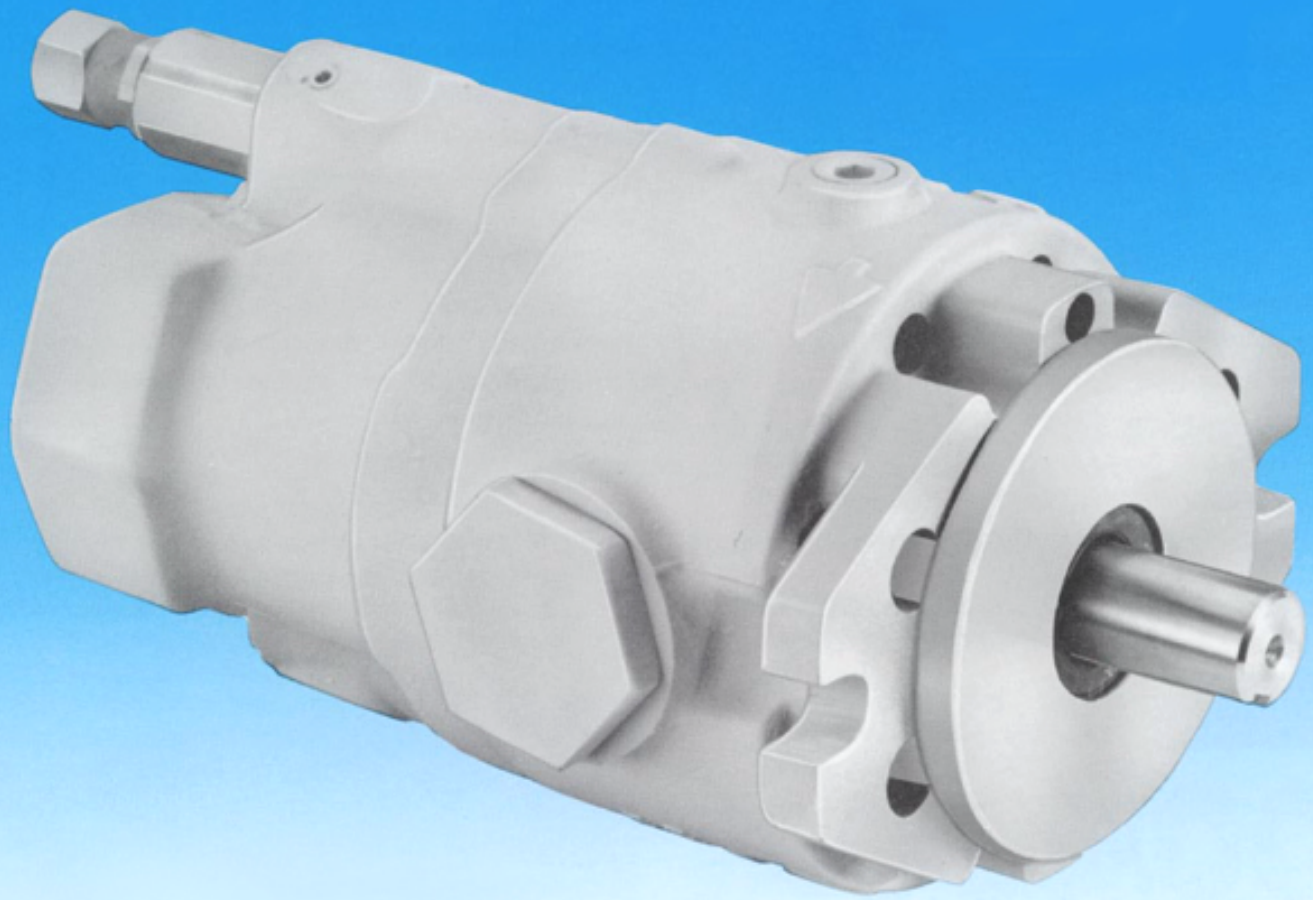

300/400 SERIES

ATMOSPHERIC INLET AXIAL PISTON PUMPS and MOTORS

HARTMANN CONTROLS INC.

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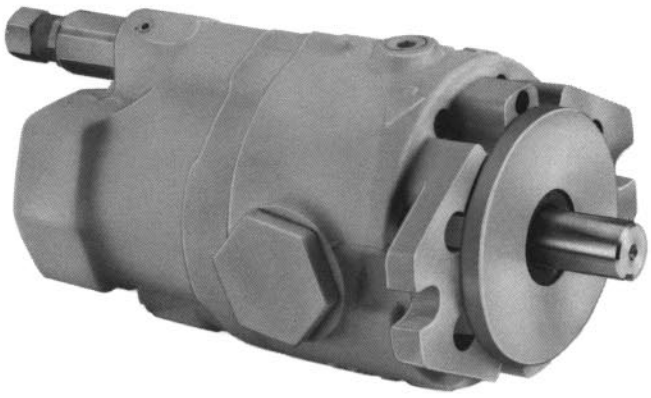
300/400 SERIES

ATMOSPHERIC INLET AXIAL PISTON PUMPS



GENERAL CHARACTERISTICS (Theoretical)

Specifications (Theoretical)	300 Series		400 Series	
Displacement, max.	3.2 in.³/rev.	52.0 ml./rev.	4.1 in.³/rev.	67.0 ml./rev.
Flow @ 1800 rpm	25 gpm	94.6 lpm	32.7 gpm	123.8 lpm
Operating Speed Minimum Rated Maximum with atmospheric inlet (6 in. Hg.)	 500 rpm 1800 rpm 2400 rpm		 500 rpm 1800 rpm 2200 rpm	
Operating Pressure (varies with model) Minimum Maximum, continuous With intermittent use up to	 0-400 psi 3000-4000* psi 4000-5000* psi	 0-28 bar 207-276* bar 275-345* bar	 0-400 psi 3000 psi 4000 psi	 0-28 bar 207 bar 275 bar
Power Output Rated, continuous duty	58.0 HP	43.0 kW	57.0 HP	42.0 kW
	*Heavy-Duty, High-Pressure Models			

300/400 SERIES ORDERING INFORMATION

DESIGN CODE	Basic Model Number					Options						
	P	V	3	20	R-	A	B	1-	A	1		C
EXAMPLE												

P - Pump
M - Motor

F - Fixed Displacement
V - Variable Displacement

3 - 300 Series (3.2 $in.^3$/rev.)
4 - 400 Series (4.1 $in.^3$/rev.)

Control Type:
00 - Fixed Unit — No Control
10 - Handwheel
20 - Std. Pressure Compensator
21 - Handwheel Adjustable Pressure Compensator
24 - Remote Pressure Compensator
25 - Load-Sensing (Flow Compensator)
30 - Remote Hydraulic
40 - Mechanical

Rotation (viewed from Shaft End):
R - Clockwise
L - Counter-Clockwise
D - Bidirectional (motors only)

Fluid Connections:
A - Std. on 300/400 Series—1 1/2" (3000 psi SAE 4 Bolt Split Flange Pad Inlet & Discharge)
B - SAE 1 7/8"-12 SAE Straight Thread O-Ring Port Inlet & Discharge (Required for Design Code #6 units)
C - 1 1/2" (3000 psi SAE 4 Bolt Inlet & 3/4 NPTF Discharge-HP limiter only)

Seals:
B - Std. Buna-N (Nitrile)—for Mineral Oil, Water-Glycol, Invert Emulsion
V - Viton—for Phosphate Ester, Hi-Temp. Service

Drive Shaft:
1 - Std. St. Keyed (1 1/8")
2 - SAE C Spline
5 - SAE C St. Keyed (1¼")

Displacement Control Options:
A - Fixed Volume Limit (Std. on Variable Displacement Units only-PV)
B - Adjustable Volume Limit
C - Handwheel Volume Limit
D - Hi-Low Volume Limit
E - Special Limited Max. Volume (contact factory)
F - Std. on Fixed Displacement Units (PF, MF)

Previous PV & MF models and parts are still available. Consult factory.

Separate Mounting Brackets & Adapters (shipped as separate items):
P/N 33269 - Foot Mounting Bracket Assy
P/N 33824 - SAE C 2 Bolt Drive Mounting Adapter

Other Options:
C - SAE C 2 Bold Adapter
D - Ductile End Cover
E - Extended Trunnion installed (Std. on all PV340, PV440)

"FR" Mounting Brackets & Adapters (Must be installed at factory):
C - SAE C 2 Bolt Drive Mount Adapter ("FR" only)
F - Foot Mounting Bracket Assy ("FR" only)

Design Code:
1 - Std. Unidirectional Pump Valve Plate
2 - Std. Bidirectional Motor Valve Plate
3 - Low Pressure Valve Plate
4 - Low Pressure Option (for control types 20-24)
5 - Special (refer to assy. dwg. for unique item)
6 - High Pressure High Cycle Service* (4000-5000 psi depending on model—for variable displacement models with control types 20-25)
*Requires Type B Fluid Connections
7 - Special "FR" Model for Fire Resistant, Water Base Fluid Service (Note: You must add either "C" or "F" for proper mounting with special "FR" mounts)

DESIGN FEATURES & BENEFITS

FEATURES:

A. Separate Valve Plate—Separate hardened alloy steel valve plate resists wear. Unidirectional designs include a precompression orifice from the discharge port to the approaching cylinder. This method allows a uniform, gradual pressure rise from inlet to outlet to minimize mechanical shock and the resultant noise. A decompression orifice communicates with the cylinder approaching the inlet port to the pump case. This decompresses the oil that remains in the cylinder after leaving the discharge port. This increases volumetric efficiency and promotes stiffer systems by providing a means to remove air-entrained oil from the circuit.

B. Forged Rotor—One-piece forged bronze rotor resists wear, pick-up, and fretting caused by fluid-borne contaminants or low-lubricity fluid conditions. Rotor is splined to permit axial motion to compensate for fluid film thickness and temperature changes.

