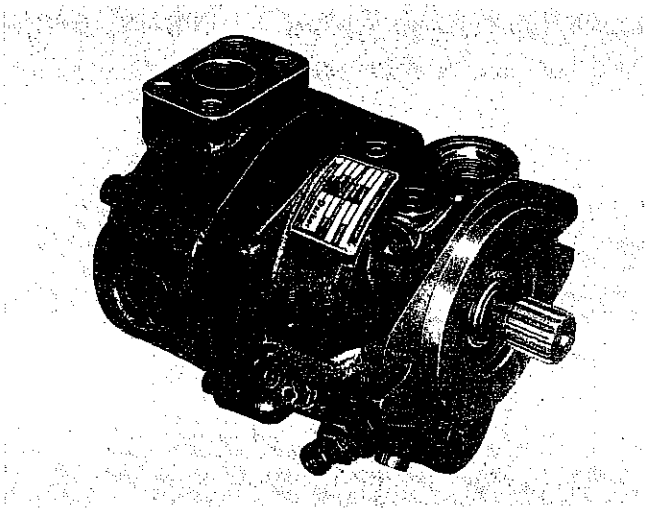
Controls

- Pressure Compensation
- Remote Pressure Compensation
- Load Sensing
- Horsepower Limiting
- Horsepower and Load Sensing
- Adjustable Maximum Volume Stop
- Electrohydraulic Pressure
- Electrohydraulic Flow and Pressure (Servo Control)
- Low Pressure Standby

Schematic Symbol

(Basic Pump)





Specifications

Pressure Ratings:

Outlet Port: 3000 PSI (207 bar) Continuous (P1)
3600 PSI (248 bar) Peak (P3)

Inlet Port: 25 PSI (1.7 bar) Maximum
5 In-Hg Minimum @ 1800 RPM
(See Inlet Chart for other speeds)

Control Drain: 100 PSI (7 bar) Maximum

Speed Ratings: 600 to 3000 RPM

Operating Temperature Range: – 40°F to 160°F
(– 40°C to 71°C)

Housing Material: Cast-Iron

Filtration: Maintain SAE Class 4, ISO 16/13, ISO 18/15 Maximum Recommended

Mounting: SAE C 2-Bolt Flange Mount or Diagonally on SAE C 4-Bolt Flange Mount

Installation Data: See page 41 of this catalog for specific recommendations pertaining to system cleanliness, fluids, start-up, inlet conditions, shaft alignment, drain line restrictions and other important factors relative to the proper installation and use of these pumps.

Weight and Package Size

Model	Weight In Pounds	Length From Mounting Face In Inches (CM)	Height in Inches (CM)	Width In Inches (CM)
PAVC65	62	8.82 (22.4)	7.42 (18.8)	8.00 (20.3)

Quick Reference Data Chart

Pump Model	Displacement CM^3/REV (IN^3/REV)	Pump Delivery @ 300 PSI (21 bar) in GPM (LPM)		*Approximate Noise Levels dB(A) @ Full Flow 1800 RPM (1200 RPM)				Horsepower At 1800 RPM and At Maximum Pressure & Displacement
		1200 RPM	1800 RPM	500 PSI (34 bar)	1000 PSI (69 bar)	2000 PSI (138 bar)	3000 PSI (207 bar)	
PAVC65	65 (4.0)	20.8 (78.7)	31.2 (118.1)	77 (75)	78 (76)	80 (78)	81 (79)	56.5

* Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.

Ordering Information

	PAVC	65											
Multiple Pumps	Pump Axial Piston Variable Controllable	Displace-ment	Bearing Option	Shaft	Outlet	Inlet	Rotation	Differential Control Option	Volume Stop	Control Options	Seals	Paint	Design Series

Code	Multiple Pumps
Omit	Single Pump
—	Factory Mounted to Rear of Another Pump

Code	CM³/REV (In³/Rev.)
65	65 (4.0)

Code	Bearing Option
Omit	Single Piece Shaft
9*	Dual Bearing

* For applications where side loading may be experienced. Max. side load = 425#.

Typical Applications:
Belt/chain drive
Universal joint drive
Massive couplings
Foot mount installations

Code	Shaft Option
Omit	Keyed (SAE C)
B	Spline (SAE C)

Code	Outlet Port	
	Type	Location
Omit	Straight Thd.	Top

Code	Port		
	Inlet	Location	Type
Omit	Str. Thd.	Rear	SAE/Inch
2	Flange	Top	SAE/Inch
8	Flange	Top	ISO 6149/Metric

Code	Rotation
R	Right (CW)
L	Left (CCW)

Viewed from shaft end.

Code	Differential Options
Omit	Non-Adjustable Differential
4	Adjustable Differential

Code	Volume Stop Options
Omit	Volume Stop Plugged
2	Maximum Volume Stop
5	Max. Vol. Stop With O-Ring

Code	Control Options
Omit	Standard Pressure Compensated Setting Pressure 400-3000 PSI (28-207 bar)
A	Pressure & Flow (Load Sensing)
*C	Pressure, Flow & HP Limiting
*H	Pressure Compensated & HP Limiting
†M	Remote Pressure - (Master)
†ME	Remote Pressure - (Slave)
S	Servo Press. & Volume - (Master) (Requires PPC, Amplifier & Seq. Valve)
†SE	Servo Press. & Volume - (Slave) (Requires PPC, Amplifier & Seq. Valve)
†AM	Remote Press. & Flow Comp.
*†CM	Remote Press. Flow & Power Comp.
*†HM	Remote Press. & Power Comp.

* Horsepower controlled pumps (H, C, HM or CM) must have maximum input horsepower limit specification at a particular drive speed (RPM) included with order.

† Pumps with M, ME, S or SE controls will be set to compensate at 3000 PSI (207 bar) unless Chart #1 otherwise specifies.

Code	Painting
Omit	No Paint
P	Paint

Code	Seals
Omit	Buna-N (Standard)

Ordering Notes

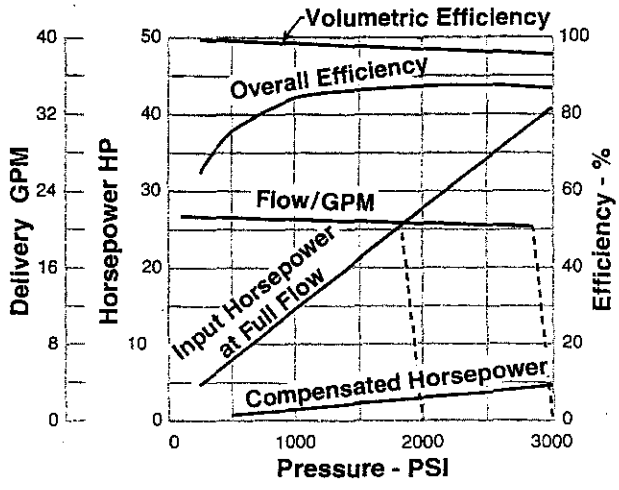
Unless otherwise specified, pump is shipped at maximum GPM (1800 RPM) and set to 1000 PSI (69 bar). When factory settings are required, the items shown in Chart #1 must be included with order.

Chart #1 Item	
RPM	
PSI	
HP	
GPM	

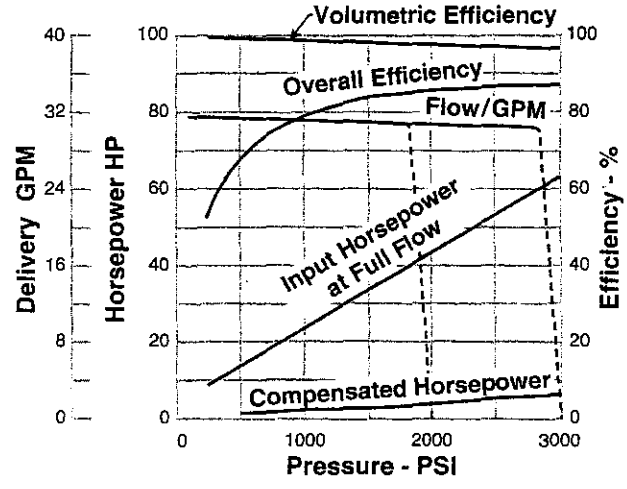
Performance Data - PAVC65

Fluid: Standard Hydraulic Oil 100 SSU @ 120°F (49°C)

PAVC65 @ 1200 RPM



PAVC65 @ 1800 RPM



NOTE: The efficiencies and data in the graph are good only for pumps running at 1800 RPM and stroked to maximum. To calculate approximate horsepower for the other conditions, use the following formula:

$$HP = \left[\frac{Q \times (PSI)}{1714}\right] + (CHp)$$

Actual GPM is directly proportional to drive speed and maximum volume setting. Flow loss, however, is a function of pressure only.

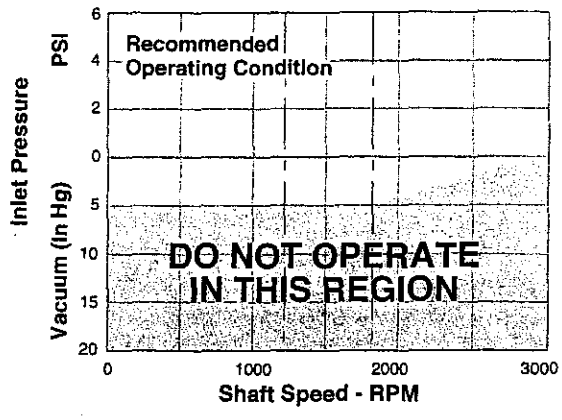
WHERE:

Q = Actual Output Flow in GPM

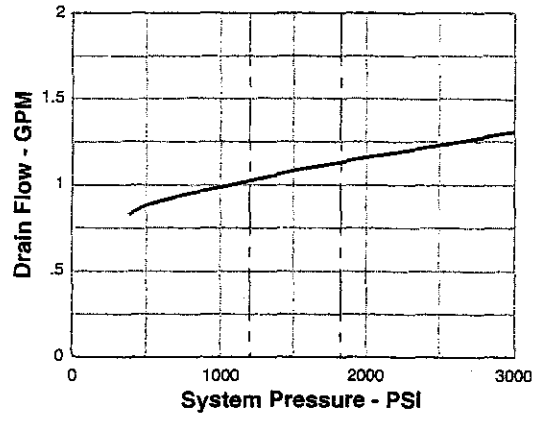
PSI = Pressure At Pump Outlet

CHp = Input Horsepower @ Full Compensation @ 1800 RPM (from graph read at operating pressure)

Inlet Characteristics

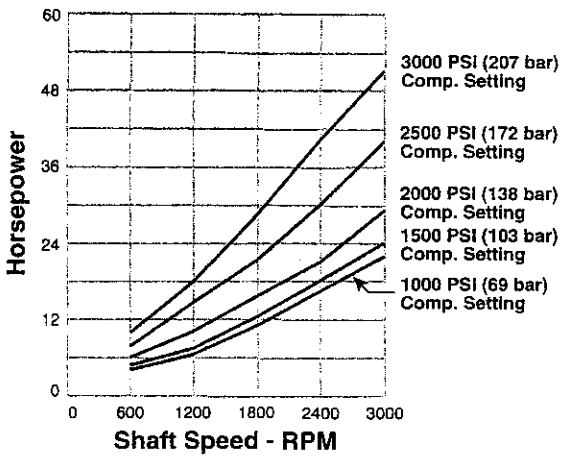


Compensated Control Drain Flow @ 1800 RPM



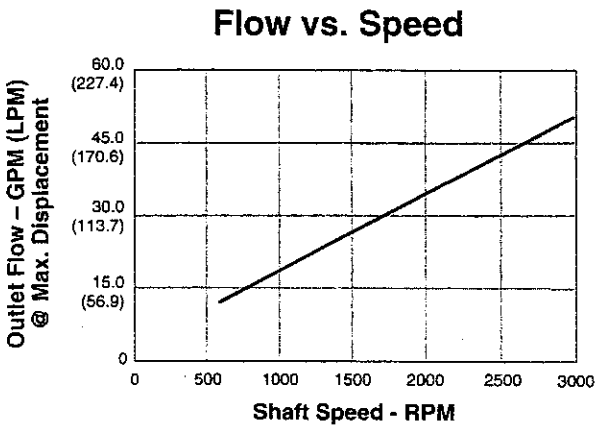
Performance Data - PAVC65

Minimum Horsepower Settings Attainable With Control Options C, H, CM & HM



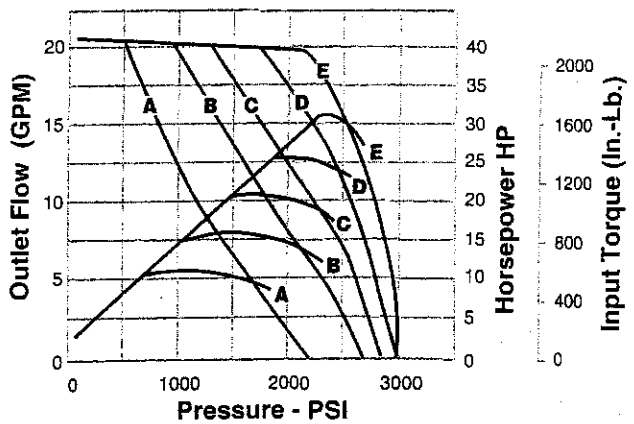
NOTE: Minimum attainable HP setting means that input horsepower will not exceed the indicated setting at the indicated RPM and that the pump will achieve full compensator pressure selected. If setting horsepower limiter below full flow boundary, full flow may not be obtained at low operating pressure.

Flow vs. Speed

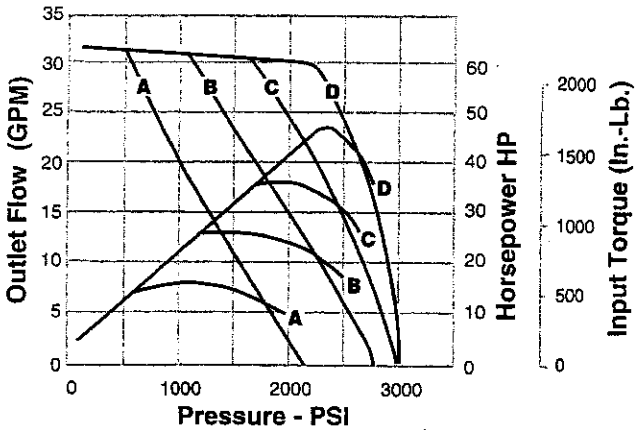


Determine maximum horsepower limitation at desired RPM. All points above desired compensator setting curve can be achieved.

