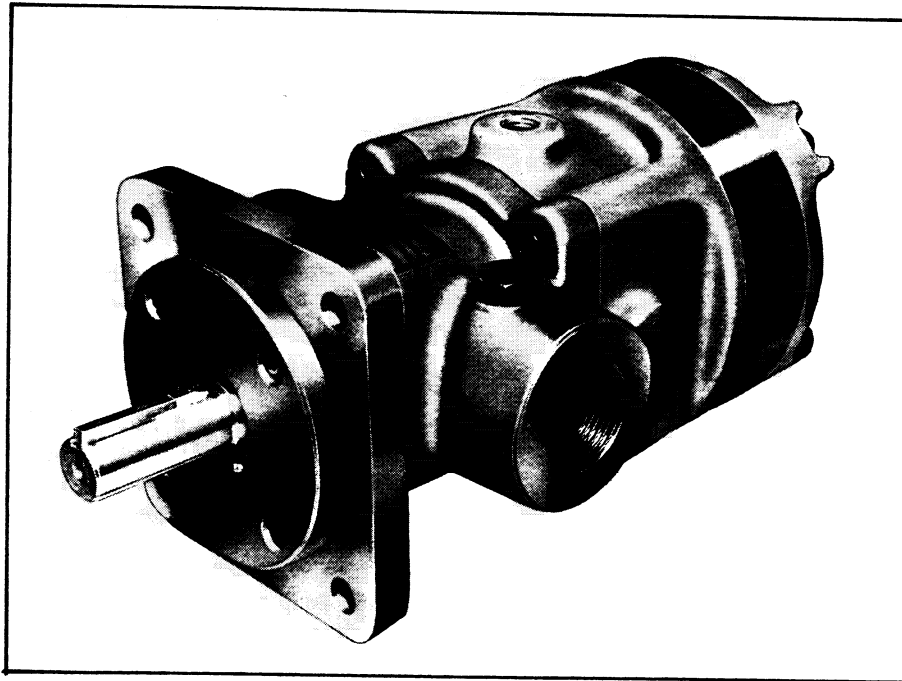


DENISON

Hydraulics

SERVICE LITERATURE



500 SERIES

AXIAL PISTON CONSTANT VOLUME PUMP

GENERAL INFORMATION

The hydraulic pump mechanism is enclosed in a meehanite housing consisting of three parts: the port block, the body, and the end cap. The port block incorporates the shaft assembly and consists of two preloaded angular contact bearings spaced far enough apart to insure rigidity to the outboard portion of the shaft. A lip type seal held in place by a removable seal retainer effectively prevents leakage around the shaft.

The port plate is made of hardened tool steel lapped on both sides to highly polished surfaces. To prevent turning, the plate is pinned in position. Arcuate shaped openings mate with similar openings in the port block.

The cylinder bore, or piston carrying member is driven by a keyed or splined shaft. The valving of the porting is accomplished by the ported surface of the barrel rotating against the port plate, which has two arcuate shaped ports; one for suction and the other for discharge. The bores in the barrel have small arcuate ports generated on the same porting circle as the port plate and substantially of the same width as the pressure and suction ports.

A blank, unbroken surface separates the ends of the suction and pressure ports on the port plate and this constitutes the cut-off between pressure and suction. The cylinder barrel is held in proper abutment with the port plate by the spring hold-down assembly, which fits in the splined end shaft and also holds the pistons out against the cam plate on the suction stroke. The pump incorporates a large roller bearing that takes the radial load created by the angle of the cam plate.

The piston assembly consists of seven hardened tool steel pistons. Pistons are inserted into the cylinder barrel with the open end towards the port plate. The closed end of the piston is machined into a ball shape.

A bronze shoe is crimped around the piston ball. The piston ball and shoe incorporates a drilling which carries pressure from the piston into a relief cut in the face of the piston shoe. The fluid introduced thus, serves to lubricate as well as take up some of the force of the shoe pressing against the cam plate. The rotating action of the pistons, while being held against the angular surface of the cam plate, imports a reciprocation to the pistons, drawing oil in on the suction stroke and forcing oil out on the pressure stroke. The quantity of oil delivered by the pump is determined by the degree of angularity of the cam plate.