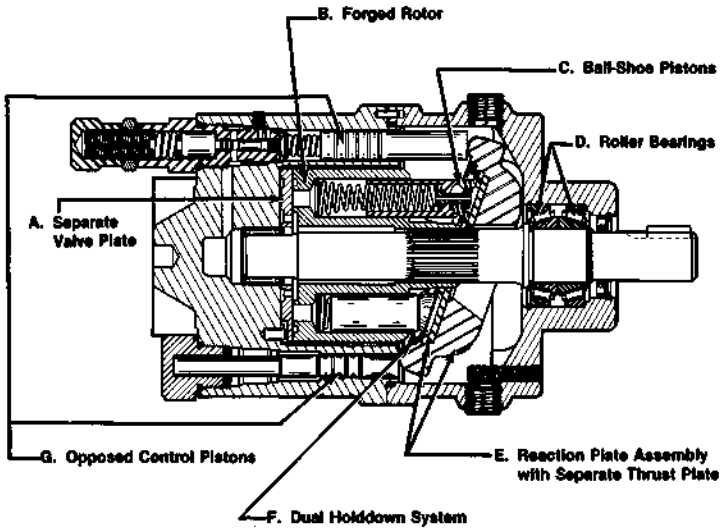
C. Ball-Shoe Pistons—The ball of the piston knuckle joint is formed on the piston shoe. This reduces the overall piston length and the resultant side force on the cylinder bores.

D. Roller Bearings—Dual, heavy duty, tapered roller bearings support the drive end of the input shaft. They are lubricated by the hydraulic fluid and designed to accept external side loads normally encountered in belt-drive applications.

E. Reaction Plate Assembly—Heavy forged steel reaction plate assembly has a separate hardened alloy steel thrust plate, to distribute wear and reduce repair costs.

F. Dual Holddown System—Individual piston springs preload the entire piston assembly against the thrust plate. A fixed-clearance mechanical retainer assembly holds the piston shoes against the thrust plate. Compared to single-spring holddown systems, which retain only the piston shoe, this method reduces mechanical lash, wear of the piston knuckle, and related noise generation.

G. Opposed Control Pistons—Displacement changes are rapid and stable due to the high positioning force available from the line pressure operated controls. The opposed pistons hydraulically "clamp" the displacement changing mechanism for optimal delivery stability.



BENEFITS:

Lower System Costs
The high pressure capability of these units permit the use of smaller size system components to handle the same horsepower at lower cost. Heavy duty shaft bearings accept overhung loads, eliminating the need for a countershaft on most indirect drives.

Lower Operating Costs
High overall efficiencies and power-saving controls reduce power consumption and cooling requirements.

Extended Service Life
Tough alloy bronze mated to hardened alloy steels in the rotating group, and heavy duty bearings are used throughout the pump to provide long life operation.

Repairable
Designed to permit easy field service. All parts subject to wear are field serviceable.

Low Noise Levels
Preloaded pistons, unique port timing, and rigid case construction yield low noise levels (PV320 83.5 dBa at 1800 RPM, 4000 psi, 24 GPM).

300/400 SERIES
GENERAL INFORMATION

OPERATING PRINCIPLES:

These pumps are of axial piston, inline design and are available in either fixed or variable displacement versions.

The drive shaft is splined to the pump rotor, which carries seven pistons located axially about its axis. Each piston has a shoe that is free to pivot and rotate. The shoes bear against a reaction plate, which is angled with respect to the axis of the pump. The port end of the rotor seals against the port plate with its two arcuate openings. These connect with the inlet and outlet port of the pump. The rotor is free to move axially to compensate for wear and fluid film variations caused by pressure and temperature.

During the inlet period of the pumping cycle, the piston assemblies are held against the angled thrust plate. A fixed clearance holddown plate rotates at shaft speed behind the shoes, positively preventing piston liftoff under adverse operating conditions.

The shoes bear against the cam surface of the thrust plate. The thrust plate rotates slowly in the reaction plate to distribute the effects of wear. Rotation of the shaft causes the pistons to reciprocate as they follow the cam surface to accept fluid from the inlet port and displace it to the outlet port.

The reaction plate angle determines the piston stroke and thus the displacement of the pump. This angle is fixed in fixed displacement units, and infinitely variable in the variable displacement units.

Wear is reduced to a minimum in these units through selection of optimal materials, unique shock suppression techniques, and hydrostatically balanced design. Hardened alloy steel parts mate with high strength bronze material for superior durability.

FLUID RECOMMENDATIONS

A. Petroleum Based Fluids

Viscosity*: Maximum at cold start — 5000 SUS
Maximum at full power — 300 SUS
Minimum — 100 SUS
*At 100°F (38°C)
Viscosity Index: 90 VI

The fluid recommended for use in these pumps and motors has a petroleum base and contains agents which provide oxidation inhibition and anti-rust, antifoam, and deaerating properties.

B. Fire-Resistant Fluids

There are applications which require fire-resistant fluids.

They will give good service if the system is originally designed for their use. Permissible fluids include: synthetics, water glycols and water in oil emulsions, although pump life can be shortened dependent on the fluid used.

Consult Hartmann Controls for written advice and for design requirements and warranty limitations for the particular fire-resistant fluid contemplated.

See page 7 for more information on the "FR" Series pumps.

RATING AND CAPABILITIES

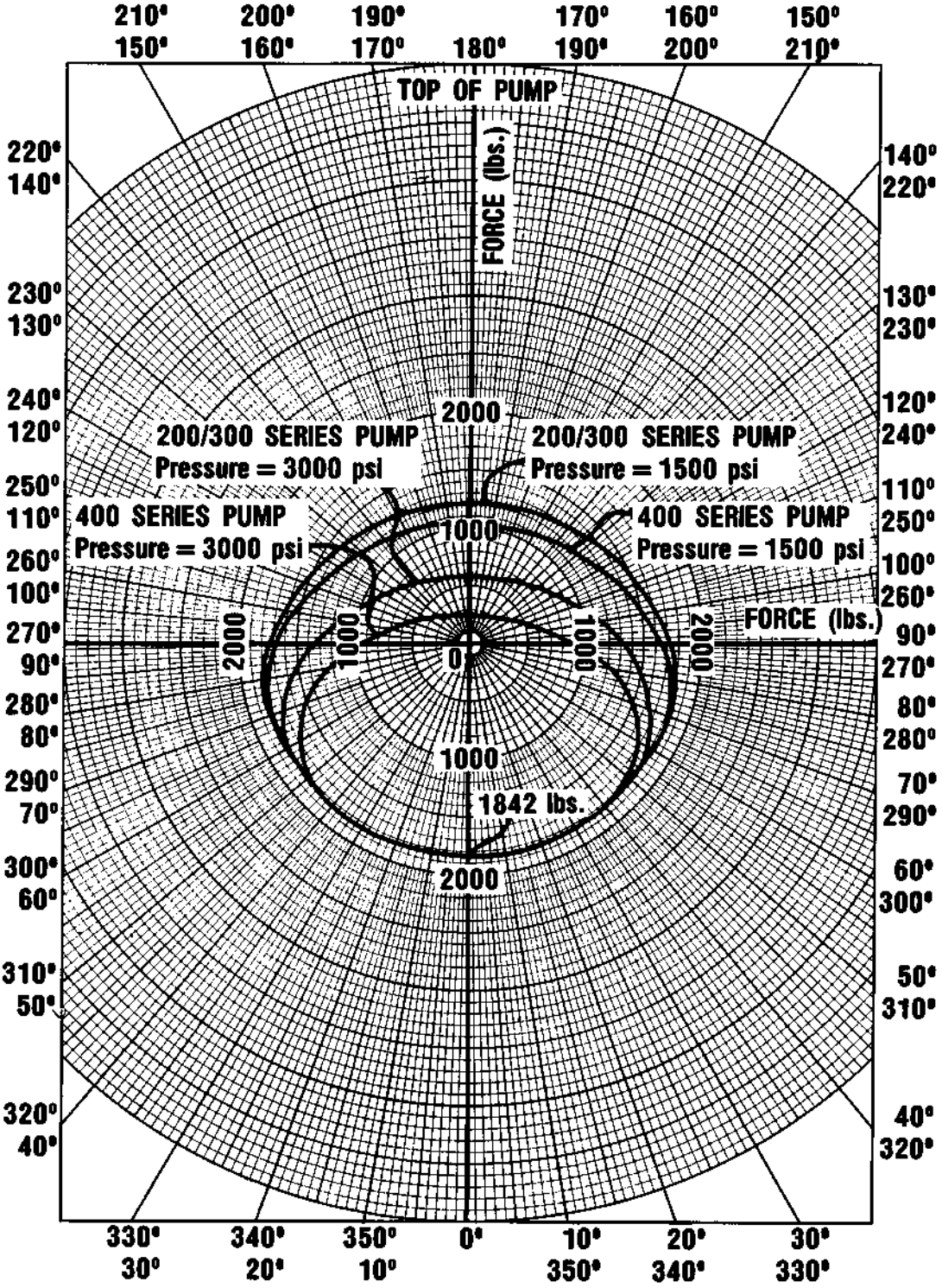
All ratings shown in this designers' guide were computed under normal operating conditions, which insures maximum life for the average application using a high quality mineral base hydraulic fluid. Warranty is based on these ratings.

TO INSURE WARRANTY COVERAGE, consult Hartmann Controls for written advice before applying units in applications that require operation at other than rated levels.

In lieu of written advice from Hartmann Controls and compliance with this advice, NO WARRANTY SHALL APPLY.