PAVC65 @ 1200 RPM



PAVC65 @ 1800 RPM



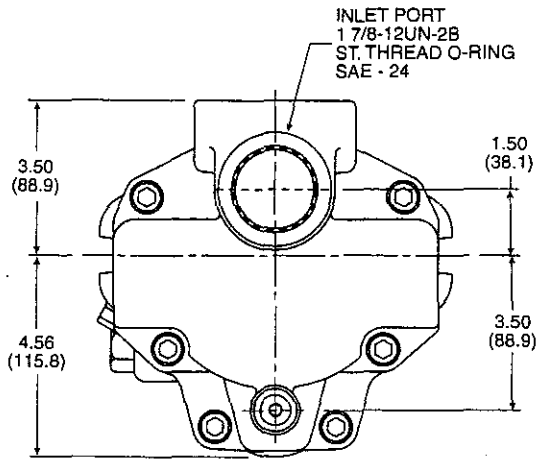
See page 8 for "How to Read Horsepower Control Curves" information.

Dimensions – Rear Port

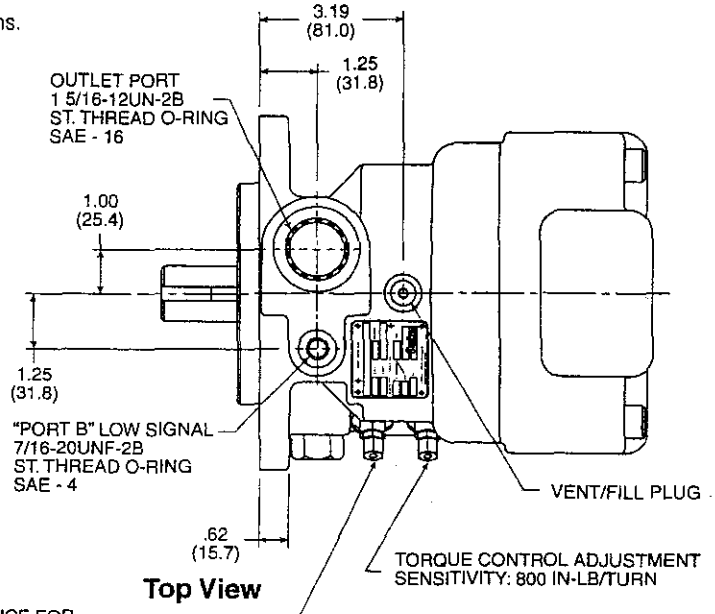
Millimeter equivalents for inch dimensions are shown in (**).

NOTES:

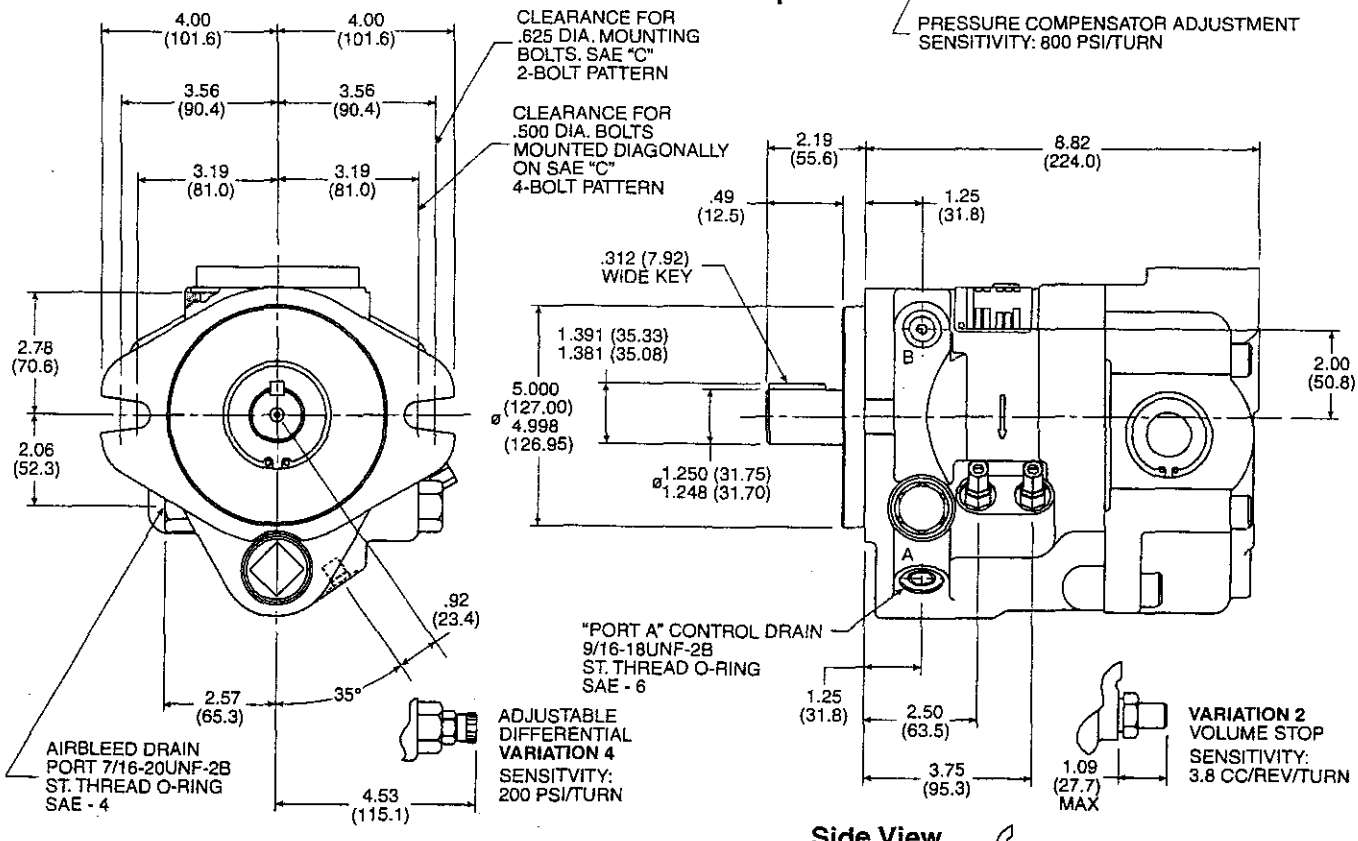
1. Pump shown and dimensioned is a clockwise rotation pump. Outlet port, A and B ports, and controls will be on opposite side for a counterclockwise rotation pump.
2. Pump mounting and shaft comply with SAE "C" dimensions.



Rear View

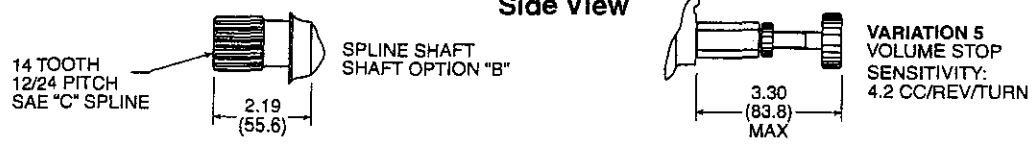


Top View



Front View

Side View



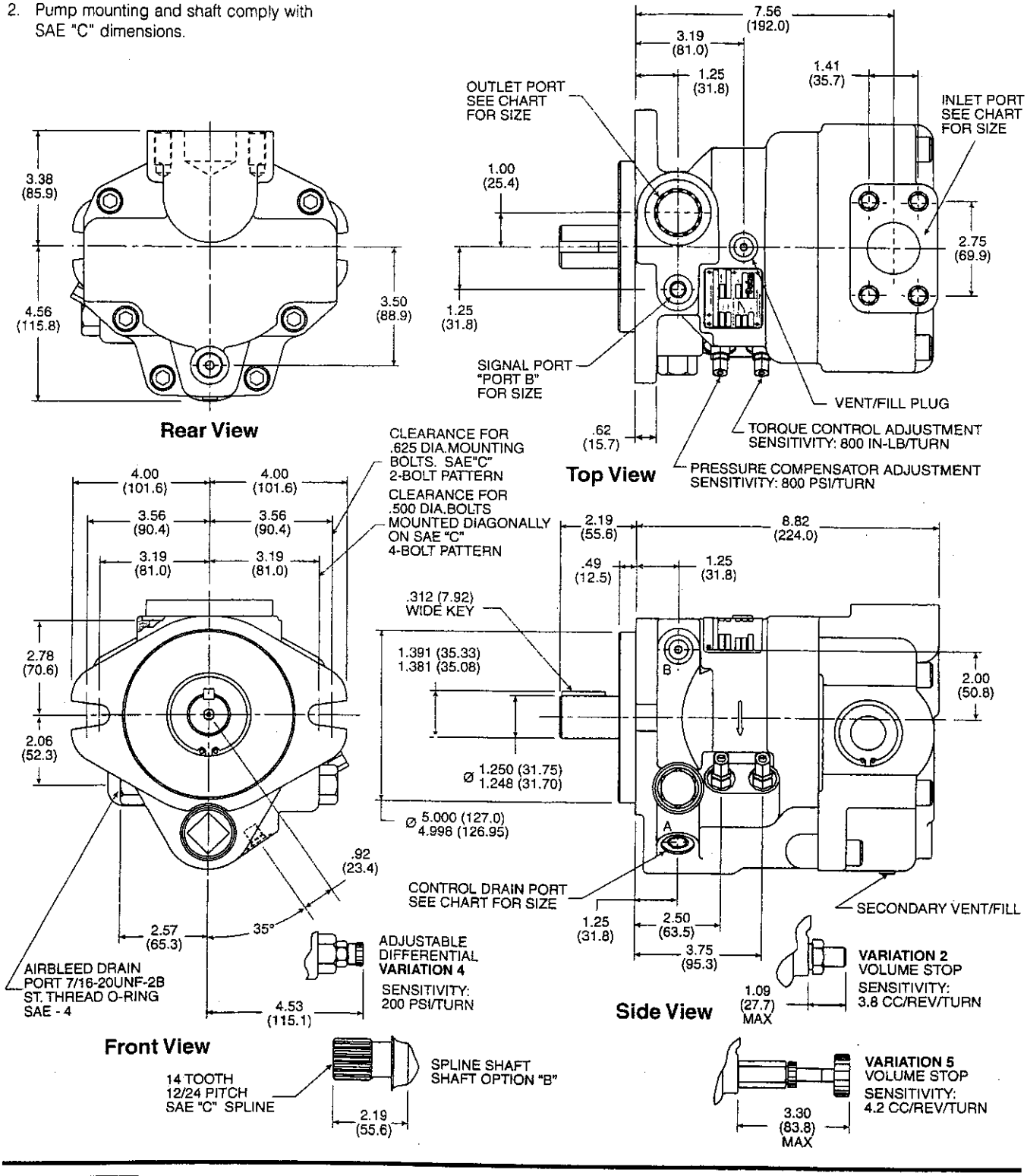
Dimensions – Top Port

Millimeter equivalents for inch dimensions are shown in (**).

NOTES:

1. Pump shown and dimensioned is a clockwise rotation pump. Outlet port, A and B ports, and controls will be on opposite side for a counterclockwise pump.
2. Pump mounting and shaft comply with SAE "C" dimensions.

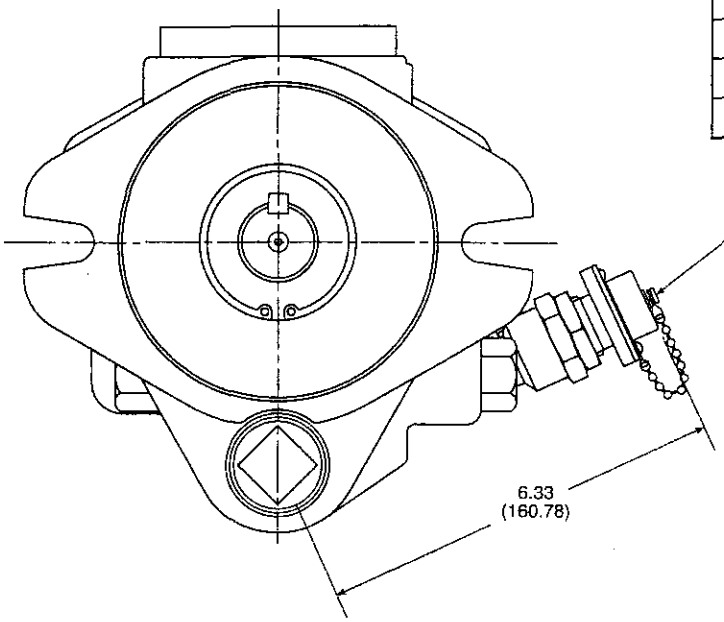
Port Location				
Option	**Outlet Port**	**Inlet Port**	**Control Drain**	**Signal Port**
2	SAE-16 Straight Thread (1-5/16-12UNC)	1-1/2 SAE 4-Bolt Flange 1/2-13 Threads Standard Pressure Series (Code 61)	SAE-6 Straight Thread (9/16-18UNC)	SAE-4 Straight Thread (7/16-20UNC)
8	ISO 6149-16 Straight Thread (M33 x 2)	1-1/2 SAE 4-Bolt Flange M12 x 1.75 Threads Standard Pressure Series (Code 61)	ISO 6149-5 Straight Thread (M14 x 1.5)	ISO 6149-4 Straight Thread (M12 x 1.5)



Dimensions – Electrohydraulic Pump

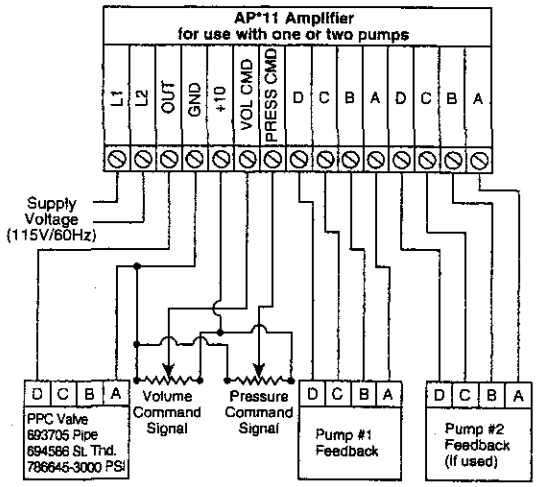
Millimeter equivalents for inch dimensions are shown in (**).