MAINTENANCE INSTRUCTIONS FOR DISASSEMBLY AND ASSEMBLY OF "500" PUMP

This pump may be repaired or inspected in the machine without removing the entire pump. However, if packing or bearings are to be removed from the shaft end, it is

necessary to remove the entire unit. Surfaces within pump are lapped to a critical finish and should be carefully handled during removal and replacement.

To examine cam plate, piston and shoes, spring retainer and spring, remove four bolts from end cap and tap lightly on end cap and cap will come off. You can now examine the above parts. To remove pump from circuit, all lines must be disconnected from the pump body.

The outer bearing race can now be removed, exposing bearing rolls and cylinder and piston assembly. To disassemble, remove piston shoe retainer and lift the pistons out as a unit; care should be taken that the pistons are re-assembled. The pistons may be removed from the retainer.

When removing the cylinder barrel, the port plate may cling to the porting surface of the barrel due to the film of oil on the surface.

The port plate is not attached to the cylinder barrel and a few light bumps will cause it to break loose from the barrel. The plate catches on the splined shaft when this occurs, and can later be removed after the barrel is out of the way. In the event it does not catch on the spline, be careful that the port plate does not drop from the barrel. The hold down assembly consisting of ball, bronze spring socket and steel spring retainer will slide out with a few light taps on the retainer. The bearing is released from the cylinder barrel by removing seven bolts. In handling all parts removed, be extremely careful to keep them clean and free from harmful bumps or scratches on critical surfaces.

To remove port plate without removing bearings and seal retainer from the side, insert two brass rods of the same diameter as the sausage porting and by placing on opposite sides and squeezing together, a grip on the plate can be obtained so that the plate can be removed. Removing plate after the shaft and bearing assembly on the other end has been removed is much simpler. This is not a tight fitting plate and should be removed easily.

Working from the shaft connection end, remove six bolts from oil seal retainer and remove retainer. Extreme care should be taken in removing oil seal if it is to be used again.

Minute scratches on the surfaces of the seal will cause leakage around the shaft, especially where light fluid is used. Place a brass rod inside the splined end of the shaft and by tapping lightly, shaft and bearing assembly may be removed from port block.

To remove bearings from the shaft, bend the ear up on the lock washer and remove nut and washer from the shaft. Bearings can then be pressed off the shaft.

INSTRUCTIONS FOR REASSEMBLY

To reassemble shaft end bearing assembly, bearings must be replaced in proper position in relation to the preload conditions of the bearings. These are matched preloaded bearings and care must be taken to assemble them correctly. The assembly consists of the two bearings, and an inner and outer spacer which are held firmly in place by the nut and lock washer. Direction of preload is indicated by the slotted opening on each side of the bearing retainer. The narrowest slot should be placed inward, toward the spacer in each case. After bearings are in place, the lock washer and nut are tightened against the inner spacer. The inner spacer prevents tightening the nut too tightly and should be turned for a snug fit. Bend the ear down on washer into the slot in the nut to lock in position.

Before replacing port block, be sure that the porting surface of the port block is clean and free of scratches or burrs incurred during dismantling of the pump. This is a lapped surface and unless perfectly smooth and flat, will not seal against port plate.

To replace shaft and bearing assembly in the port block, place the block on the bench and insert the shaft, splined end first, through the block. Lift the assembly vertically so that the shaft rests on a wooden bench and holding the block in both hands, bump the shaft lightly. Do not allow bearing race to bump the shoulder too hard as it reaches the extreme in position, as damage may occur to the bearing race. "O" ring is next inserted in the grooved shoulder of the seal retainer. Seal retainer is next mounted to the port block and again care must be taken in sliding the seal over the shaft to avoid even slight scratching. Always use some method of protecting the seal from the shaft while this is being done. Place "O" ring on port block pilot. Place body on bench with small opening up. Insert port block and

shaft assembly with splined end of shaft down and carefully fit block into body. Insert six bolts and tighten securely.