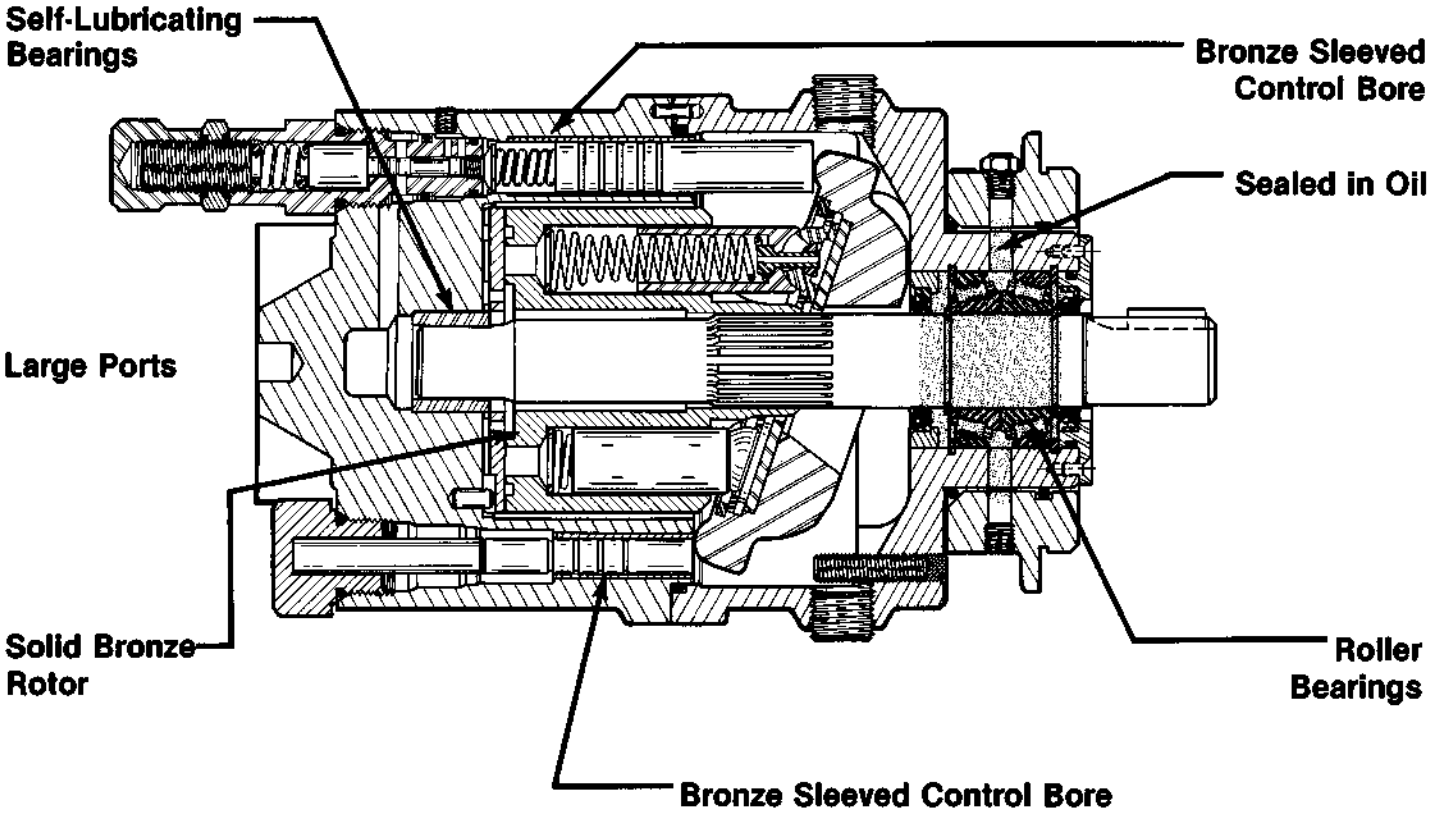
ALLOWABLE EXTERNAL BELT OR GEAR FORCE VS. DIRECTION OF FORCE

B-10 Life = 5000 hrs.
1800 RPM



PUMPS & MOTORS FOR FIRE RESISTANT FLUIDS

- **Designed to be used up to 3000 psi and 1800 rpm**
- **Improve plant safety**
- **Lower fluid cost**
- **Reduce pollution**



These pumps and motors are designed specifically to handle fire resistant fluids such as water glycols and invert emulsions up to 3000 psi and 1800 rpm. The rolling element bearings at the drive shaft end of the pump are sealed in an oil bath, separating them from the "FR" fluid. Self-lubricating bearings are used on the reaction plate and drive shaft tail for maximum support. Chrome plated control pistons ride in bronze sleeved control bores providing excellent bearing qualities.

Models available include:
PF 300, MF 300,
PF 400, MF 400 - Fixed Displacement
PV 310, PV 410 - Handwheel
PV 320, PV 420 - Standard Pressure Compensator
PV 324, PV 424 - Remote Pressure Compensator
PV 325, PV 425 - Load-Sensing Control

For higher ratings, contact factory.

"FR" Series Option (Mounts must be installed at the factory.)

Design Code "FR" Series	Mounting Bracket Or Adapter Installed	Specify When Pump to be Mounted -
7C	SAE C 2-Bolt Drive Mount Adapter	- on a bell housing or accessory gearcase
7F	Foot Mounting Bracket Assy	- separately from the electric motor

"FR" Series Pumps & Motors have been tested for endurance using these fire resistant fluids:
Invert Emulsion — Mobil Pyrogard D or equivalent
Water Glycol — Houghton Houghto-Safe 620 or equivalent
"95-5" — Contact factory

FIXED DISPLACEMENT (Pumps & Motors)

MODELS 300/400

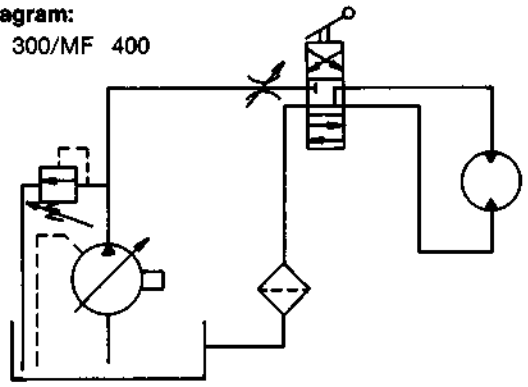
Fixed displacement motors and pumps cannot be regulated. The displacement (flow rate) is determined by the angle of the reaction plate support and the drive speed. They are normally set for maximum displacement, but can be supplied on special order set for reduced displacement.

The output torque of a fluid motor is a function of the pressure and displacement. Generally they should be used where the torque requirements are fairly constant throughout the speed range of a particular application. Under all operating conditions the oil pressure at either port must not fall below atmospheric pressure,

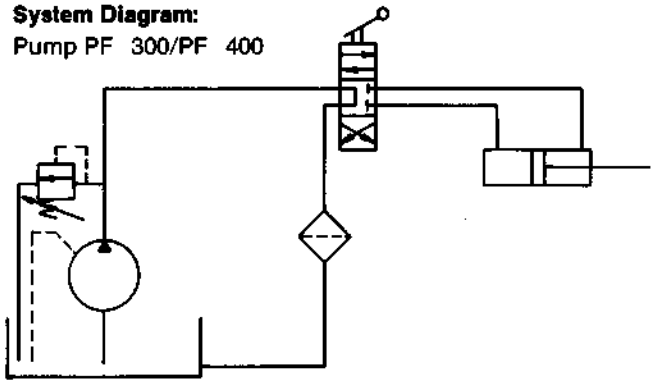
Motor drive shaft rotation is bidirectional (oil flow can be reversed—see chart).

Unlike motors, the pump drive shaft rotation is unidirectional (oil flows in one direction only—see chart). A pressure relief valve must be incorporated into the circuit for both pumps and motors.

System Diagram:
Motor MF 300/MF 400



System Diagram:
Pump PF 300/PF 400



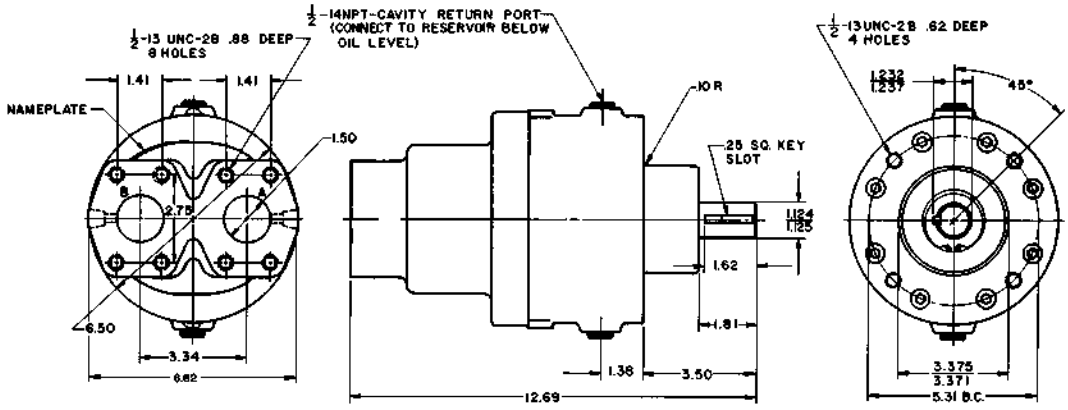
Drive Shaft Rotation

Motor	Rotation of shaft*	Oil Flow	Ports** Inlet	Ports** Outlet
MF 300 & MF 400	D(CW or CCW)	CW	A	B
		CCW	B	A

Drive Shaft Rotation

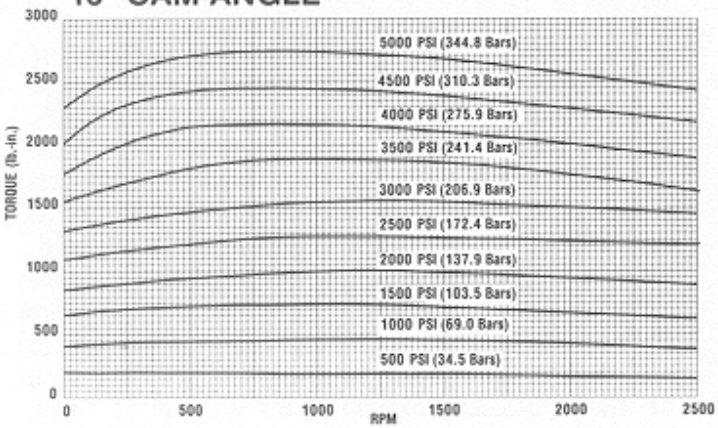
Pump	Rotation of shaft*	Oil Flow	Ports** Inlet	Ports** Outlet
PF 300 & PF 400	R(CW only)	CW	A	B
	L(CCW only)	CCW	B	A

*As viewed from the front or shaft end.
**As viewed from the port end (nameplate up).