Accessories for S & SE Options	
PPC Valve	694586
Amp Single Pump	AP11
Amp Double Pump	AP211
Seq. Valve (40 GPM Max.)	SX6PM8, SX6VM8
Seq. Valve (90 GPM Max.)	SX10PM8, SX10MM8



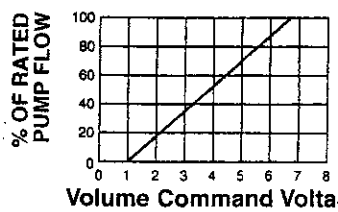
NOTES:

1. Consult factory for information relative to pump option selection and additional components required for desired pump function.
2. For electrohydraulic flow and pressure control of one or two pumps, make electrical connections per Figure IV. When one pump is used, omit connections to pump #2 feedback.
3. For electrohydraulic flow only, eliminate pressure command signal and place jumper between "Press CMD" and "+10V" terminals (compensating pressure will be controlled by maximum setting on pump or remote compensator if used).
4. For electrohydraulic pressure only, eliminate volume command signal, and place jumper between "VOL CMD" and "+10V" terminals or use 801179 pressure driver card.
5. Figures I thru III show nominal input vs. output relationships. The actual values will vary with component tolerances. Full volume range will be realized with 0 to 7 volts. Full pressure range will be realized with 0 to 7 volts, or 0-500MA.
6. Pump shown is a clockwise rotation. For a counterclockwise rotation LVDT feedback is on opposite side.
7. For further detail on installation of AP11/AP211, refer to Catalog 2600-400-1/NA.



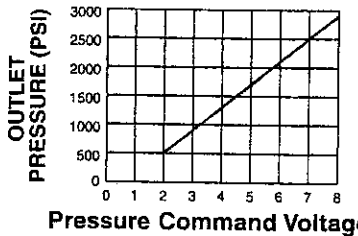
Typical Hookup for Infinitely Variable Electrohydraulic Pressure & Volume Control.

Fig. IV



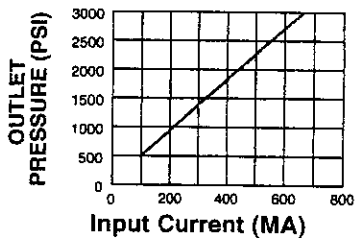
Nominal output flow vs. input command voltage when used in conjunction with AP*11 amplifier and 786645 proportional pressure controller.

Fig. I



Nominal output pressure vs. input command voltage when used in conjunction with AP*11 amplifier and 786645 proportional pressure controller.

Fig. II



Nominal input current vs. pressure when used in conjunction with a current source and 786645 proportional pressure controller.

Fig. III

Performance Information

Series PAVC100 Pressure Compensated, Variable Volume, Piston Pump

Features

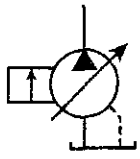
- High Strength Cast-Iron Housing
- Built-In Supercharger
- High Speed Capability - 2600 RPM
- Cartridge Type Controls - Field Changeable
- Replaceable Bronze Clad Port Plate
- Airbleed Standard for Quick Priming
- Hydrodynamic Cylinder Barrel Bearing
- Full Pressure Rating on Water Glycol Fluids
- Filtered and/or Cooled Drain Line Capable (100 PSI Max)
- Thru-Shaft Capable

Controls

- Pressure Compensation
- Remote Pressure Compensation
- Load Sensing
- Horsepower Limiting
- Horsepower and Load Sensing
- Adjustable Maximum Volume Stop
- Electrohydraulic Pressure
- Electrohydraulic Flow and Pressure (Servo Control)
- Low Pressure Standby

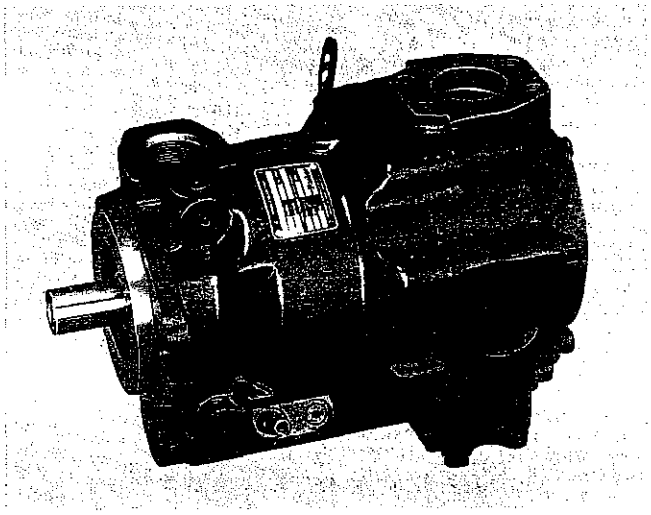
Schematic Symbol

(Basic Pump)



Weight and Package Size

Model	Weight In Pounds	Length From Mounting Face In Inches (CM)	Height in Inches (CM)	Width In Inches (CM)
PAVC100	110	12.10 (30.70)	9.82 (24.90)	8.50 (21.60)



Specifications

Pressure Ratings:

Outlet Port: 3000 PSI (207 bar) Continuous (P1)
3600 PSI (248 bar) Peak (P3)

Inlet Port: 25 PSI (1.7 bar) Maximum
5 In-Hg Minimum @ 1800 RPM
(See Inlet Chart for other speeds)

Control Drain: 100 PSI (7 bar) Maximum

Speed Ratings: 600 to 2600 RPM

Operating Temperature Range: – 40°F to 160°F
(– 40°C to 71°C)

Housing Material: Cast-Iron

Filtration: Maintain SAE Class 4, ISO 16/13, ISO 18/15 Maximum Recommended

Mounting: SAE C 2-Bolt Flange Mount or Diagonally on SAE C 4-Bolt Flange Mount

Installation Data: See page 41 of this catalog for specific recommendations pertaining to system cleanliness, fluids, start-up, inlet conditions, shaft alignment, drain line restrictions and other important factors relative to the proper installation and use of these pumps.

Quick Reference Data Chart

Pump Model	Displacement CM^3/REV (IN^3/REV)	Pump Delivery @ 300 PSI (21 bar) in GPM (LPM)		*Approximate Noise Levels dB(A) @ Full Flow 1800 RPM (1200 RPM)			Horsepower At 1800 RPM and At Maximum Pressure & Displacement
		1200 RPM	1800 RPM	1000 PSI (69 bar)	2000 PSI (138 bar)	3000 PSI (207 bar)	
PAVC100	100 (6.1)	31.6 (119.6)	47.5 (179.8)	82 (78)	82 (79)	85 (80)	95.5

* Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.

Ordering Information

	PAVC	100														
Multiple Pumps	Pump Axial Piston Variable Controllable	Displace-ment	Bearing Option	Shaft	Outlet	Inlet	Rotation	Differential Control Option	Volume Stop Option	Thru-Shaft Threads	Variations	Control Options	Seals	Paint	Design Series	Multiple Pumps

Code	Multiple Pumps
Omit	Single Pump
—	Factory Mounted to Rear of Another Pump

Code	CM³/REV (In³/Rev.)
100	100 (6.1)

Code	Bearing Option
Omit	Single Piece Shaft
9*	Dual Bearing

* For applications where side loading may be experienced. Max. side load = 250#.

Typical Applications:
Belt/chain drive
Universal joint drive
Massive couplings
Foot mount installations

Code	Shaft Option
Omit	Keyed (SAE C)
B	Spline (SAE C)
C	Keyed (SAE CC)
D	Spline (SAE CC)

Use SAE "C-C" shaft on thru-shaft pump variation when combined input torque of front and rear pumps exceed 5000 in.-lbs.

Code	Outlet Port
Omit	Str. Thread
3	Flange

Code	Port		
	Inlet	Location	Type
Omit	Flange	Rear	SAE/Inch
2	Flange	Top/Bottom	SAE/Inch
8	Flange	Top/Bottom	ISO 6149/Metric

Code	Rotation
R	Right (CW)
L	Left (CCW)

Viewed from shaft end.

Code	Differential Options
Omit	Non-Adjustable Differential
4	Adjustable Differential

Code	Volume Stop Options
Omit	Volume Stop Plugged
2	Maximum Volume Stop
5*	Max. Vol. Stop With O-Ring

* Not available with thru-shaft option.

Code	Thru-Shaft Threads
6	UNC
9*	Metric

* Must be used with "8" porting option.

Code	Control Options
Omit	Standard Pressure Compensated Setting Pressure 600-3000 PSI (41-207 bar)
A	Pressure & Flow (Load Sensing)
*C	Pressure, Flow & HP Limiting
*H	Pressure Comp. & HP Limiting
†M	Remote Pressure - (Master)
†ME	Remote Pressure - (Slave)
†S	Servo Press. & Volume - (Master) (Requires PPC, Amplifier & Seq. Valve)
†SE	Servo Press. & Volume - (Slave) (Requires PPC, Amplifier & Seq. Valve)
†AM	Remote Press. & Flow Comp.
*†CM	Remote Press. Flow & Power Comp.
*†HM	Remote Press. & Power Comp.

* Horsepower controlled pumps (H, C, HM or CM) must have maximum input horsepower limit specification at a particular drive speed (RPM) included with order.

† Pumps with M, ME, S or SE controls will be set to compensate at 3000 PSI (207 bar) unless Chart #1 otherwise specifies.

Code	Seals
Omit	Buna-N (Standard)

Code	Painting
Omit	No Paint
P	Paint

Code	Multiple Pumps
Omit	Single Pump
—	Pump Factory Mounted on Rear

Code	Thru-Shaft Variations
Omit	No Thru-Shaft Option
A3	Thru-Shaft, SAE "AA" Pilot, 9 Tooth 20/40 Pitch Spline Shaft
A4	Thru-Shaft, SAE "A" Pilot, 9 Tooth 16/32 Pitch Spline Shaft
*B1	Thru-Shaft, SAE "B" Pilot, 7/8" Keyed Shaft
*B2	Thru-Shaft, SAE "B" Pilot, 1" Keyed Shaft
*B3	Thru-Shaft, SAE "B" Pilot, 13 Tooth 16/32 Pitch Spline Shaft
*B4	Thru-Shaft, SAE "B" Pilot, 15 Tooth 16/32 Pitch Spline Shaft
*C2	Thru-Shaft, SAE "C" Pilot, 1-1/4" Keyed Shaft
*C3	Thru-Shaft, SAE "C" Pilot, 14 Tooth 12/24 Pitch Spline Shaft

Inlet port option "2" or "8" (top/bottom) must be used with all thru-shaft pumps.
* Use SAE "C-C" shaft on thru-shaft pump variation when combined input torque of front and rear pumps exceed 5000 in.-lbs.

Ordering Notes

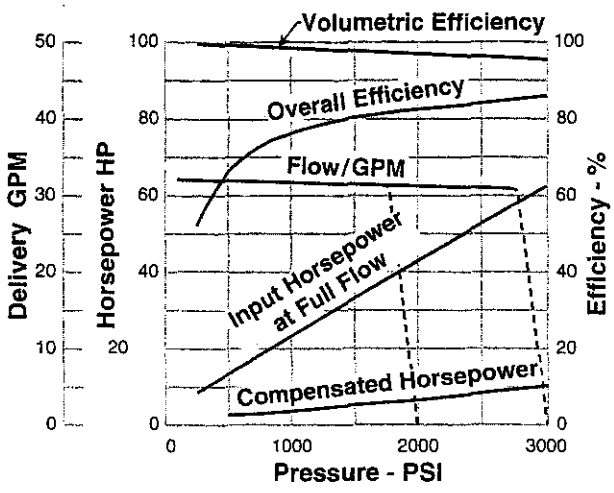
Unless otherwise specified, pump is shipped at maximum GPM (1800 RPM) and set to 1000 PSI (69 bar). When factory settings are required, the items shown in Chart #1 must be included with order.

Chart #1 Item	
RPM	
PSI	
HP	
GPM	

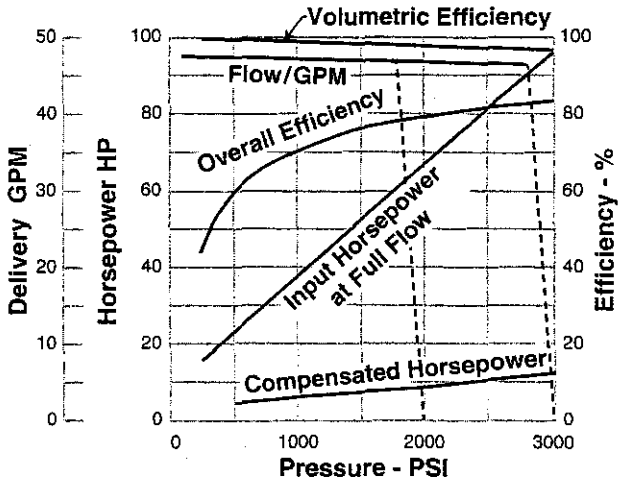
Performance Data - PAVC100

Fluid: Standard Hydraulic Oil 100 SSU @ 120°F (49°C)

PAVC100 @ 1200 RPM



PAVC100 @ 1800 RPM



NOTE: The efficiencies and data in the graph are good only for pumps running at 1800 RPM and stroked to maximum. To calculate approximate horsepower for the other conditions, use the following formula:

$$HP = \left[\frac{Q \times (PSI)}{1714}\right] + (CHp)$$

Actual GPM is directly proportional to drive speed and maximum volume setting. Flow loss, however, is a function of pressure only.