These bolt holes are not equally spaced so block should be rotated until all holes are in correct alignment. Lay pump on side and insert port plate, over shaft and into pilot bore of the body, making sure dowel pin is inserted in the center hole of port plate. Be sure port plate is not on bind. After locating, check with hand to see if it will move slightly and freely.

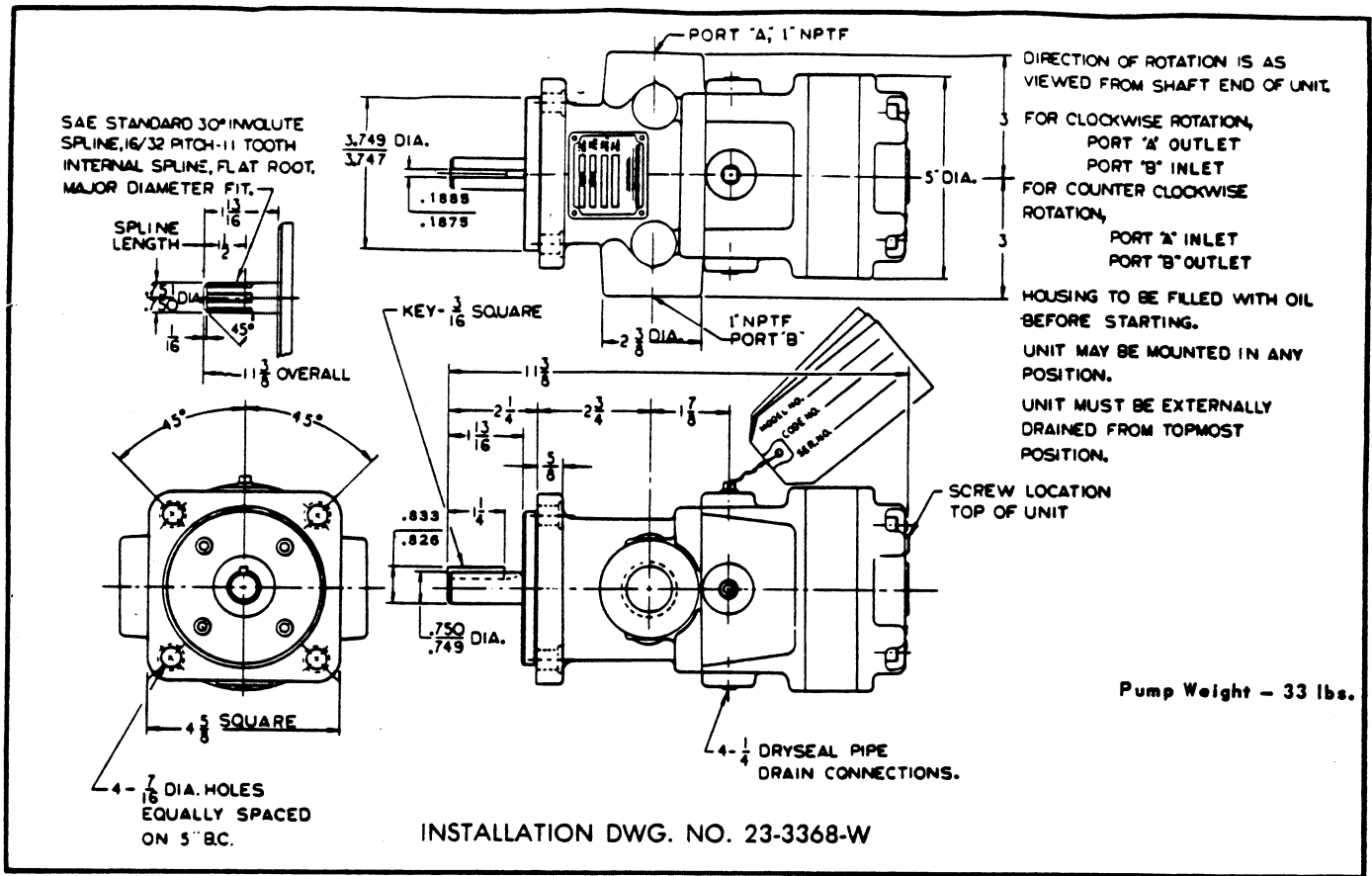
Before replacing cylinder barrel in position, examine surface of porting to be sure no scratches or burrshave been incurred during the removal. Replace, making sure that the face of barrel is not bumped. With pump in upright position, the barrel will fall in place easily. In replacing spring retainer of the hold down assembly, locate on small dowel pin and be sure it rests correctly on end of splines in barrel. Insert spring and bronze spring socket and place ball in position on socket.