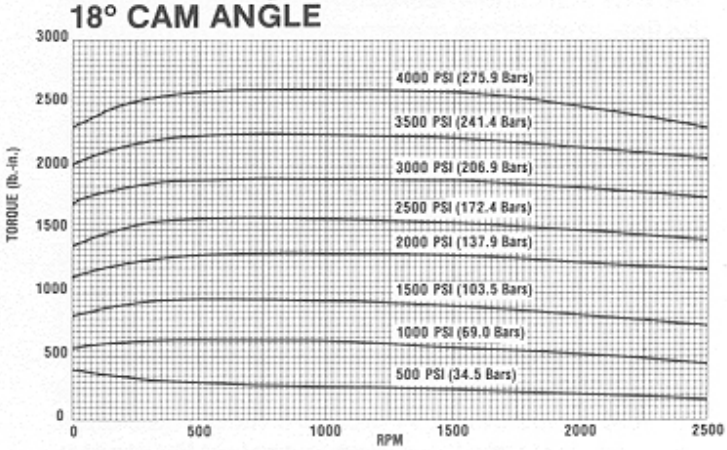


TYPICAL PERFORMANCE — MODELS 300/400

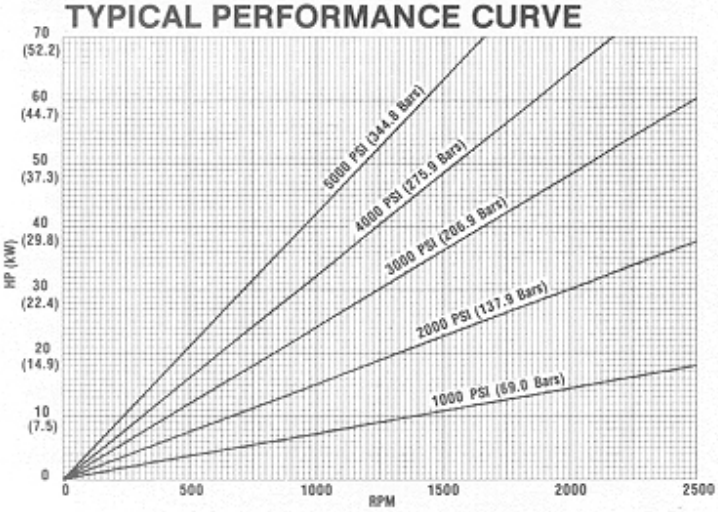
MF 300 FIXED DISPLACEMENT MOTOR 18° CAM ANGLE



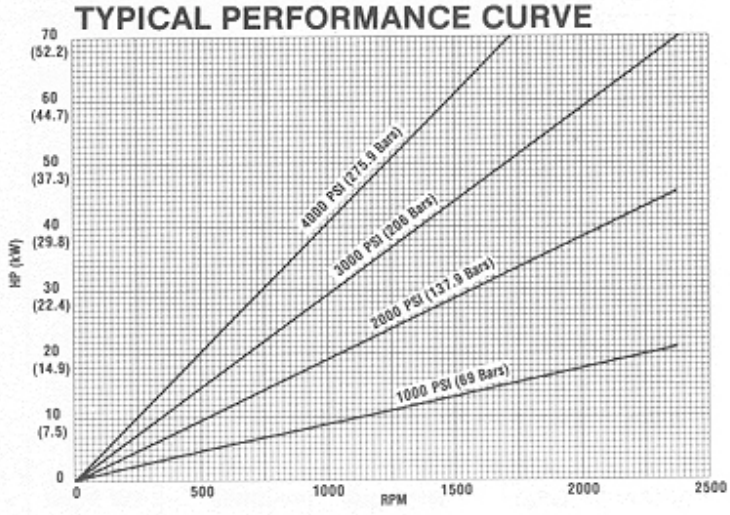
MF 400 FIXED DISPLACEMENT MOTOR 18° CAM ANGLE



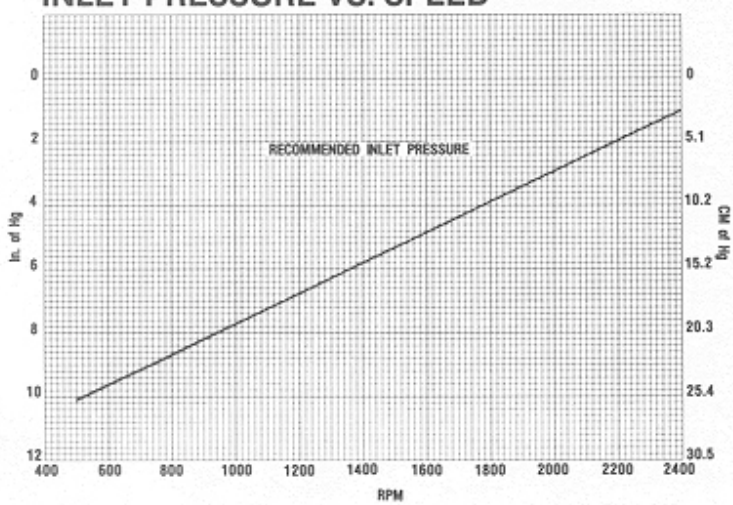
PF 300 FIXED DISPLACEMENT PUMP TYPICAL PERFORMANCE CURVE



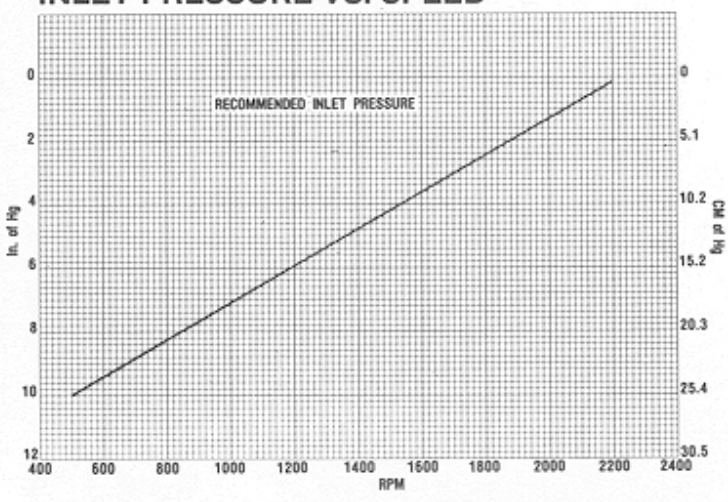
PF 400 FIXED DISPLACEMENT PUMP TYPICAL PERFORMANCE CURVE



PF 300 SERIES AXIAL PISTON PUMP INLET PRESSURE VS. SPEED



PF 400 SERIES AXIAL PISTON PUMP INLET PRESSURE VS. SPEED



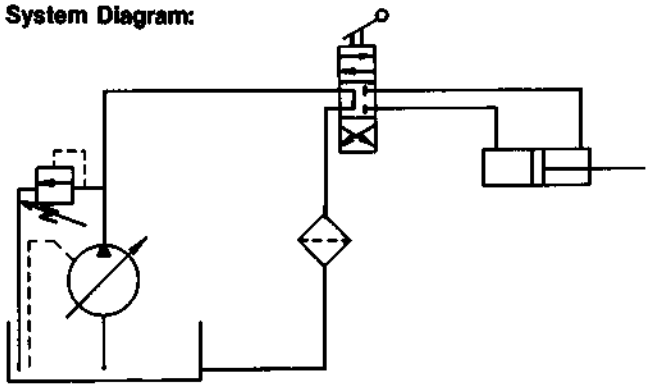
Higher RPM's can be attained by supercharging inlet. Consult factory.

HANDWHEEL
VARIABLE DISPLACEMENT PUMPS

MODELS 310/410

The external handwheel control manually regulates the flow from zero to maximum delivery by means of a threaded extension that is used to position the angle of the reaction plate. Changing this angle controls the length of the piston stroke, thereby increasing or decreasing displacement of the pump. Rotating the handwheel one turn results in approximately 1° change in the angle of the reaction plate. One turn of the handwheel changes the flow approximately 1.50 gpm at 1800 rpm (5.7 L/min at 1800 rpm) on the PV 310 series pump. One turn of the handwheel changes the flow approximately 2.0 gpm at 1800 rpm (7.6 L/min at 1800 rpm) on the PV 410 series pump. **A pressure relief valve must be incorporated in the circuit to protect the system from excessive pressures.**

System Diagram:



Typical Performance PV 310 Pumps

RPM	HP at 100 PSI GPM	HP at 100 PSI HP Input	kW at 100 PSI L/min	kW at 100 PSI kW Input
1200	15.6	1.89	59.0	1.41
1500	19.7	2.86	74.6	2.13
1800	24.1	3.20	91.2	2.39
2400	31.1	3.75	141.9	2.80

Typical Performance PV 410 Pumps

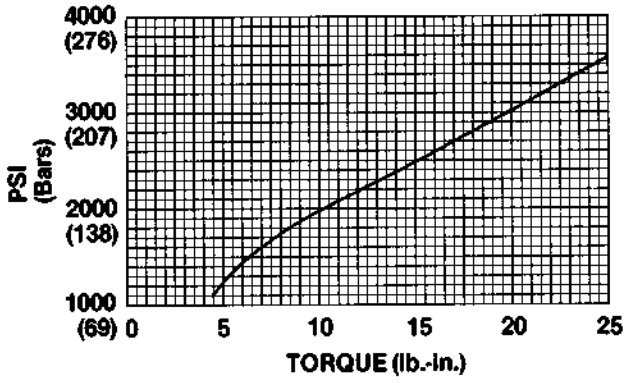
RPM	HP at 100 PSI GPM	HP at 100 PSI HP Input	kW at 100 PSI L/min	kW at 100 PSI kW Input
1200	21.3	2.47	93.5	1.84
1500	26.4	3.32	99.9	2.48
1800	32.2	4.16	125.7	3.10
2200	38.3	5.30	200.6	3.95

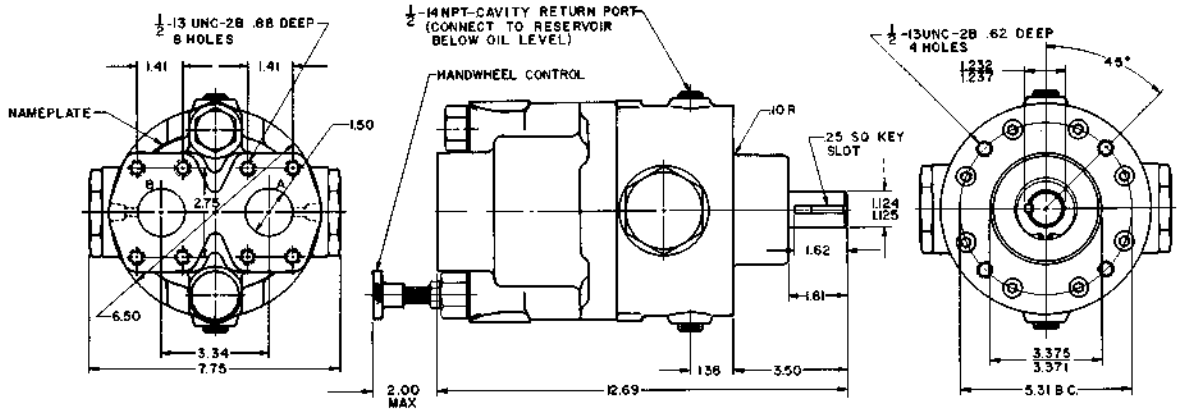
Drive Shaft Rotation

Pump	Rotation of shaft*	Oil Flow	Ports** Inlet	Ports** Outlet
PV 310 & PV 410	R(CW only)	CW	A	B
	L(CCW only)	CCW	B	A

*As viewed from the front or shaft end.
**As viewed from the port end (nameplate up).