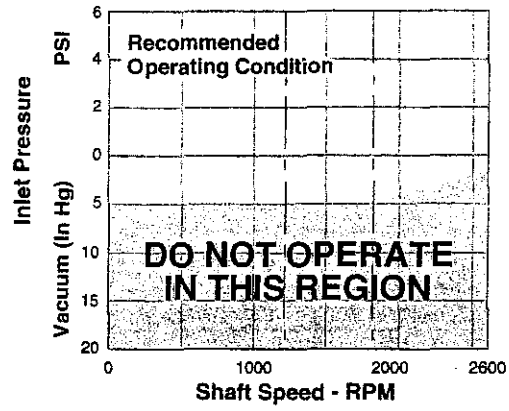
WHERE:

Q = Actual Output Flow in GPM

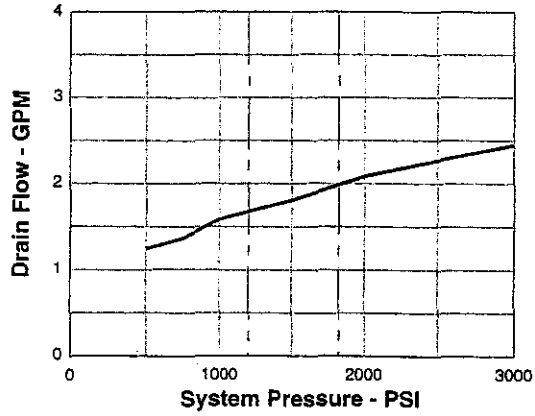
PSI = Pressure At Pump Outlet

CHp = Input Horsepower @ Full Compensation @ 1800 RPM (from graph read at operating pressure)

Inlet Characteristics

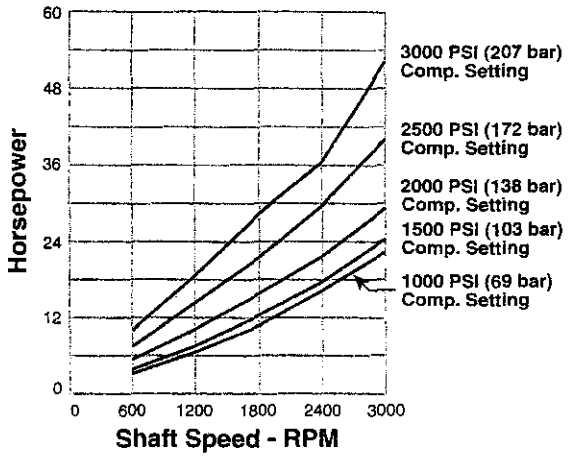


Compensated Control Drain Flow @ 1800 RPM



Performance Data - PAVC100

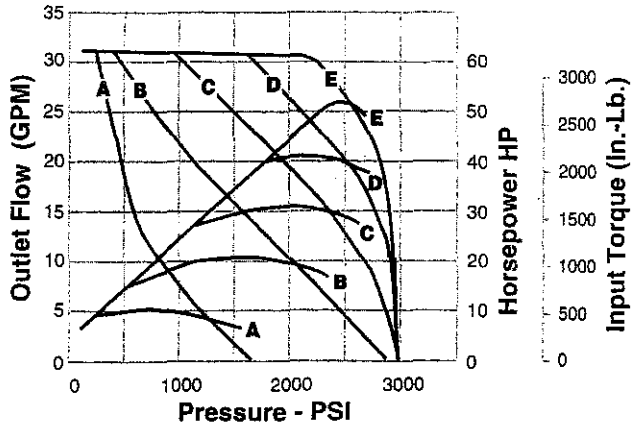
Minimum Horsepower Settings Attainable With Control Options C, H, CM & HM



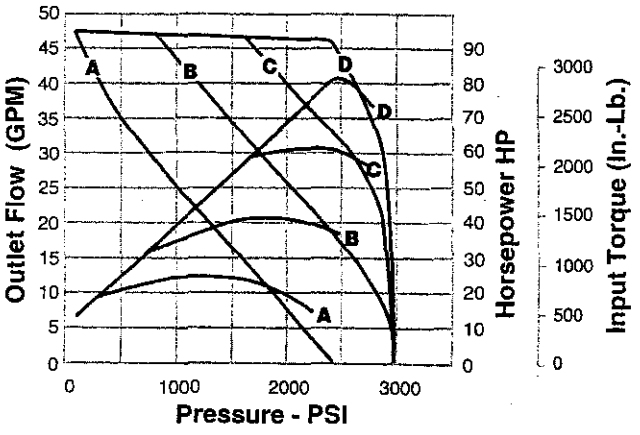
NOTE: Minimum attainable HP setting means that input horsepower will not exceed the indicated setting at the indicated RPM and that the pump will achieve full compensator pressure selected. If setting horsepower limiter below full flow boundary, full flow may not be obtained at low operating pressure.

Determine maximum horsepower limitation at desired RPM. All points above desired compensator setting curve can be achieved.

PAVC100 @ 1200 RPM



PAVC100 @ 1800 RPM



See page 8 for "How to Read Curves" information.

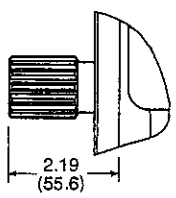
Dimensions – Rear Port

Millimeter equivalents for inch dimensions are shown in (**).

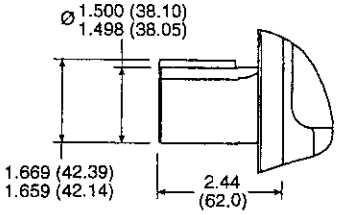
NOTE:

Pump shown and dimensioned is a clockwise rotation pump. For a counterclockwise rotation pump the outlet port, control drain, signal port and pump controls will be on other side.

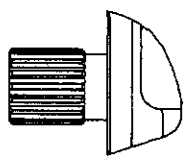
Port Location					
Outlet Option	**Inlet Option**	**Outlet Port**	**Inlet Port**	**Control Drain**	**Signal Port**
Omit	Omit	SAE-20 Straight Thread (1-5/8-12UNC)	2" SAE 4-Bolt Flange 1/2-13 Threads Standard Pressure Series (Code 61)	SAE-6 Straight Thread (9/16-18UNC)	SAE-4 Straight Thread (7/16-20UNC)
3	Omit	1-1/4" SAE Flange 7/16-14 Thread Standard Pressure Series (Code 61)	2" SAE 4-Bolt Flange 1/2-13 Threads Standard Pressure Series (Code 61)	SAE-6 Straight Thread (9/16-18UNC)	SAE-4 Straight Thread (7/16-20UNC)



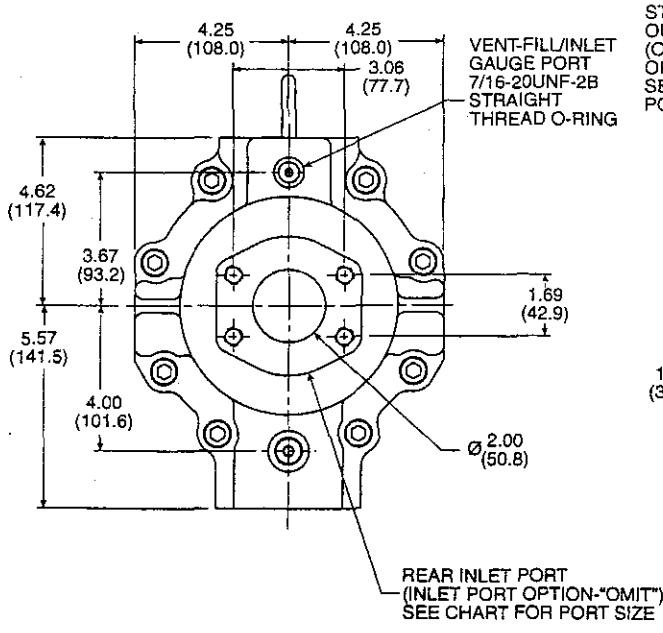
SPLINE SHAFT OPTION "B"
SAE-"C" SPLINE
14 TOOTH 12/24 DP
30° INVOLUTE SPLINE
5,600 IN-LBS MAX TORQUE



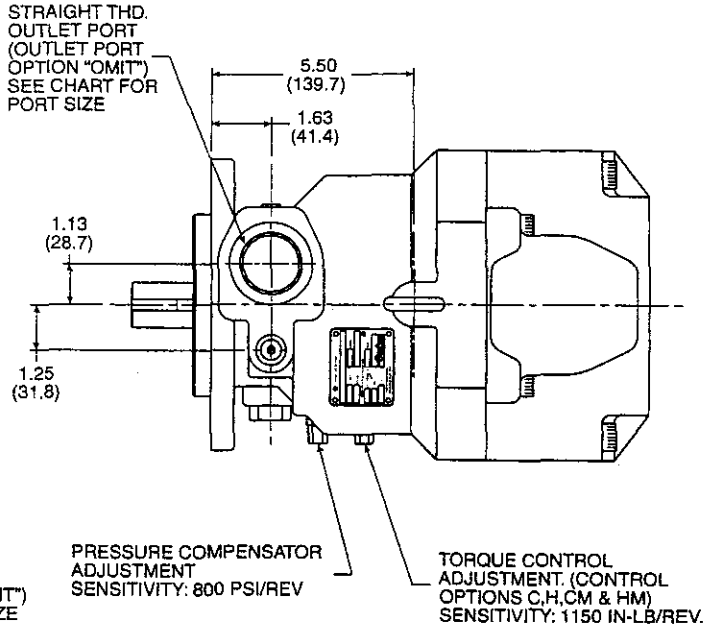
STRAIGHT SHAFT
OPTION "C"
SAE - "C-C" SHAFT
10,500 IN-LBS MAX TORQUE



SPLINE SHAFT OPTION "D"
SAE - "C-C" SPLINE
17 TOOTH 12/24 DP
30° INVOLUTE SPLINE
10,500 IN-LBS MAX TORQUE



Rear View



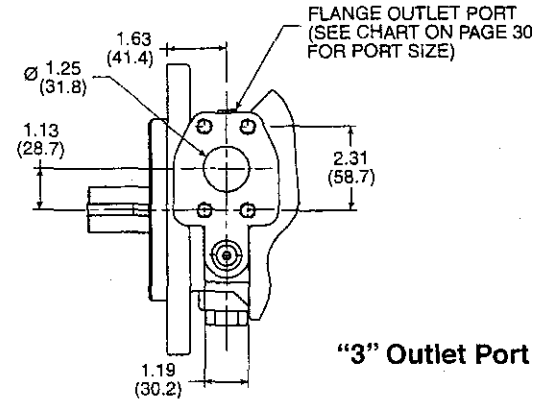
Top View

Dimensions – Rear Port

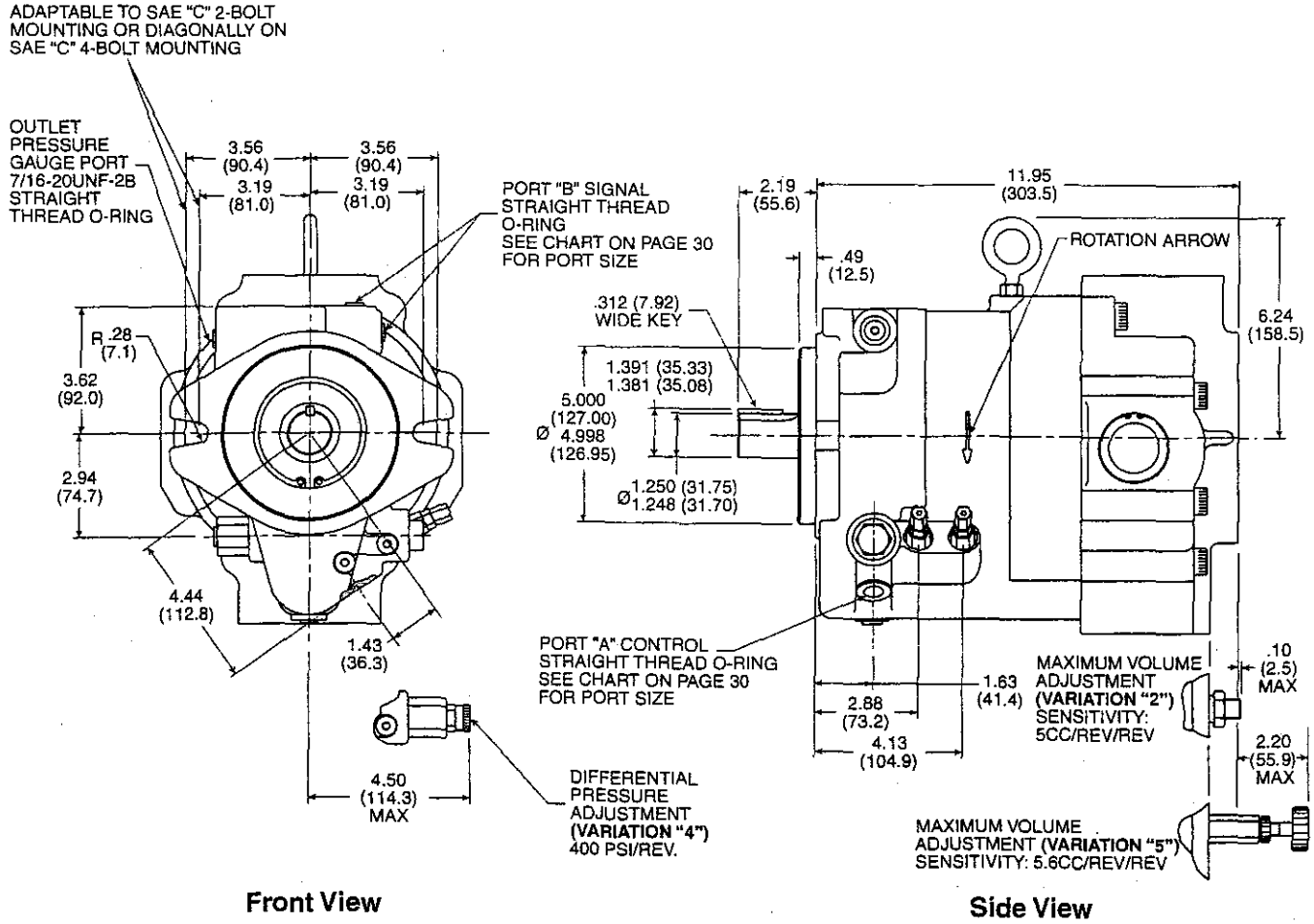
Millimeter equivalents for inch dimensions are shown in (**).

NOTE:

Pump shown and dimensioned is a clockwise rotation pump. For a counterclockwise rotation pump the outlet port, control drain, signal port and pump controls will be on other side.