Replace pistons in the piston shoe retainer. Piston shoes should lie flat in piston shoe retainer. The lapped surface should be free of scratches. Replace the piston assembly in the cylinder barrel, making sure that the pistons are replaced as nearly as possible in the same position as removed. Replace bearing race, replacing "O" ring on body of motor before assembly, lining up holes with holes in pump body. Holes are unevenly spaced and can be mounted in two position - 180° apart. Install the cam plate in end cap, check "O" ring seal for appearance and placement. Pour small quantity of oil over the piston shoe assembly and place end cap in position. Tighten the bolts securely that hold the end cap in place, pulling down evenly.

DRAIN CONNECTIONS - CONNECT DRAIN LINE FROM TOP OF PUMP TO TANK. BE SURE DRAIN CONNECTION IS OPEN TO ATMOSPHERIC PRESSURE AND PUMP HOUSING IS FILLED WITH OIL BEFORE STARTING PUMP.

Note

When assembling the pump for right hand rotation (viewed from the shaft end) the thin side of the cam plate must be on the same side of the pump as the pin which locates the port plate. To operate the pump in the opposite direction remove the end cap and place the thin side of the cam plate 180° from the pin. On 3¼ and 7¼ gallon pumps the screw must be removed from the cam plate and installed in the holes in the cam marked CCW.



INSTALLATION DWG. NO. 23-3368-W

INSTALLATION DATA—FLANGE MOUNTED PUMPS

MODEL NUMBER KEY SHEET FOR SERIES 500 PISTON PUMPS & FLUID MOTORS

| COLUMN 1 Series | | COLUMN 2 Capacities GPM @ 1200 R.P.M. In.Lb. Per 100 P.S.I. | | COLUMN 3 Shaft | | COLUMN 4 Rotation | | COLUMN 5 Controls | | COLUMN 6 Connections | | COLUMN 7 Mountings | | COLUMN 8 Auxiliary Packages | |
|--------------------|----------------------|--|----------------|-------------------|-----------------------------------|----------------------|------------------------|----------------------|--|-------------------------|-------------------------|-----------------------|--------------------------|-----------------------------------|------|
| Code | Group | Code | Cam Plate | Code | Type | Code | Direction | Code | Type | Code | Port Block | Code | Type | Code | Type |
| PF05 | Constant Volume Pump | 001 | 1.33 GPM | 1 | Key Type for Lip Type Seal | R | Right Hand Rotation CW | 00 | No Control | 1 | For PF05 & MF05 1" NPTF | 0 | (None) Face | | |
| MF05 | Motor | 002 | 2.48 GPM | 2 | Key Type for Mechanical Type Seal | L | Left Hand Rotation CCW | 06 | Compensator w/handwheel Full Volume | 3 | For PV05 1" NPTF | 1 | Bracket for PF & MF Only | | |
| PV05 | Var. Vol. Pump | 003 | 3.31 GPM | | | N | Bi-Directional | 07 | Compensator w/handwheel Reduced Volume | | | 2 | Bracket for PV Only | | |
| | | 004 | 4.08 GPM | | | | | | | | | | | | |
| | | 005 | 5.00 GPM | | | | | | | | | | | | |
| | | 006 | 6.63 GPM | | | | | | | | | | | | |
| | | 006 | 6 Gal. | | | | | | | | | | | | |
| | | 007 | Meter | | | | | | | | | | | | |
| | | 014 | 7.60 In. Lbs. | | | | | | | | | | | | |
| | | 020 | 15.33 In. Lbs. | | | | | | | | | | | | |
| | | | 20.31 In. Lbs. | | | | | | | | | | | | |

PF05 - 001 - 31 R - 001 - 1

Add to end of Model Number (when used)