Torque Required to Turn Handwheel Control





STANDARD PRESSURE COMPENSATOR VARIABLE DISPLACEMENT PUMPS

MODELS 320/420

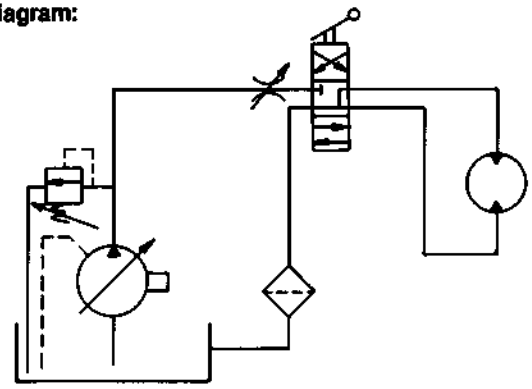
When this control has been set at the desired pressure, the pump will automatically deliver maximum flow until the preselected pressure has been reached. It will then automatically maintain the output pressure. Simultaneously, the output volume and power requirements are automatically reduced to the amount necessary to maintain this set pressure.

This is how the pressure compensator control operates. When the pump first starts, a starter spring forces the cam reaction plate off-center, to partial pumping position. As pressure builds up, discharge pressure is ported to the compensator spool and the larger of the two control piston bores through an orifice, forcing the reaction plate to the maximum displacement position.

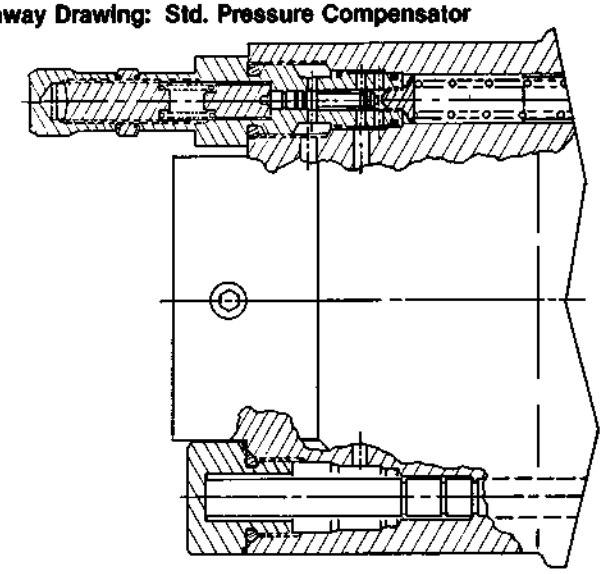
If the preset discharge pressure is exceeded, the compensator spool will open, dropping the pressure on the large control piston. The bore of the lower, or smaller, control piston is also ported to discharge pressure. When the compensator control valve relieves the pressure against the upper control piston, the high pressure against the lower control piston forces the cam reaction plate toward neutral reducing pump flow.

Compensator pressure is adjustable from 500 PSI to maximum design pressure of the unit. **Relief valves are recommended in all systems and should be set at 10% over the desired compensator setting.** In systems using accumulators or pressure compensated flow control valves, a check valve must be installed at the pump outlet port. This is desirable in all systems.
Note: Contact factory for lower pressure settings.

System Diagram:



Cutaway Drawing: Std. Pressure Compensator

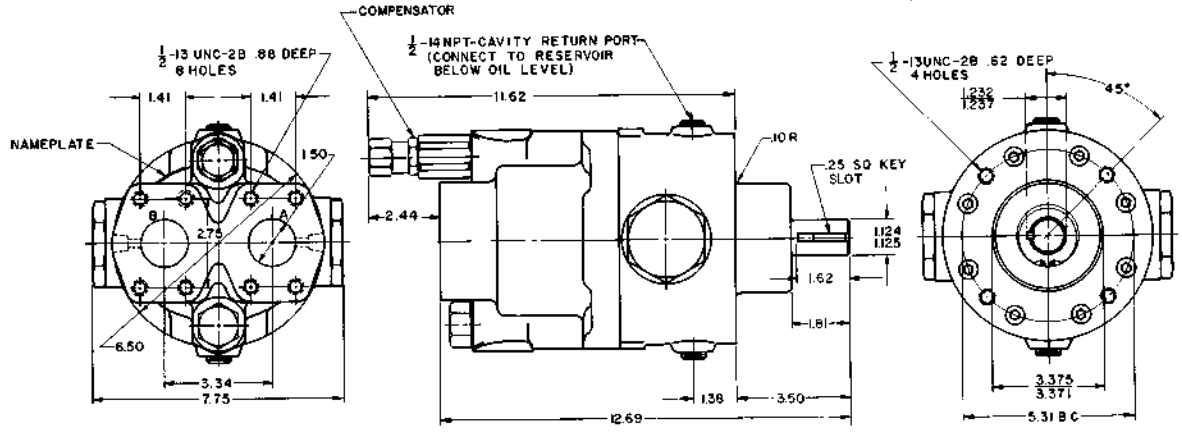


Optional Volume Limit Displacement Control available (see page 22).

Drive Shaft Rotation

Pump	Rotation of shaft*	Oil Flow	Ports** Inlet	Outlet
PV 320 & PV 420	R(CW only)	CW	A	B
	L(CCW only)	CCW	B	A

*As viewed from the front or shaft end.
**As viewed from the port end (nameplate up).

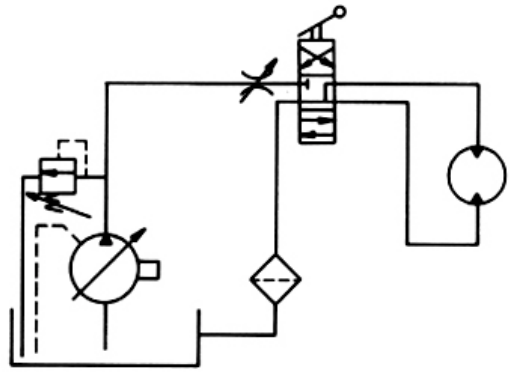


HANDWHEEL PRESSURE COMPENSATOR VARIABLE DISPLACEMENT PUMPS

MODELS PV321 & PV421

For description of operation, see the standard pressure compensator pump model PV 320. In addition to the standard pressure compensator features, these control types offer a handwheel on the pressure compensator to facilitate easy manual adjustment of compensating pressures.

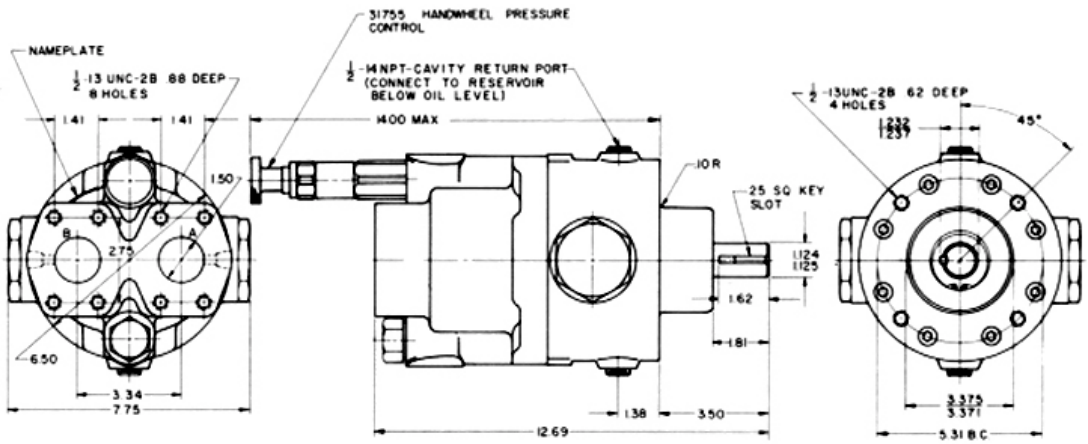
System Diagram:



Drive Shaft Rotation

Pump	Rotation of shaft*	Oil Flow	Ports** Inlet	Outlet
PV 321 & PV 421	R(CW only)	CW	A	B
	L(CCW only)	CCW	B	A

*As viewed from the front or shaft end.
**As viewed from the port end (nameplate up).



REMOTE PRESSURE COMPENSATOR VARIABLE DISPLACEMENT PUMPS

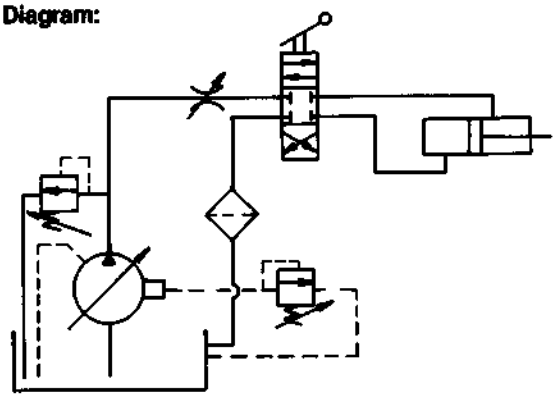
MODELS 324 & 424

The remote pressure compensator control is designed for those applications where frequent adjustment of the compensating pressure and/or multiple pressure control circuits is desired. It adjusts pump delivery automatically to meet system flow requirements while maintaining the preselected pressure.

The compensator pressure setting is determined by the setting of the pilot relief valve, located at a convenient position remote from the pump. When the pump discharge pressure is below the setting of the remote valve, fluid is ported through the compensator valve spool to the large control piston, stroking the pump. When the discharge pressure reaches the desired setting, the relief valve opens and the compensator valve opens reducing pump flow to maintain the set pressure.