"3" Outlet Port Option



Front View

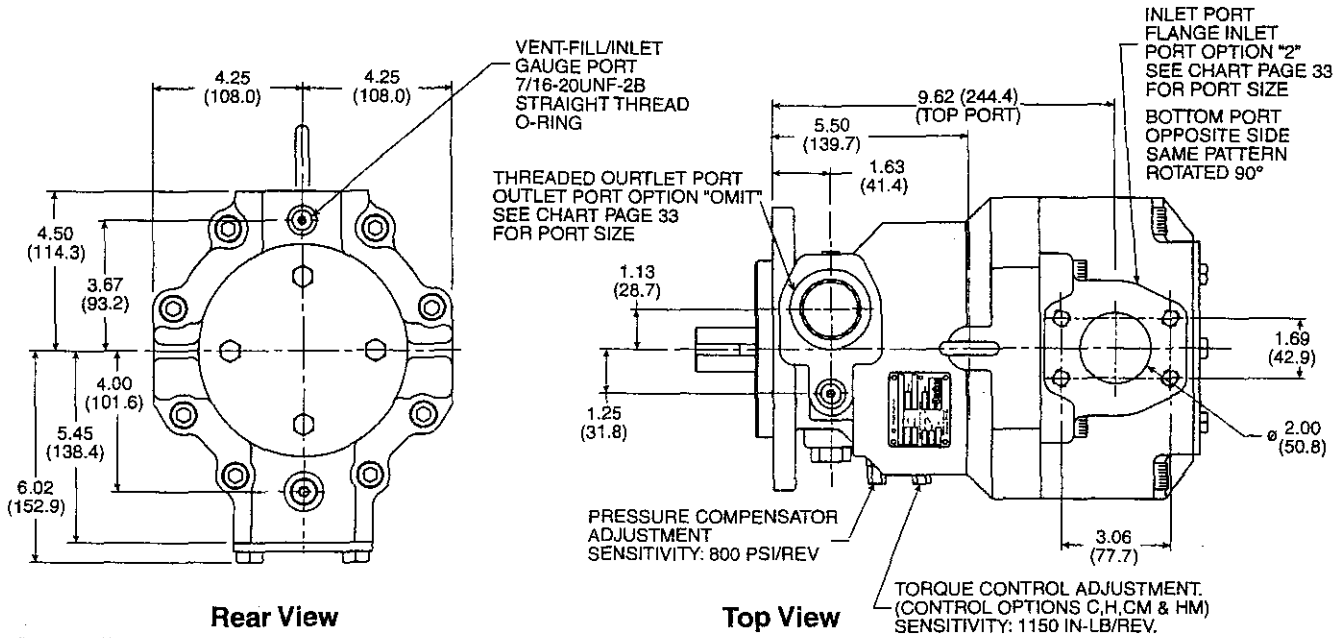
Side View

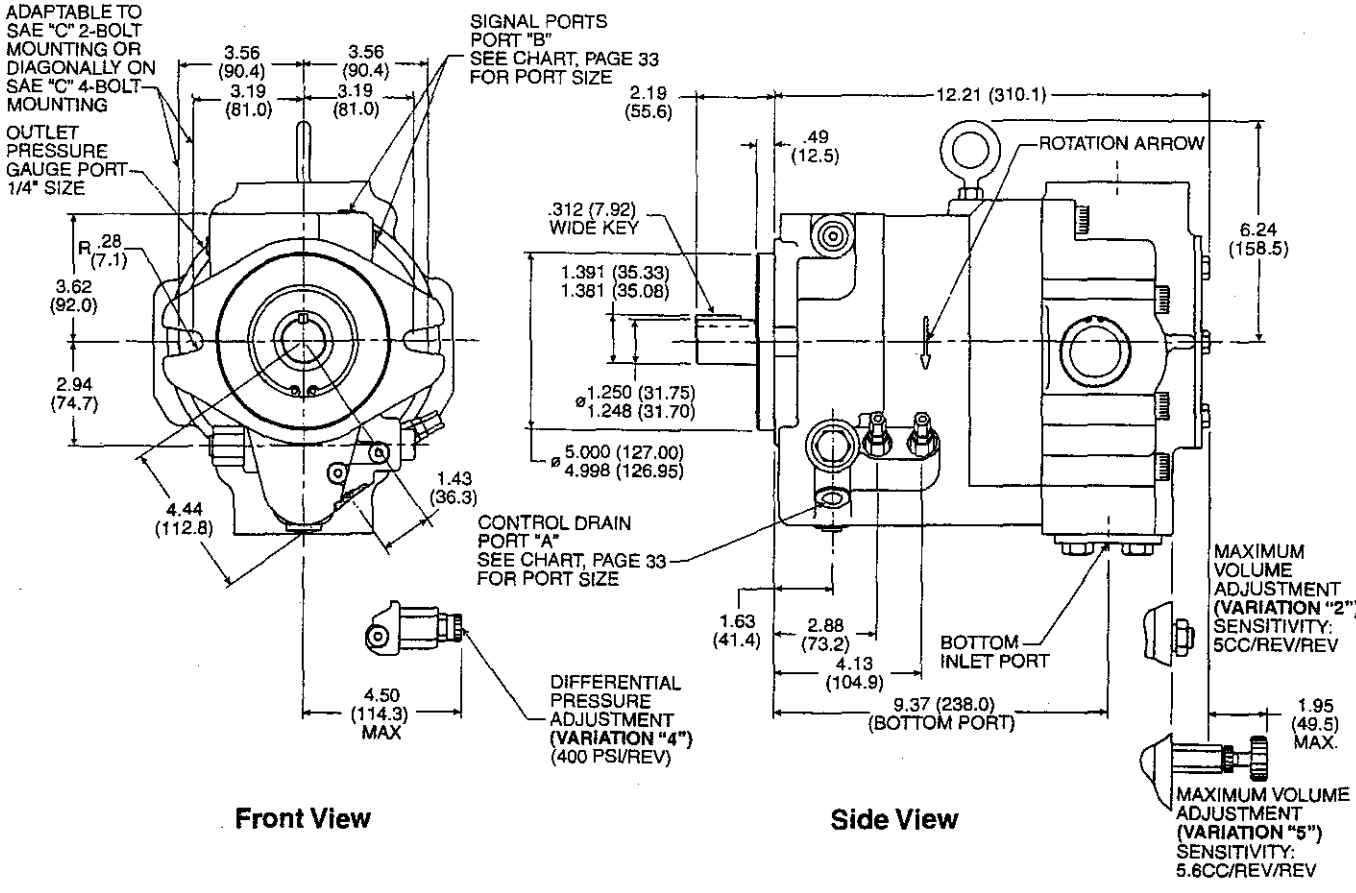
Dimensions – Top/Bottom Port

Millimeter equivalents for inch dimensions are shown in (**).

NOTES:

1. Pump shown and dimensioned is a clockwise rotation top/bottom inlet option pump. For a counterclockwise rotation pump the outlet port, control drain, signal port, and pump controls will be on other side.
2. For other available shafts see page 33.





Dimensions – Top/Bottom Port

Millimeter equivalents for inch dimensions are shown in (**).

NOTE:

Pump shown and dimensioned is a clockwise rotation pump. For a counterclockwise rotation pump the outlet port, control drain, signal port and pump controls will be on other side.

Port Location					
Outlet Option	**Inlet Option**	**Outlet Port**	**Inlet Port**	**Control Drain**	**Signal Port**
Omit	2	SAE-20 Straight Thread (1-5/8-12UN)	2" SAE 4-Bolt Flange 1/2-13 Threads Standard Pressure Series (Code 61)	SAE-6 Straight Thread (9/16-18UN)	SAE-4 Straight Thread (7/16-20UN)
	8	ISO6149-20 Straight Thread (M42 x 2)	2" SAE 4-Bolt Flange M12 x 1.75 Threads Standard Pressure Series (Code 61)	ISO6149-5 Straight Thread (M14 x 1.5)	ISO6149-4 Straight Thread (M12 x 1.5)
3	2	1-1/4" SAE Flange 7/16-14 Thread Standard Pressure Series (Code 61)	2" SAE 4-Bolt Flange 1/2-13 Threads Standard Pressure Series (Code 61)	SAE-6 Straight Thread (9/16-18UN)	SAE-4 Straight Thread (7/16-20UN)
	8	1-1/4" SAE Flange M10 x 1.5 Thread Standard Pressure Series (Code 61)	2" SAE 4-Bolt Flange M12 x 1.75 Threads Standard Pressure Series (Code 61)	ISO6149-5 Straight Thread (M14 x 1.5)	ISO6149-4 Straight Thread (M12 x 1.5)

Dimensions – Thru-Shaft Options

Millimeter equivalents for inch dimensions are shown in (**).

Variation	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ	Ⓗ
6A1	.500 (12.70)	Ø 2.001/2.002 (50.83)/(50.85)	3.250 (82.55)	N/A	5/16-18UNC-2B	N/A	Ø .500 x .125 Key (12.70) (3.175)	N/A
6A3	.500 (12.70)	Ø 2.001/2.002 (50.83)/(50.85)	3.250 (82.55)	N/A	5/16-18UNC-2B	N/A	9 Tooth 20/40 Pitch	N/A
6A4	—	Ø 3.251/3.252 (82.58)/(82.60)	4.188 (106.38)	N/A	3/8-16UNC-2B	N/A	9 Tooth 16/32 Pitch	N/A
6B1	2.125 (53.98)	Ø 4.001/4.002 (101.63)/(101.65)	5.750 (146.05)	3.536 (89.81)	1/2-13UNC-2B	1/2-13UNC-2B	Ø .875 x .250 Key (22.23) (6.35)	⚠2
6B2	2.125 (53.98)	Ø 4.001/4.002 (101.63)/(101.65)	5.750 (146.05)	3.536 (89.81)	1/2-13UNC-2B	1/2-13UNC-2B	Ø 1.000 x .250 Key (25.40) (6.35)	⚠2
6B3	2.125 (53.98)	Ø 4.001/4.002 (101.63)/(101.65)	5.750 (146.05)	3.536 (89.81)	1/2-13UNC-2B	1/2-13UNC-2B	13 Tooth 16/32 Pitch	N/A
6B4	2.125 (53.98)	Ø 4.001/4.002 (101.63)/(101.65)	5.750 (146.05)	3.536 (89.81)	1/2-13UNC-2B	1/2-13UNC-2B	15 Tooth 16/32 Pitch	N/A
6C2	2.125 (53.98)	Ø 5.001/5.002 (127.03)/(127.05)	7.125 (180.98)	4.508 (114.50)	5/8-11UNC-2B	1/2-13UNC-2B	Ø 1.250 x .312 Key (31.75) (7.92)	3.250 (82.55)
6C3	2.125 (53.98)	Ø 5.001/5.002 (127.03)/(127.05)	7.125 (180.98)	4.508 (114.50)	5/8-11UNC-2B	1/2-13UNC-2B	14 Tooth 12/24 Pitch	N/A
9A1	.500 (12.70)	Ø 2.001/2.002 (50.83)/(50.85)	3.250 (82.55)	N/A	M8 x 1.25	N/A	Ø .500 x .125 Key (12.70) (3.175)	N/A
9A3	.500 (12.70)	Ø 2.001/2.002 (50.83)/(50.85)	3.250 (82.55)	N/A	M8 x 1.25	N/A	9 Tooth 20/40 Pitch	N/A
9A4	—	Ø 3.251/3.252 (82.58)/82.60)	4.188 (106.38)	N/A	M10 x 1.50	N/A	9 Tooth 16/32 Pitch	N/A
9B1	2.125 (53.98)	Ø 4.001/4.002 (101.63)/(101.65)	5.750 (146.05)	3.536 (89.81)	M12 x 1.75	M12 x 1.75	Ø .875 x .250 Key (22.23) (6.35)	⚠2
9B2	2.125 (53.98)	Ø 4.001/4.002 (101.63)/(101.65)	5.750 (146.05)	3.536 (89.81)	M12 x 1.75	M12 x 1.75	Ø 1.000 x .250 Key (25.4) (6.35)	⚠2
9B3	2.125 (53.98)	Ø 4.001/4.002 (101.63)/(101.65)	5.750 (146.05)	3.536 (89.81)	M12 x 1.75	M12 x 1.75	13 Tooth 16/32 Pitch	N/A
9B4	2.125 (53.98)	Ø 4.001/4.002 (101.63)/(101.65)	5.750 (146.05)	3.536 (89.81)	M12 x 1.75	M12 x 1.75	15 Tooth 16/32 Pitch	N/A
9C2	2.125 (53.98)	Ø 5.001/5.002 (127.03)/(127.05)	7.125 (180.98)	4.508 (114.50)	M16 x 2	M12 x 1.75	Ø 1.250 x .312 Key (31.75) (7.92)	3.250 (82.55)
9C3	2.125 (53.98)	Ø 5.001/5.002 (127.03)/(127.05)	7.125 (180.98)	4.508 (114.50)	M16 x 2	M12 x 1.75	14 Tooth 12/24 Pitch	N/A

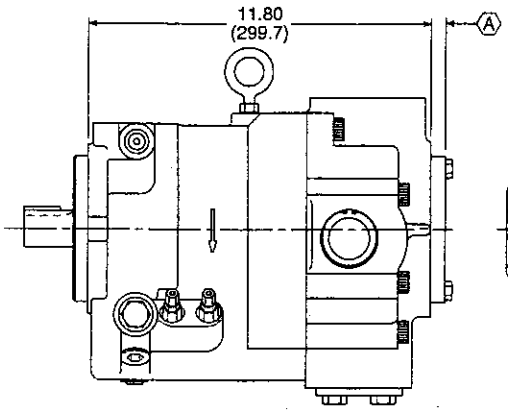
⚠2 3.500 (88.90) for pumps with shaft lengths between 2.10 (53.34) and 2.31 (58.67) inches.
3.000 (76.20) for pumps with shaft lengths between 1.60 (40.64) and 1.80 (45.72) inches.

Dimensions – Thru-Shaft Options

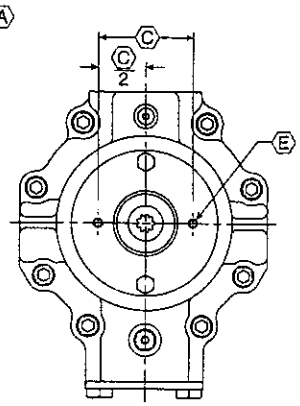
Millimeter equivalents for inch dimensions are shown in (**).

NOTES:

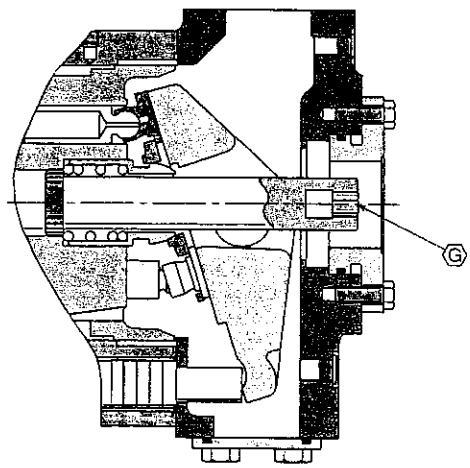
1. Rear adapters may be rotated 90°
2. Pump shown is a clockwise rotation pump. For a counterclockwise pump the outlet port, control drain and control adjustments will be on opposite side.