One or more numbers to designate redesigned pump

| Operating Pressure Range | |
|--------------------------|------|
| 2 | 2000 |
| 3 | 3000 |
| 4 | 4000 |
| 5 | 5000 |

| Special Fluids | |
|----------------|-------|
| S4 | Seals |
| S5 | Seals |
| S6 | Seals |

MN 500
INDUSTRIAL
Key Sheet 6-B

SERVICE TIPS FOR PUMPS

| Difficulties | Probable Cause | Remedy |
|---|--|---|
| INSUFFICIENT FLOW | <ol style="list-style-type: none"> 1. Clogged filters; restriction in suction lines. 2. Air in suction lines due to loose unions, low oil level or pump worn internally. | <ol style="list-style-type: none"> 1. Flush filters and replace elements; remove and blow out lines. 2. Tighten all unions in suction lines, check oil level, examine pump parts. |
| INSUFFICIENT PRESSURE | <ol style="list-style-type: none"> 1. Pump not delivering oil due to wear. 2. Relief valve faulty. | <ol style="list-style-type: none"> 1. Check internal parts. 2. Check relief valve parts. |
| CHATTERING OR VIBRATION IN HYDRAULIC SYSTEM | <ol style="list-style-type: none"> 1. Air in system. 2. Coupling misaligned. | <ol style="list-style-type: none"> 1. Cycle pressure in system by opening and closing bypass valve. 2. Correct |
| PUMP MAKING NOISE | <ol style="list-style-type: none"> 1. Restricted intake line. 2. Air leak in pump intake lines. | <ol style="list-style-type: none"> 1. Pump must receive oil freely or pump will cavitate. 2. Test by pouring oil on all pipe joints. Listen for change in sound of operation. Tighten joints as required. |

Table I Recommended Oil Specifications*

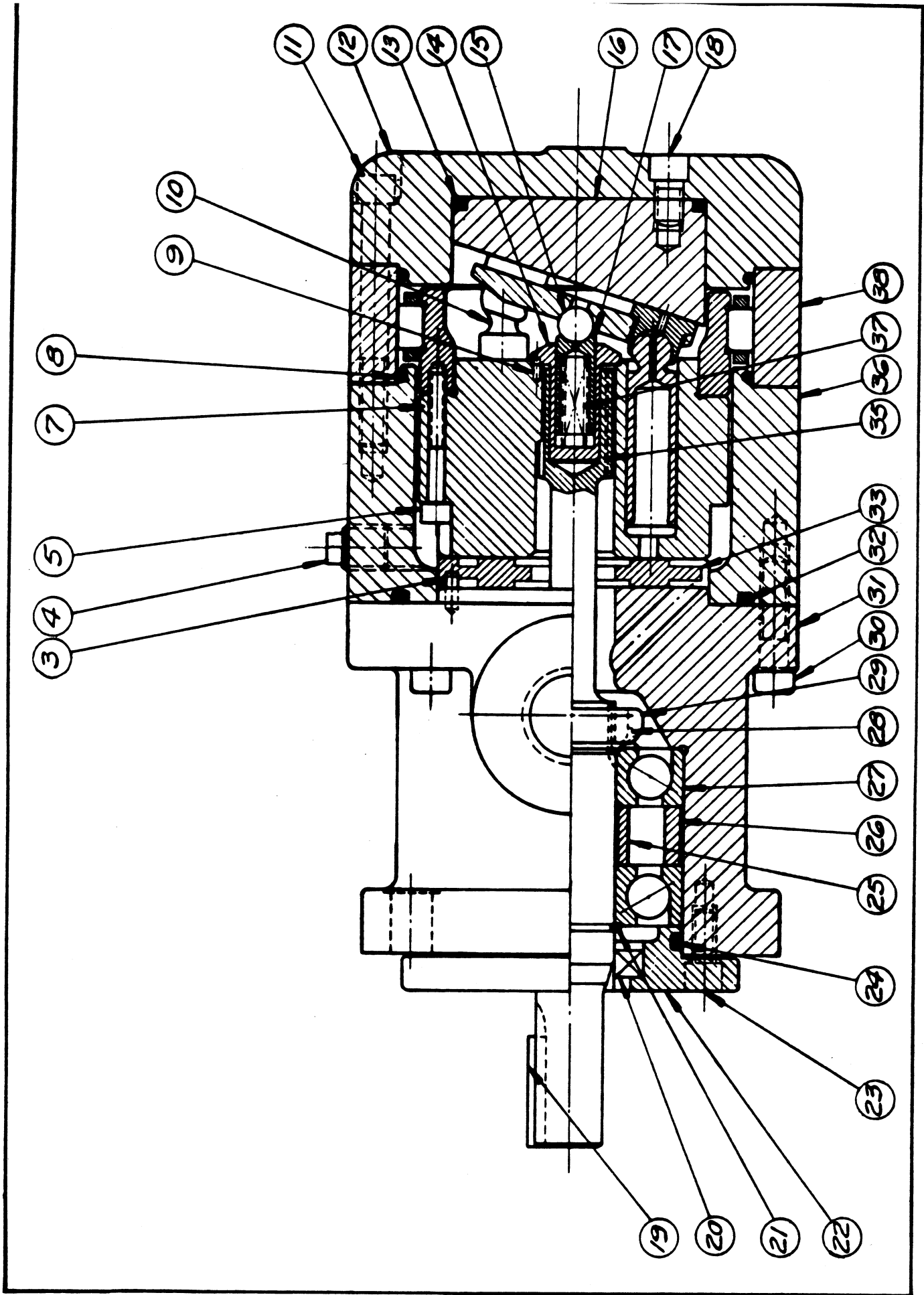
| | |
|---|---------------------------------------|
| Viscosity Range | 150 to 300 SUS at 100° F |
| Viscosity Index | 90 or higher |
| Maximum Viscosity at Starting Temperature | 3000 SUS |
| Minimum Operating Viscosity | 70 SUS or as approved by Denison Div. |
| Rust and Oxidation Inhibitors | Yes |
| Anti-Foam Additive | Yes |
| API Gravity, Degrees, Range | 25 through 37 |
| Specific Gravity, 60° F/60° F, Range | 0.904 through 0.840 |