The remote compensator can be used in a two pressure (hi-low) circuit by adding a two-way valve between the pilot line to the remote relief valve and reservoir. When the two way valve is open, system compensating pressure is determined by the spring setting in the compensator valve. When the two-way valve is closed, system pressure increases to the sum of the spring setting and the setting of the remote relief valve. Additional two-way valves and relief valves connected in a series between the pilot line and the reservoir can be included to obtain intermediate pressure settings. Distances between pump and control of 50 feet or less can be used without affecting pump response time. For systems that require distances from pump to control in excess of 50 feet, contact the factory.

System Diagram:



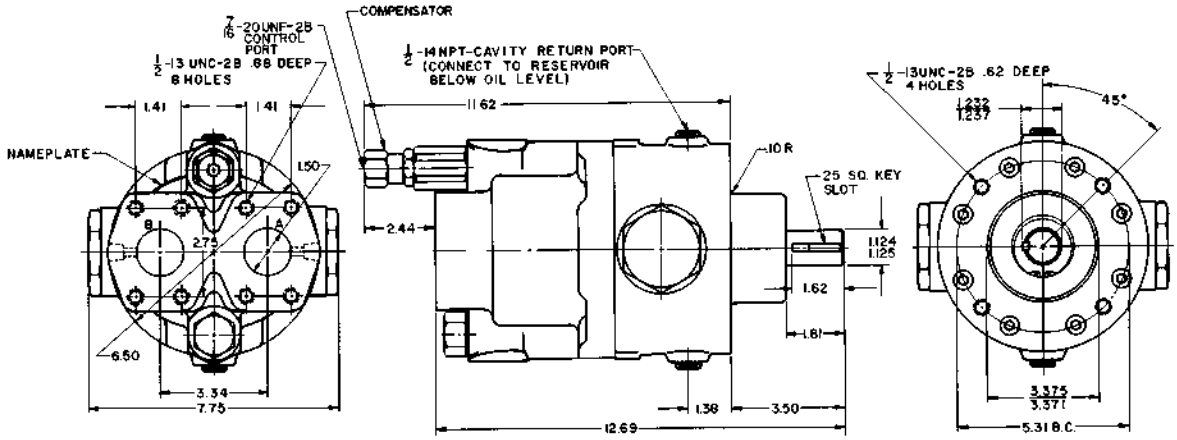
Relief valves are recommended in all systems and should be set at 10% over the desired compensator setting. In systems using accumulators or pressure compensated flow control valves, a check valve must be installed at the pump outlet port. This is desirable in all systems.

OPTIONAL ADJUSTABLE VOLUME — The maximum desired volume to be pumped can be controlled by the volume limit adjustment. This adjustment screw limits the maximum angle of the reaction plate to a predetermined maximum. (See page 22).

Drive Shaft Rotation

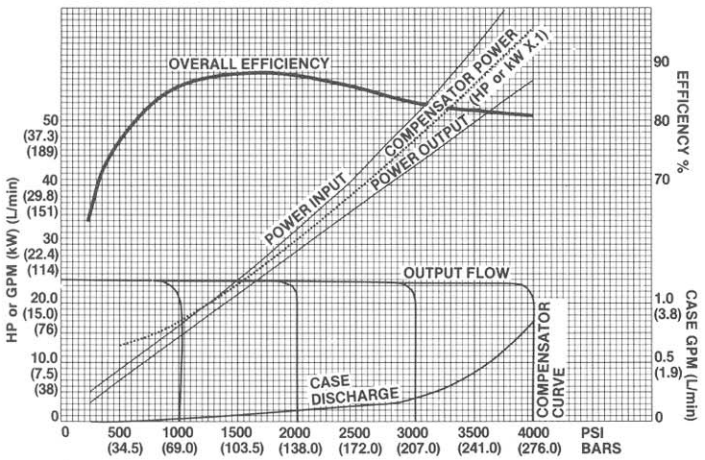
Pump	Rotation of shaft*	Oil Flow	Ports** Inlet	Outlet
PV 324 & PV 424	R(CW only)	CW	A	B
	L(CCW only)	CCW	B	A

*As viewed from the front or shaft end.
**As viewed from the port end (nameplate up).

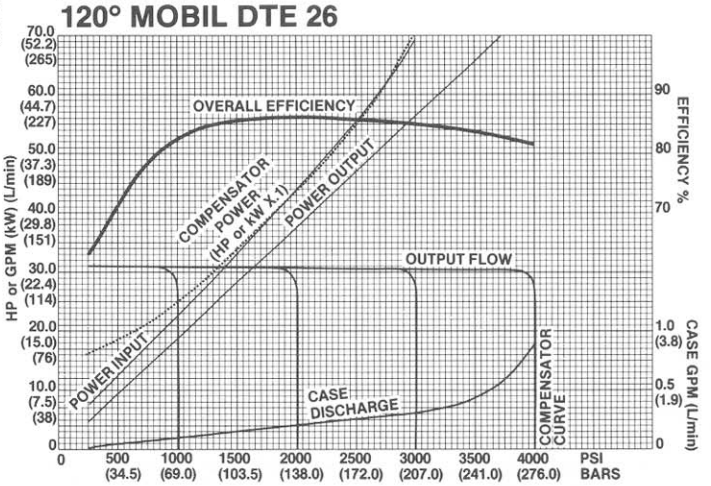


TYPICAL PERFORMANCE — MODELS 320/420

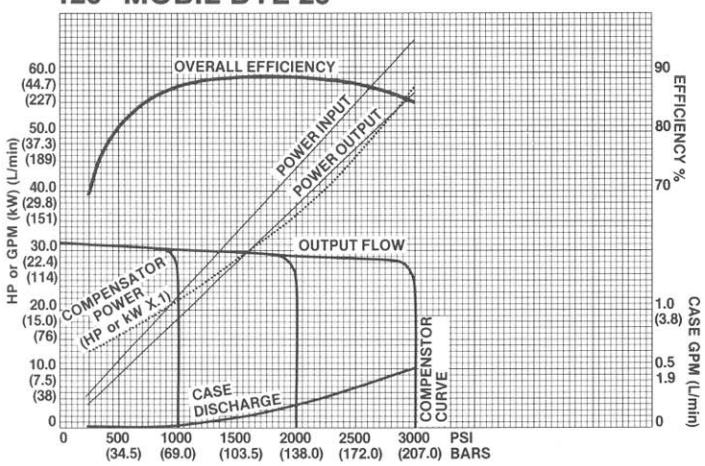
PV 320
1800 RPM
120° MOBIL DTE 26



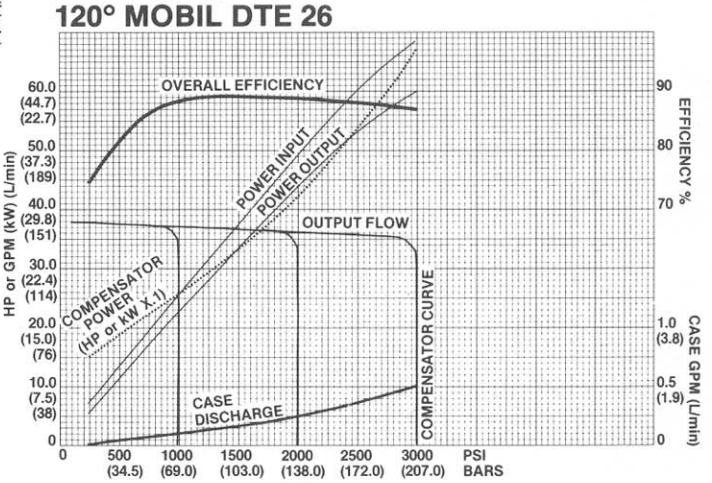
PV 320
2400 RPM
120° MOBIL DTE 26



PV 420
1800 RPM
120° MOBIL DTE 26



PV 420
2200 RPM
120° MOBIL DTE 26



LOAD SENSING CONTROL (FLOW COMPENSATOR) VARIABLE DISPLACEMENT PUMPS

MODELS 325 & 425

The constant volume control responds to a pressure drop across an orifice and can be used effectively in two different control modes.

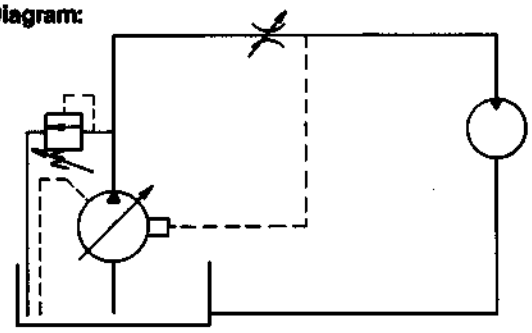
In one system let's assume the requirement is to provide a constant flow of 10.5 gpm regardless of pump input speed within the limits of the pump. This system will use a fixed orifice sized at 10.5 gpm at 150 psi pressure drop. The PV 325 pump will deliver 8 gpm at 600 rpm; the PV 425 pump will deliver 10.5 gpm at 600 rpm. As the pump speed increases, flow will increase resulting in increased pressure drop across the fixed orifice. This signal is fed back to the sensor which adjusts the reaction plate angle to re-establish the 150 psi pressure drop across the orifice, thus maintaining a fixed flow of 10.5 gpm from the pump. At maximum pump speed the reaction plate will be a relatively small angle to deliver this fixed flow. As pump speeds decrease, the pressure drop across the orifice falls resulting in the pump control repositioning the reaction plate at a larger displacement to maintain constant flow into the circuit.

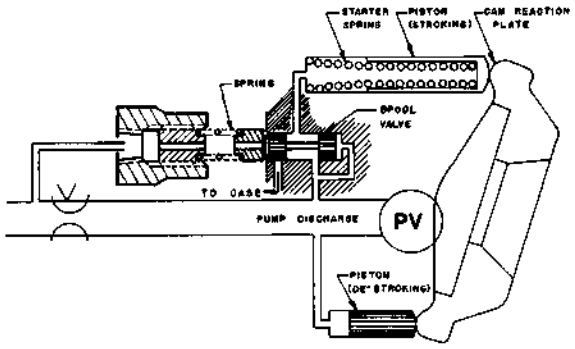
Note: As speed decreases torque increases if discharge flow and pressure remain constant.