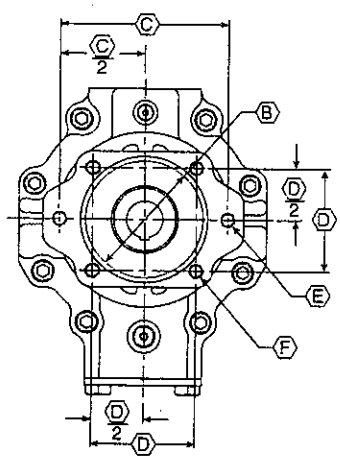
Side View



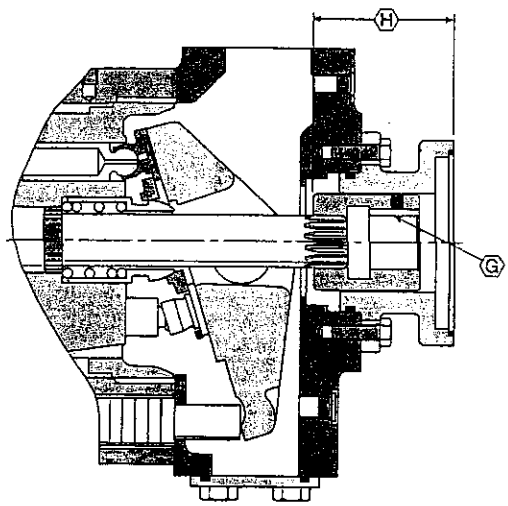
Rear View



Variations 6A* & 9A*



Rear View

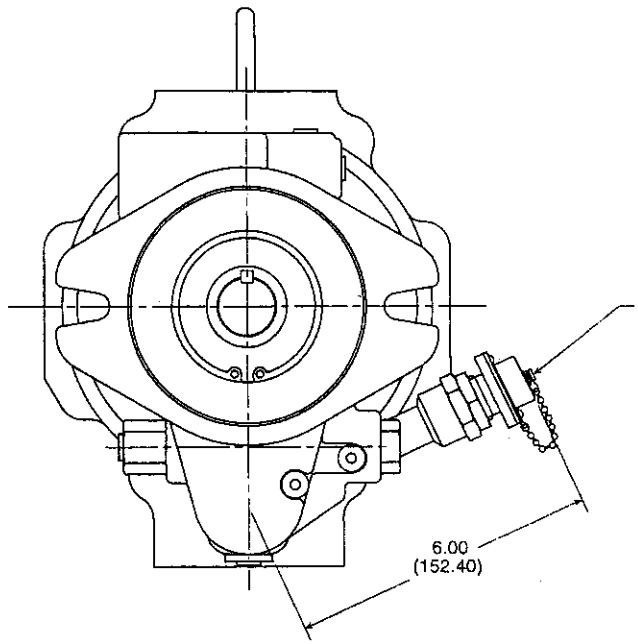


Variations 6B* & 6C*
9B* & 9C*

Dimensions - Electrohydraulic Pump

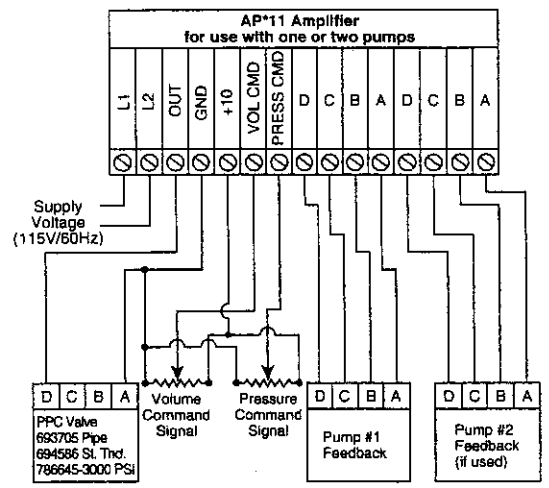
Millimeter equivalents for inch dimensions are shown in (**).

Accessories for S & SE Options	
PPC Valve	694586
Amp Single Pump	AP11
Amp Double Pump	AP211
Seq. Valve (40 GPM Max.)	SX6PM8, SX6VM8
Seq.Valve (90 GPM Max.)	SX10PM8, SX10MM8



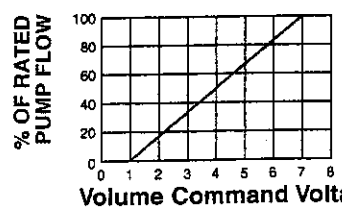
NOTES:

1. Consult factory for information relative to pump option selection and additional components required for desired pump function.
2. For electrohydraulic flow and pressure control of one or two pumps, make electrical connections per Figure IV. When one pump is used, omit connections to pump #2 feedback.
3. For electrohydraulic flow only, eliminate pressure command signal and place jumper between "Press CMD" and "+10V" terminals (compensating pressure will be controlled by maximum setting on pump or remote compensator if used).
4. For electrohydraulic pressure only, eliminate volume command signal and place jumper between "VOL CMD" and "+10V" terminals or use 801179 pressure driver card.
5. Figures I thru III show nominal input vs. output relationships. The actual values will vary with component tolerances. Full volume range will be realized with 0 to 7 volts. Full pressure range will be realized with 0 to 7 volts, or 0-500MA.
6. Pump shown is a clockwise rotation. For a counterclockwise rotation LVDT feedback is on opposite side.
7. For further detail on installation of AP11/AP211, refer to Catalog 2600-400-1/NA.



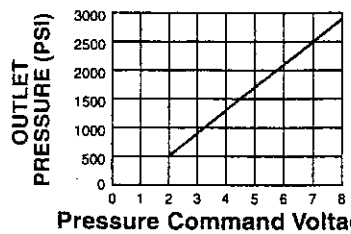
Typical hookup for infinitely variable electrohydraulic pressure & volume control.

Fig. IV



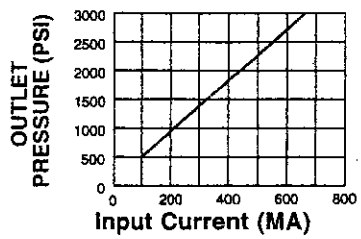
Nominal output flow vs. input command voltage when used in conjunction with AP*11 amplifier and 786645 proportional pressure controller.

Fig. I



Nominal output pressure vs. input command voltage when used in conjunction with AP*11 amplifier and 786645 proportional pressure controller.

Fig. II



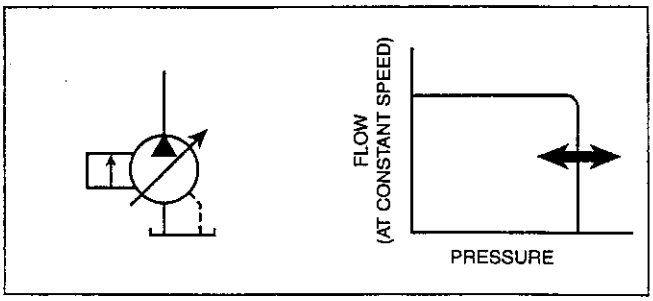
Nominal input current vs. pressure when used in conjunction with a current source and 786645 proportional pressure controller.

Fig. III

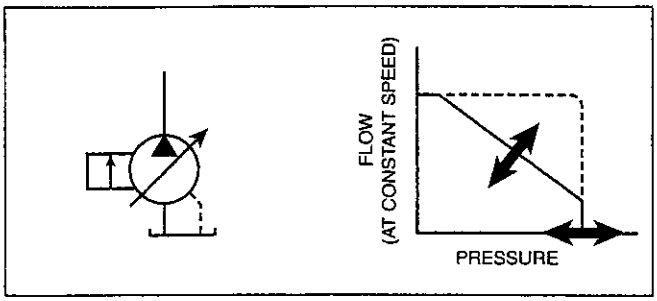
Summary of Control Circuits

All options shown are not available on all pumps.

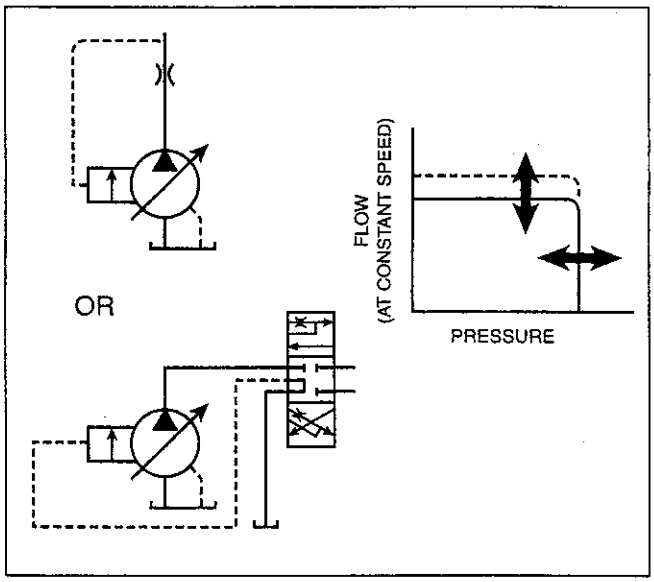
Pressure Control Option
Code: Omit



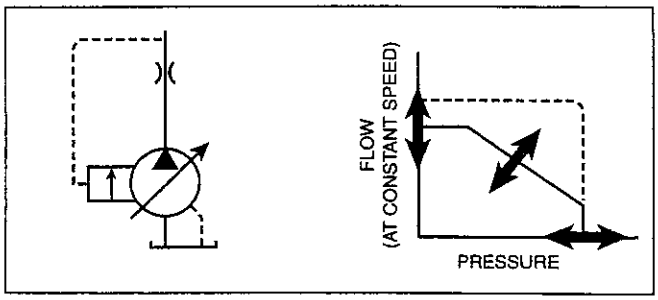
Horsepower Control Option
Code: H



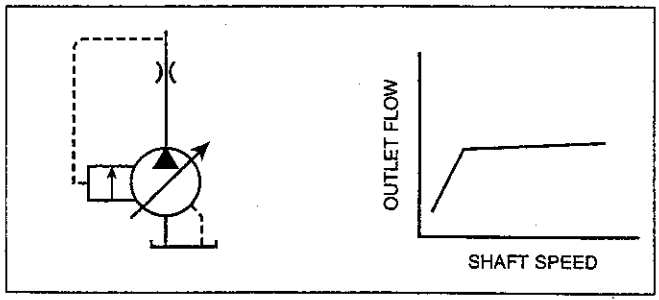
Load Sensing (Flow Control) Option
Code: A



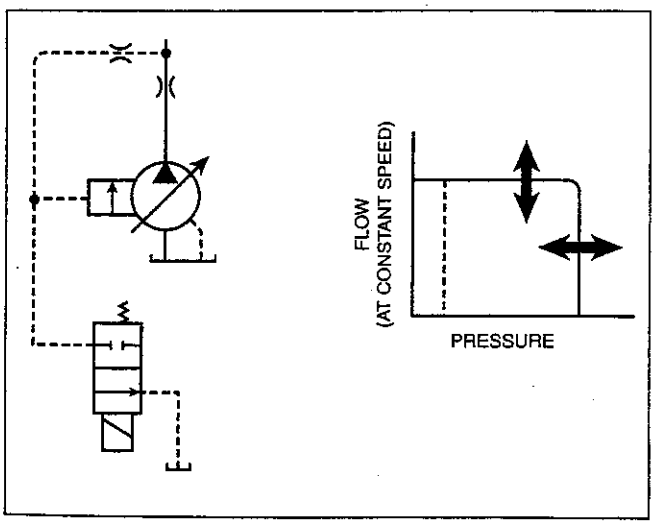
Horsepower & Flow Control Option
Code: C



Load Sense System
Fixed Orifice, Varying Shaft Speed
Code: A



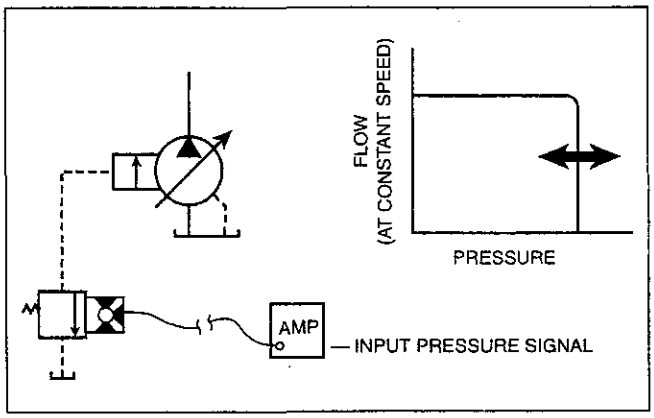
Low Pressure Standby Option
Code: A



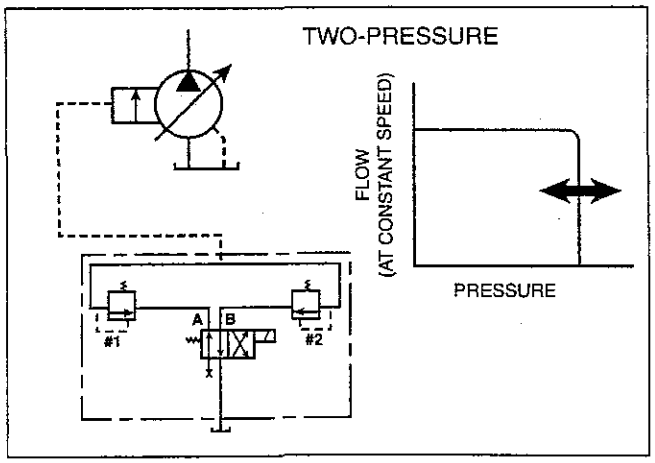
Summary of Control Circuits

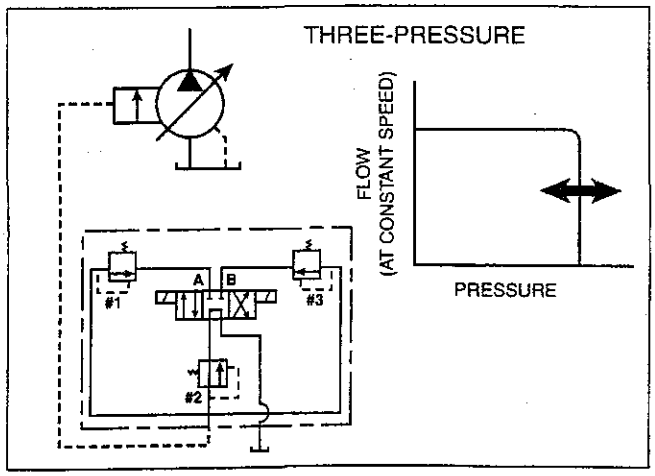
All options shown are not available on all pumps.