The other system involves a remote variable flow requirement with a fixed input speed to the pump. This system operates on the same principles as outlined above except a variable orifice is used. As the orifice is varied the reaction plate will assume an angle to satisfy the 150 psi pressure drop requirement across the orifice.

With a given orifice, and from no load to full load, the pump will provide a constant flow within ± 10%. **A relief valve is required in all systems.**

System Diagram:



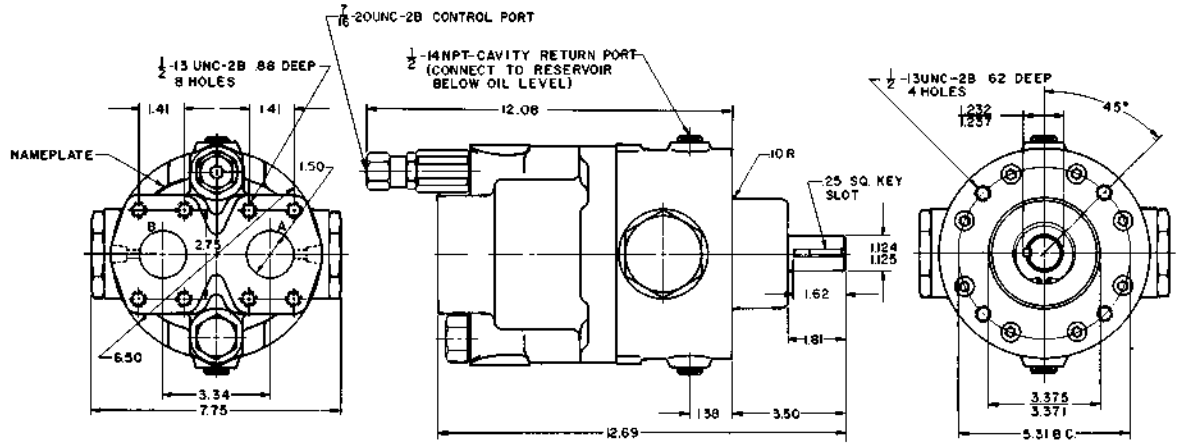


OPTIONAL ADJUSTABLE VOLUME — The maximum desired volume to be pumped can be controlled by the volume limit adjustment. This adjustment screw limits the maximum angle of the reaction plate to a predetermined maximum. (See page 22.)

Drive Shaft Rotation

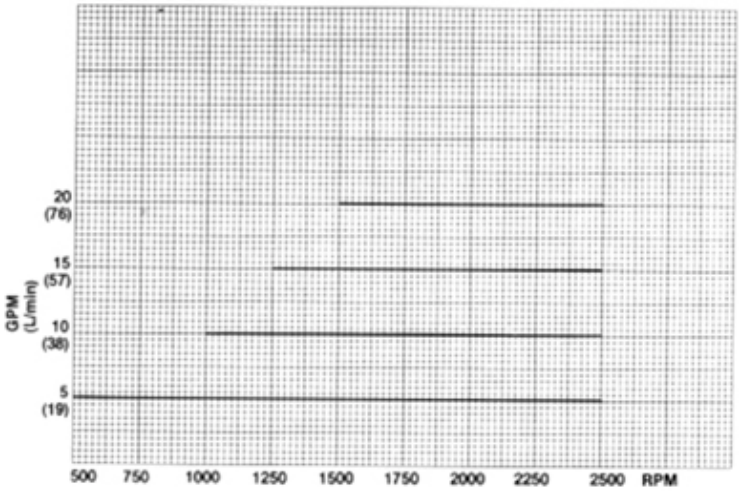
Pump	Rotation of shaft*	Oil Flow	Ports** Inlet	Outlet
PV325 & PV425	R(CW only)	CW	A	B
	L(CCW only)	CCW	B	A

*As viewed from the front or shaft end.
**As viewed from the port end (nameplate up).

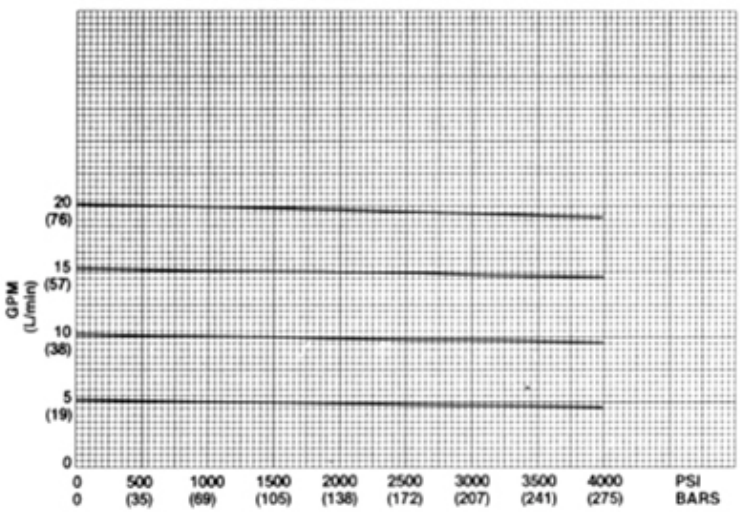


TYPICAL PERFORMANCE — MODELS 325 & 425

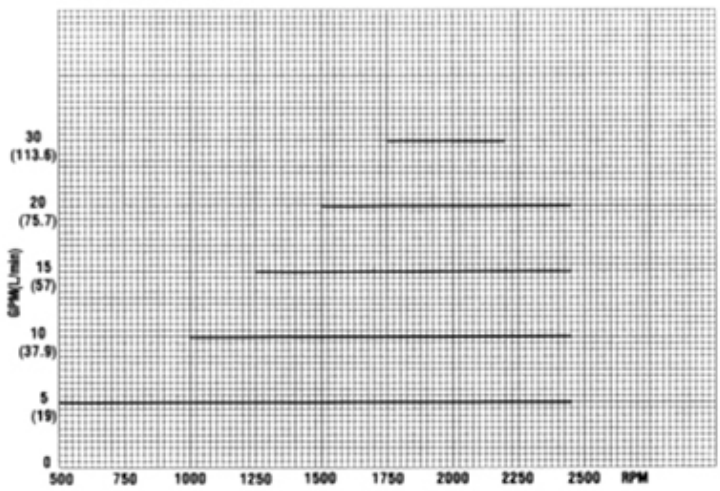
PV 325 LOAD SENSING (FLOW COMPENSATOR) PUMP
TYPICAL CURVE
FLOW VS. RPM



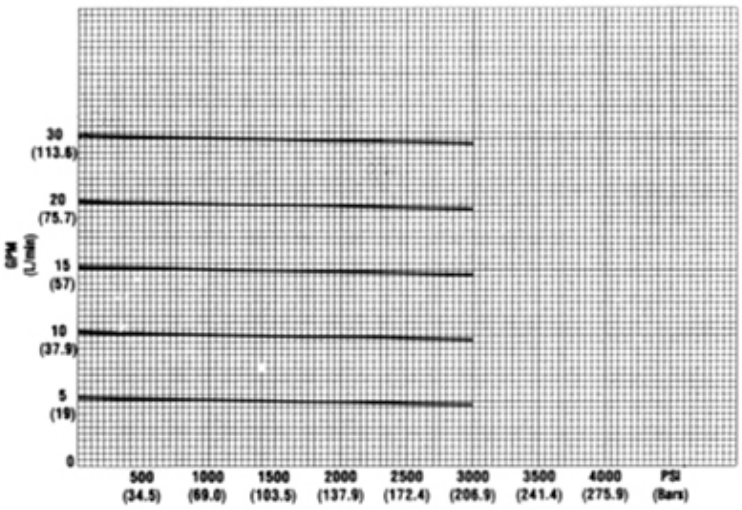
PV 325 LOAD SENSING (FLOW COMPENSATOR) PUMP
TYPICAL CURVE
FLOW VS. PRESSURE



PV 425 LOAD SENSING (FLOW COMPENSATOR) PUMP
TYPICAL CURVE
FLOW VS. RPM



PV 425 LOAD SENSING (FLOW COMPENSATOR) PUMP
TYPICAL CURVE
FLOW VS. PRESSURE

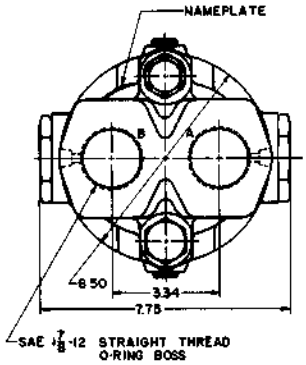


OPTIONS

FLUID CONNECTIONS:

Option B: SAE 1 7/8-12 Straight Thread O-ring Boss Port Inlet and Discharge

This option is required for high pressure service above 3000 psi for 300 and 400 Series Units.



Design Code:

Option 6: High Pressure/Heavy Duty

When this option is specified the internal design of the pump is modified for service above 3000 psi and/or high cycle service.

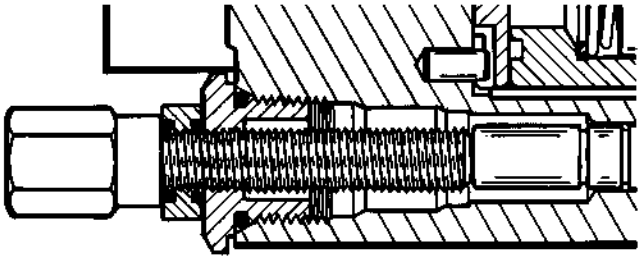
Option 6 units are rated as follows:
300 Series Units — 4000 PSI Continuous
400 Series Units — 3000 PSI Continuous

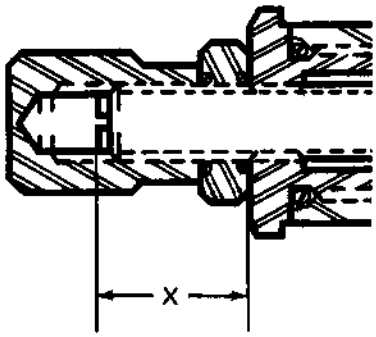
(Specify fluid connection Option B whenever design code option 6 is specified)

DISPLACEMENT CONTROL OPTIONS:

Option B: Adjustable Volume Limit

This option fits all pumps equipped with control types 20 - 26. It permits adjustment of the maximum delivery of the unit.





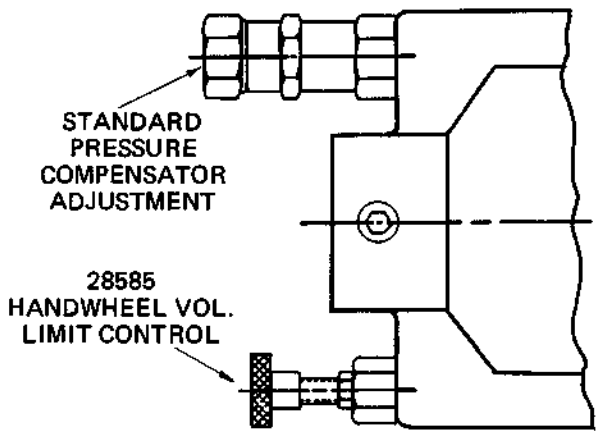
Dimension "X"

Pump Series	Max. Displacement	Zero Displacement
300	1-5/16"	1/2"
400	1-5/16"	1/2"

Based on 1800 RPM:
300 Series Units — One turn changes flow approx. 1.50 GPM (5.7 L/min)
400 Series Units — One turn changes flow approx. 2.0 GPM (7.6 L/min)

Option C: Handwheel Maximum Volume Limit

This option fits all pumps equipped with control types 20 to 26. It permits rapid hand adjustment of the maximum delivery.



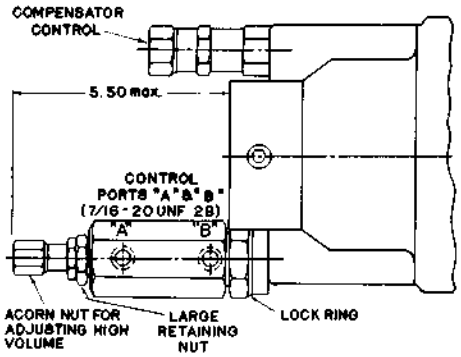
OPTIONS, Continued

Option D: HI-Low Volume Limit
Used on pressure compensated pumps to provide two different pre-selected maximum volumes or displacements.

Suitable valving is supplied by the customer to select high or low volume setting.

The control consists of a floating piston with adjustable stops for setting the desired high or low volume. Adjustment for the high volume is external while adjustment for the low volume is internal.

Adjustment for low-volume setting is internal. Remove large retaining nut, acorn nut, etc. Then remove internal floating piston. Inside the piston is an adjusting screw. Loosen locknut and turn adjusting screw in to the piston to reduce the low volume setting. Reassemble piston with locknut to the outside of control. Reassemble large retaining nut, etc. On the 3.2 in. ^{3}/rev units, one turn on the high-volume adjusting screw will change the flow 1.66 GPM and one turn on the low-volume adjusting screw will change the flow 1.33 GPM.



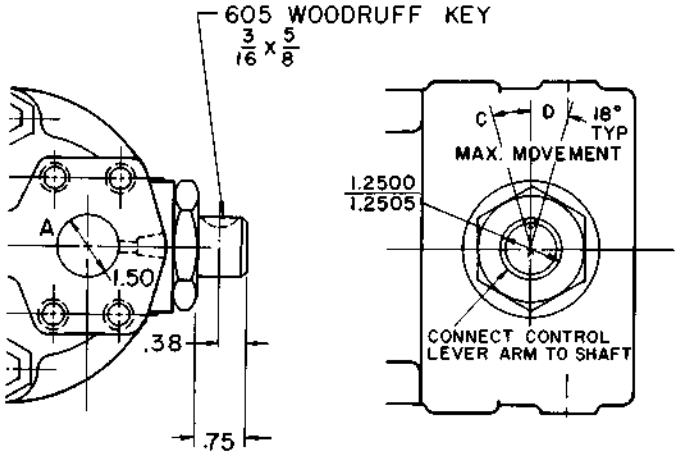
(1) Connect "A" to discharge pressure and "B" to tank for low-volume setting.
(2) Connect "A" to tank and "B" to tank or discharge pressure for high-volume setting.

Remove acorn nut and turn adjusting screw clockwise to decrease high-volume setting.

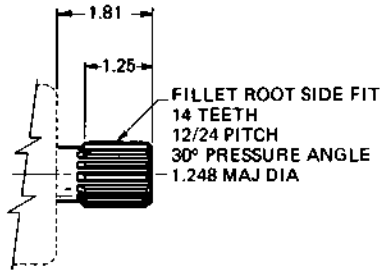
Control ports may be oriented to suit piping requirements by loosening lock ring, orienting ports, then tightening lock ring.

OTHER FACTORY INSTALLED OPTIONS:

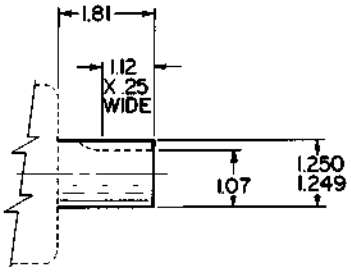
Option E: Extended Trunnion permits installation of external stroke indicator, limit switches or other position feedback devices. This option will fit all variable displacement pumps.



SAE SHAFT OPTIONS



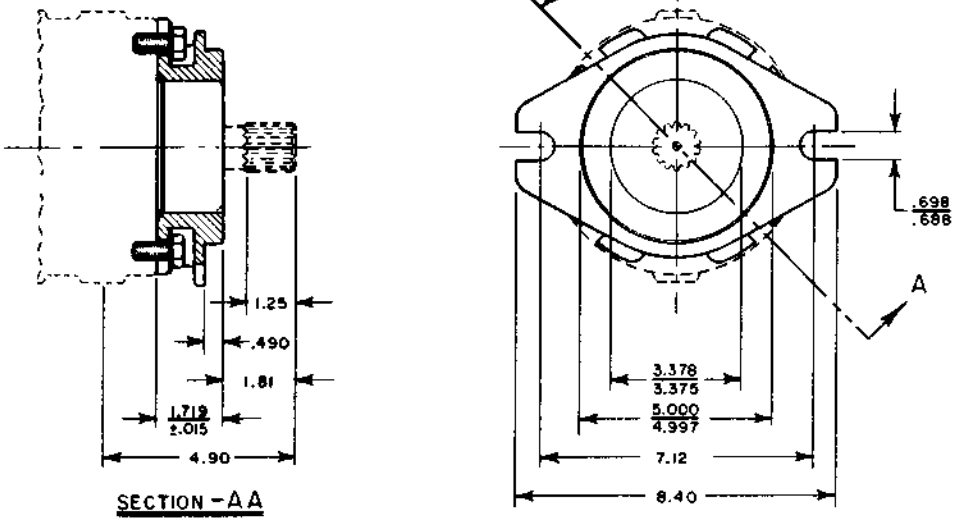
Type — Spline
Description — SAE C
Order Code — 2



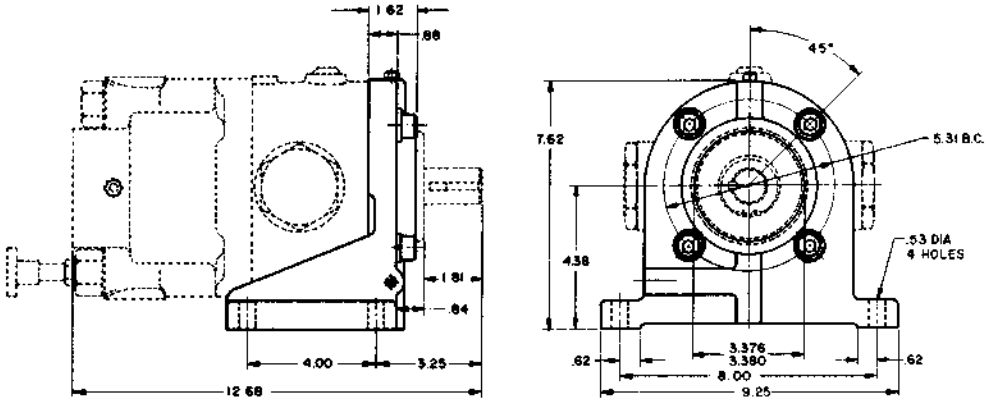
Type — Straight Keyed 1¼" Dia.
Description — SAE C
Order Code — 5

MOUNTING BRACKETS AND ADAPTERS
(all mounting hardware included in each kit)

SAE C 2-Bolt Mounting Adapter, Kit No. 33824



Foot Mounting Bracket, Kit No. 33269

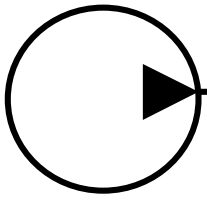


HARTMANN
CONTROLS INC.

FLUID POWER PRODUCTS WARRANTY*

All oil based fluid power products sold by Hartmann Controls, Inc. are warranted only to purchasers for resale or for the use in business or original equipment manufacture, against defects in workmanship of materials under normal use and service (rental use excluded), if notice of said defect is received by Hartmann Controls, Inc. at the factory within 36 MONTHS after installation or 42 MONTHS from the date of shipment from the factory, whichever first occurs. Any product which is determined to be defective in workmanship or materials and returned to the Hartmann Controls, Inc. factory, shipping costs prepaid, will be repaired or replaced, at Hartmann's option. The cost of such repair or replacement shall be the exclusive remedy for any breach of any warranty, and Hartmann Controls, Inc. shall not be liable to nay person for consequential damages for injury or commercial loss resulting from any breach of warranty. Hartmann Controls, Inc. makes no other warranty, express or implied, including warranty for a particular purpose, or arising from course of dealing or usage of trade. No person including any dealer or representative of Hartmann Controls, Inc. is authorized to make any representation or warranty concerning the obligations contained in this warranty. Since no Hartmann Controls, Inc. fluid power products sales are made by Hartmann Controls, Inc. to consumers as defined In the Federal Consumer Products Warranties (Magnuson-Moss) Law, Hartmann Controls, Inc. makes no warranties to those defined as consumers in said Law.

***Supercedes warranties issued prior to September 1, 1996.**



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604 Progress Drive
Hartland, WI 53029
USA

Phone: (262) 367-4299 Fax: (262) 367-5645
E-mail: pumps@hartmanncontrols.com URL: www.hartmanncontrols.com