Electrohydraulic Pressure Control Option
Code: M

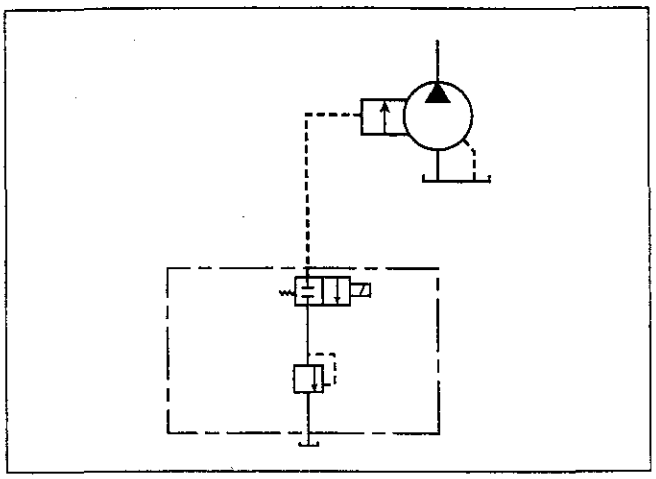


BI and TRI Option
Code: M

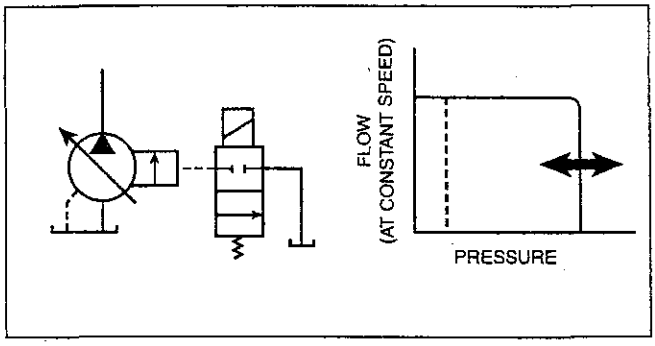




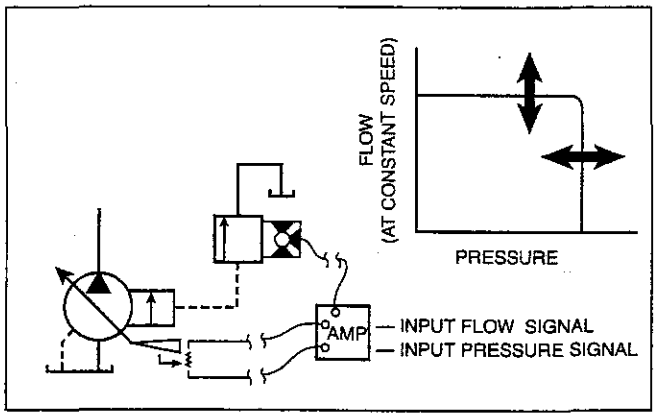
BI Option
Code: M



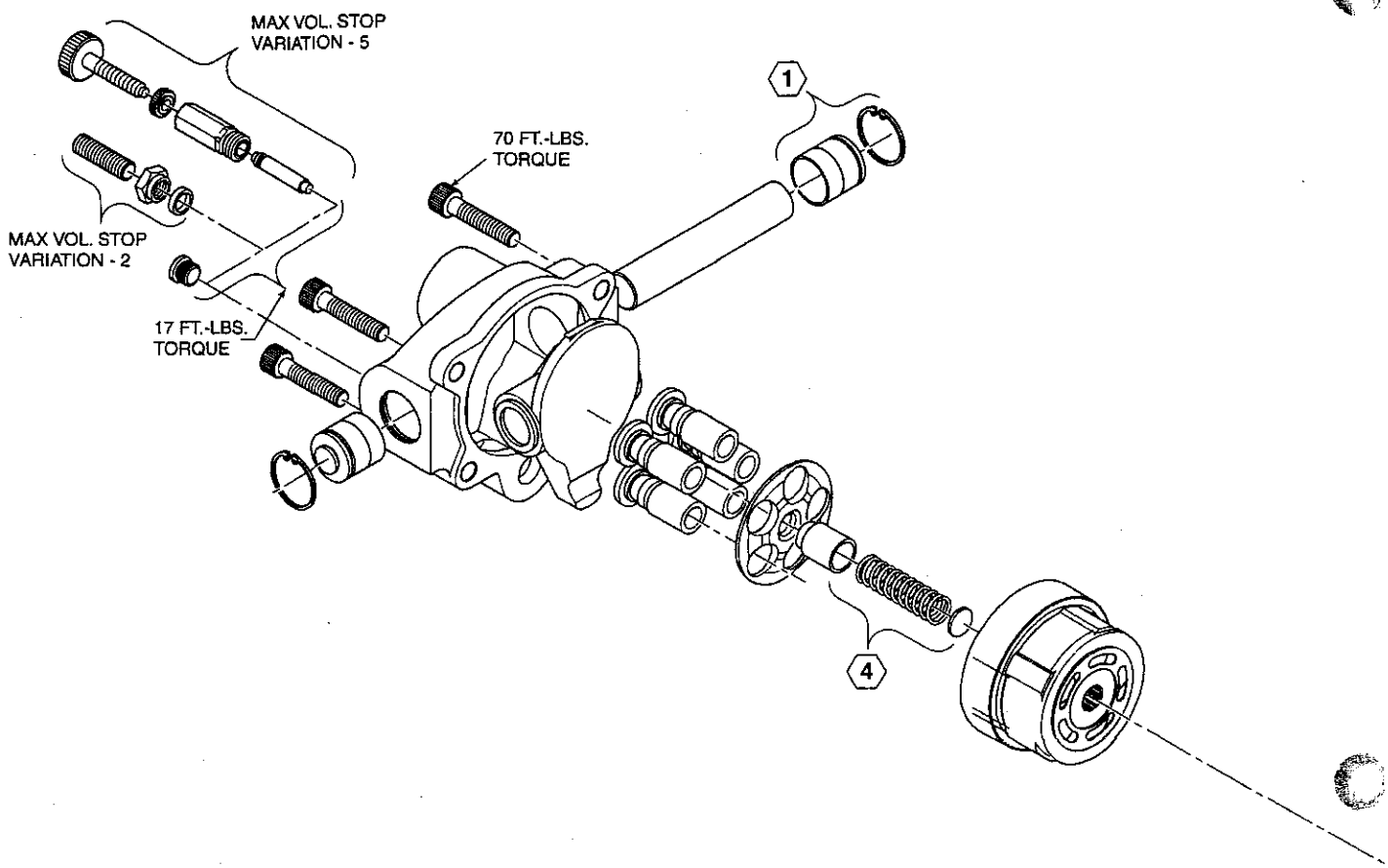
Low Pressure Standby Alternative Option
Code: M



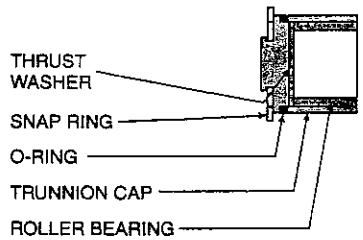
Electrohydraulic Pressure and Flow Control Option
Code: S



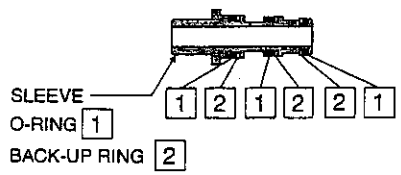
Standard Pump Assembly



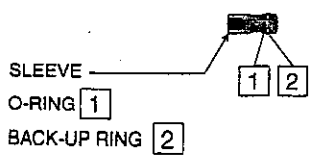
1 TRUNNION CAP ASSEMBLY



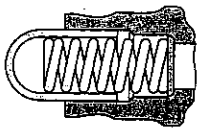
2 SLEEVE ASSEMBLY



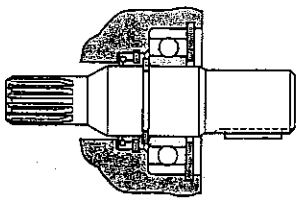
3 PLUG ASSEMBLY



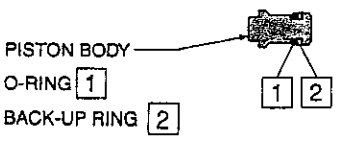
4 RETAINER DETAIL



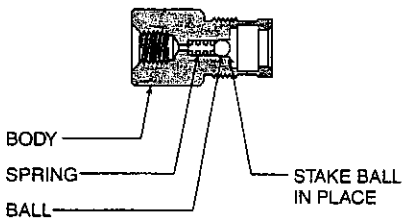
5 BEARING SHAFT ASSEMBLY



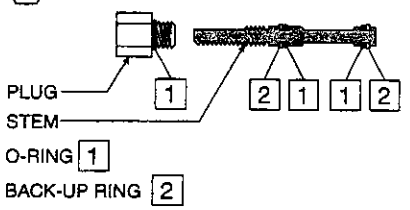
6 PISTON - DIFFERENTIAL CONTROL



7 AIR BLEED ASSEMBLY



8 ADJUSTING STEM ASSEMBLY

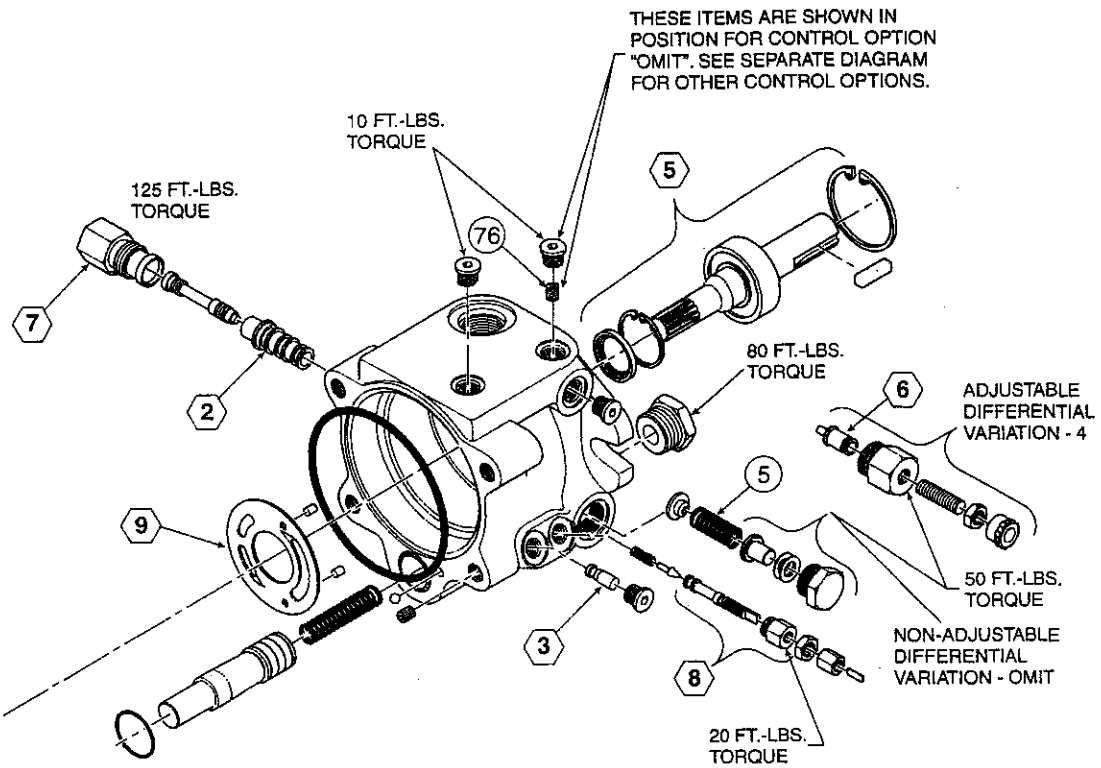


9 PORT PLATE

LEFT HAND (CCW) PORT PLATE SHOWN IN ASSEMBLY (ABOVE).
RIGHT HAND (CW) PORT PLATE SHOWN BELOW.

Installation Information

NOTE: In chart below orifices are noted as 6 digit part numbers and plugs as ***X*.

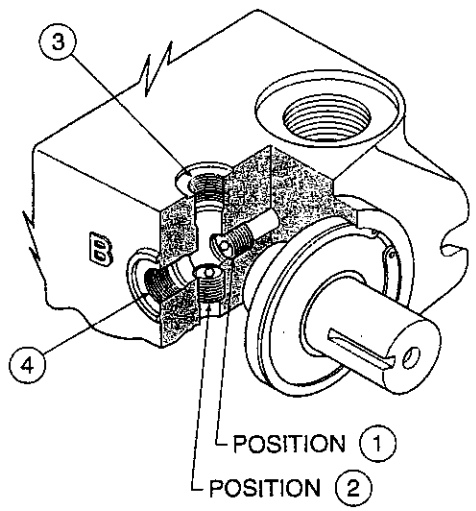


PAVC 33, 38, 65

Control Option	Position ①	②	③	④	⑤	
Omit	Open	800599	108 x 4	108 x 4	Omit	
A	102 x 1	800599	Open	108 x 4	787474	
C	102 x 1	800599	Open	108 x 4	787474	
H	Open	800599	108 x 4	108 x 4	Omit	(10)
M	800599	Open	Open	108 x 4	Omit	
ME	102 x 1	800599	Open	108 x 4	787474	
S	800599	Open	Open	108 x 4	Omit	(11)
SE	102 x 1	800599	Open	108 x 4	Omit	(11)
AM	102 x 1	800599	786635	Open	787474	
CM	102 x 1	800599	786635	Open	787474	(10)
HM	800599	Open	Open	108 x 4	Omit	(10)

PAVC100

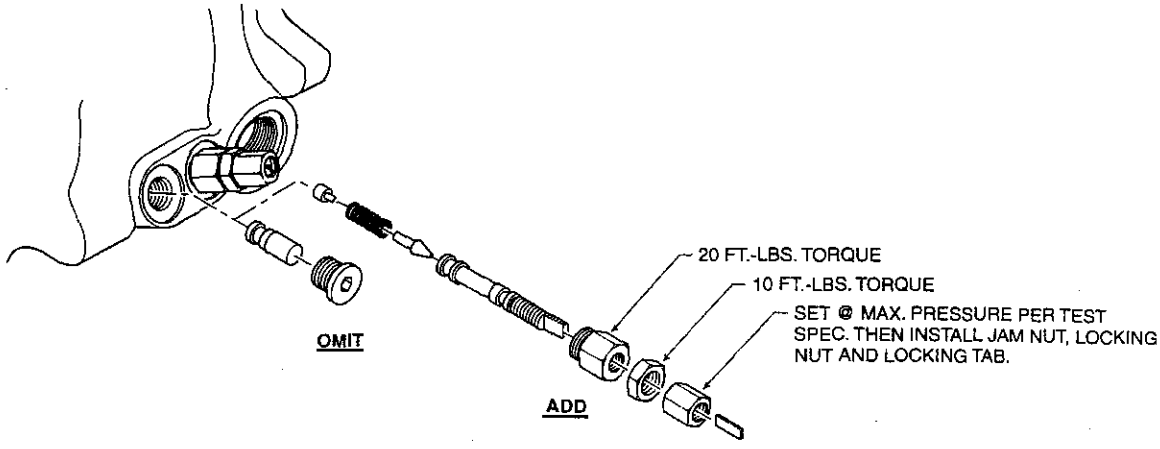
Control Option	Position ①	②	③	④	⑤	
Omit	Open	690870	108 x 4	108 x 4	Omit	
A	102 x 1	690870	Open	108 x 4	787474	
C	102 x 1	690870	Open	108 x 4	787474	
H	Open	690870	108 x 4	108 x 4	Omit	(10)
M	690870	Open	Open	108 x 4	Omit	
ME	102 x 1	690870	Open	108 x 4	787474	
S	690870	Open	Open	108 x 4	Omit	(11)
SE	102 x 1	690870	Open	108 x 4	Omit	(11)
AM	102 x 1	690870	786635	Open	787474	
CM	102 x 1	690870	786635	Open	787474	(10)
HM	690870	Open	Open	108 x 4	Omit	(10)



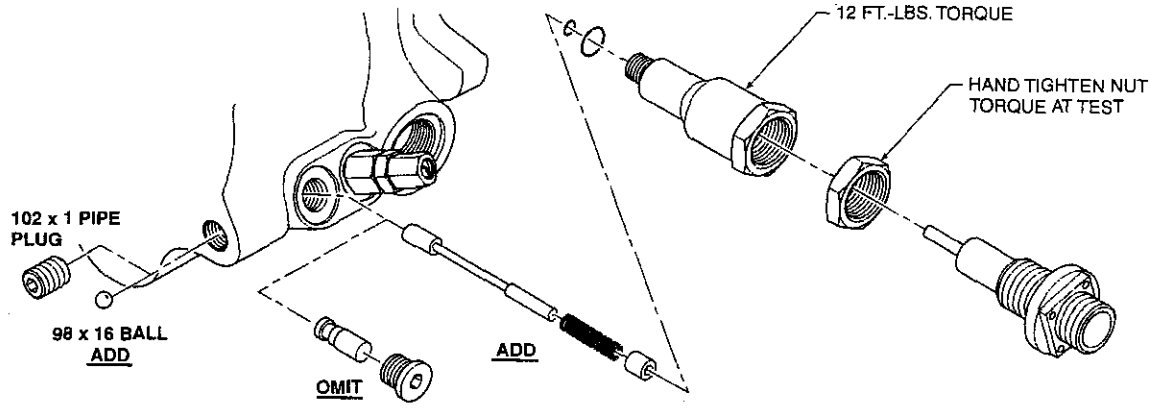
(10) **TORQUE (HP) CONTROL (See next page)**

(11) **VOLUME SERVO FEEDBACK (See next page)**

(10) CONTROL OPTION "C" & "H"
PRESS, POWER & FLOW COMP.

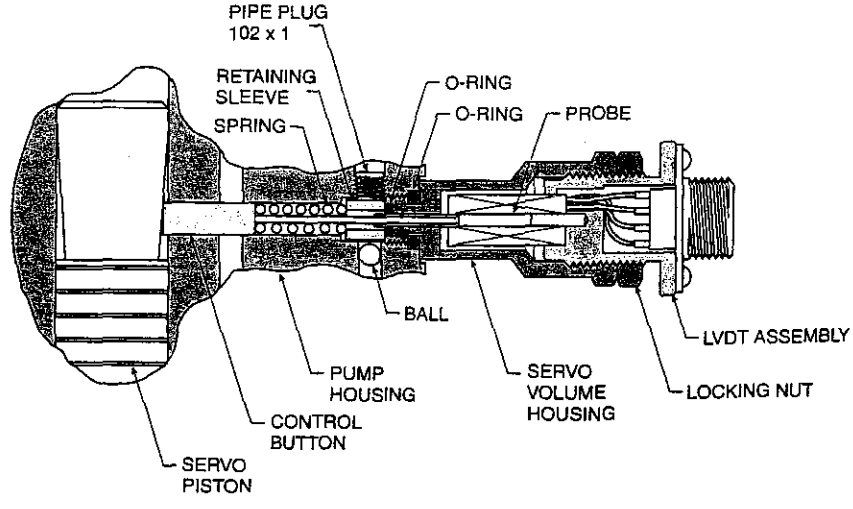


(11) CONTROL OPTION "S" & "SE"
SERVO VOLUME FEEDBACK



NOTE: Install ball through torque port, seat in place through bolt hole.

SERVO VOLUME ASSEMBLY



Use Of A Relief Valve

The use of a relief valve, while not mandatory is recommended in the main circuit to suppress hydraulic shock loads and additional system protection. If a minimum volume stop is used, the use of a relief valve is mandatory.

Fluid Recommendations

Premium quality hydraulic oil with a viscosity range between 150-250 SSU (30-50 cst.) at 100°F. (38°C.). Normal operating viscosity range between 80-1000 SSU (17-180 cst.). Maximum start-up viscosity is 4000 SSU (1000 cst.).

NOTE: Consult Parker when exceeding 160°F (71°C) operation. Oil should have maximum anti-wear properties, rust and oxidation treatment.

Filtration

For maximum pump and system component life, the system should be protected from contamination at a level not to exceed 125 particles greater than 10 microns per milliliter of fluid. (SAE Class 4/ISO 16/13). Due to the nature of variable displacement pumps, variations in pump inlet conditions, fluid acceleration losses, system aeration, and duty cycle we do not recommend suction line filters. We do recommend the use of a properly sized, in-tank suction strainer. Contact your Parker representative for assistance.

Start-Up

On initial start-up, the case should be filled with oil, pressure should be reduced and the circuit should be open or the air bled from the pump outlet to permit priming. Use of the airbleed is recommended on initial start-up. See Installation and Mounting Section to connect airbleed.

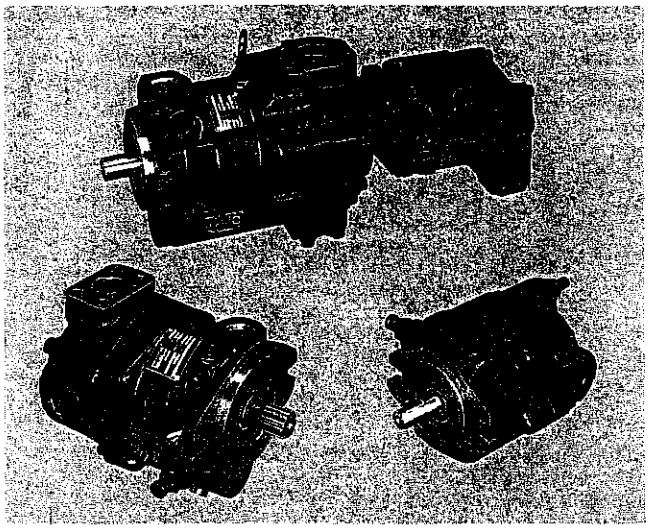
Inlet Conditions

Not to exceed 5 inches Hg. Vacuum at 1800 RPM on petroleum base fluids. See recommended speed spectrum for specific inlet conditions.

Shaft Rotation and Line Up

Pump and motor shaft alignment must be within .010 TIR maximum, using a standard floating coupling. Please follow coupling manufacturer's recommended installation instructions to prevent end thrust on pump shaft. Turn pump to assure freedom of rotation. Pump and motor must be on a rigid base.

The coupling should be sized to absorb the peak horsepower developed.



Installation and Mounting

When a PAVC Series Pump is mounted above the fluid level, the position of the "control drain" is not restricted but the inlet port should not be on the bottom. When a PAVC Series Pump is mounted below the fluid level the position of all ports are not restricted. The "control drain" should be a separate line to the reservoir and extend below the oil level as far from the inlet line as possible. The "control drain" line can be filtered and/or cooled (must not exceed 100 PSI (7 bar) back pressure). Suggested maximum line length is 10 feet.

A built in airbleed is standard on all PAVC 33, 38, 65 and 100 Pumps. To connect, remove airbleed drain plug and connect a line unrestricted to reservoir extending below minimum oil level. Back pressure in this line must not exceed 4 PSI (.28 bar).

Special Installations

Consult your Parker representative for any application requiring the following:

Pressure above rated, drive speed above maximum, indirect drive, fluid other than petroleum oil, oil temperature above 160°F (71°C).

Inlet Pressure

Not to exceed 25 PSI (1.72 bar).

Offer of Sale

The items described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors, are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any such item, when communicated to Parker Hannifin Corporation, its subsidiaries or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

1. Terms and Conditions of Sale: All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer. Acceptance of Seller's products shall in all events constitute such assent.

2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from Parker Hannifin Corporation. THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED.

NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGN OR SPECIFICATIONS.

5. Limitation of Remedy: SELLER'S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.

6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitations, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer's Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer, or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets (hereinafter "Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgements resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

Parker Hannifin Corporation
6035 Parkland Boulevard
Cleveland, Ohio 44124-4141
Telephone: (216) 896-3000
Fax: (216) 896-4031

Parker Hannifin Corporation

About Parker Hannifin Corporation

Parker Hannifin is a leading global motion-control company dedicated to delivering premier customer service. A Fortune 200 corporation, we are listed on the New York Stock Exchange with PH as our symbol. Our components and systems comprise over 1,000 product lines that control motion in a wide spectrum of essential uses in some 1,200 industrial and aerospace markets. Parker is the only manufacturer to offer its customers a choice of hydraulic, pneumatic, and electromechanical motion-control solutions. Our Company has the largest distribution network in its field, with over 6,000 distributors serving more than 300,000 customers worldwide.

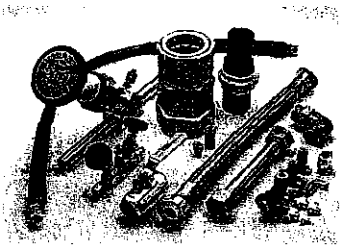
Parker's Charter

To be a leading worldwide manufacturer of components and systems for the builders and users of durable goods. More specifically, we will design, market and manufacture products controlling motion, flow and pressure. We will achieve profitable growth through premier customer service.

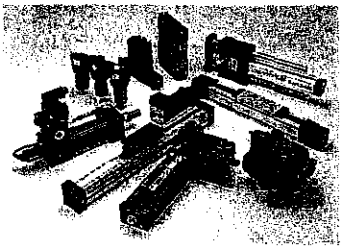
Product Information

Parker Hannifin's North American customers seeking product information, the location of a nearby distributor, or repair services will receive prompt attention by calling the Parker Product Information Center at our toll-free number: 1-800-C-PARKER (1-800-272-7537). In the UK, a similar service is available by calling : 0500-103-203.

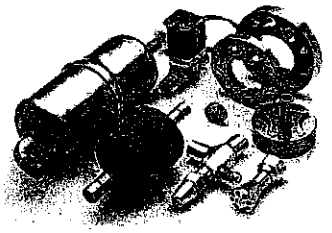
The Fluid Connectors Group designs, manufactures and markets hose, fittings, flexible connectors, instrumentation products and associated components used in fluid systems. It serves customers in the industrial, aerospace, marine, transportation, agriculture, and military markets.



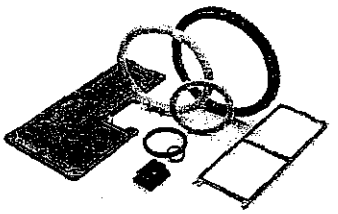
The Automation & Hydraulics Groups design, produce and market the full spectrum of components and systems to provide force, motion & control for industrial, mobile, marine, and energy related machinery and equipment. Hydraulic, pneumatic, and electromechanical solutions are offered.



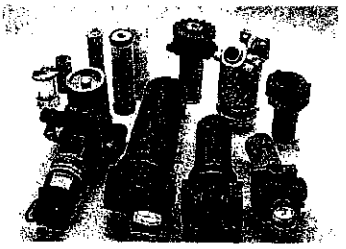
The Automotive & Refrigeration Group is a leading supplier of flow-control and fluid handling components, gerotors, and of systems support to worldwide refrigeration, air conditioning and automotive customers. Supplies high-pressure steam valves, general-purpose solenoids, and high-pressure cylinders.



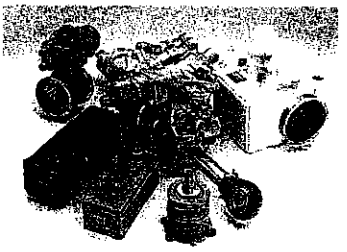
The Seal Group designs, manufactures and distributes industrial and commercial sealing devices and related products by providing superior quality and emphasizing total customer satisfaction in each of its markets.



The Filtration Group is a leading worldwide manufacturer and marketer of quality filtration and clarification products. Its goal is to provide customers with the best value, top quality, sound technical support, and global availability.



The Aerospace Group is a leader in the development, design, manufacture and servicing of hydraulic and fuel control systems and components for aerospace and related high-technology markets. It serves both commercial and military aviation customers around the world.



Parker Hannifin Corporation
Hydraulic Pump/Motor Division
100 Parker Drive
Otsego, Michigan 49078
Tel: (616) 694-9411
Fax: (616) 694-4638
Web site: http://www.parker.com

Catalog 2600-101/USA, 5M
8/97 IGS Printed in U.S.A.