NOTE: It is recommended, but not necessary, that the fluid contain anti-wear additive. To provide minimum noise and greater life, the hydraulic fluid selected should contain a minimum of 0.05%, by weight, of zinc and a minimum of 0.05% by weight of phosphorous as zinc dithiophosphate or an amount of other anti-wear additive which will impart equal properties to the fluid.

Consult a Denison Division representative before using fluids which do not meet these specifications or for high temperature operation. In addition, consult him for Fire Resistant Hydraulic Fluid applications.

CAUTION: Inlet temperature of the oil for most efficient operation should be 130° F and should not exceed 160° F for piston equipment without dropping below minimum operating viscosity.

*It is suggested that the fluid supplier provide the user with certification that his product meets the requirements.



OLD MODEL NUMBERS

PA-021-350-LF
 PA-021-350-RF
 PA-051-350-LF
 PA-051-350-RF
 PA-061-350-LF
 PA-061-350-RF

NEW MODEL NUMBERS

PF05-002-31L-001
 PF05-002-31R-001
 PF05-005-31L-001
 PF05-005-31R-001
 PF05-006-31L-001
 PF05-006-31R-001

DENISON CONSTANT VOLUME PUMP

AXIAL PISTON TYPE 500 SERIES

PARTS LIST

| REF. NO. | PART NO. | DESCRIPTION | QTY |
|----------|-----------|--|-------|
| 3 | 324-20806 | Dowel pin 1/8 x 3/8 | 1 |
| 4 | 488-13024 | AN-913-2D sq. hd. pipe plug 1/4" NPT | 1 |
| 5 | 358-10200 | S.H.C. screw 10-24 x 1 1/2 | 7 |
| 7 | 035-14409 | Cylinder Barrel | 1 |
| 8 | 671-00239 | S "O" ring 70-6230-17 (ARP-239) | 2 |
| 9 | 325-04040 | Pin 1/16" x 1/4" | 1 |
| 10 | S15-12316 | Assembly (7 pistons, 7 shoes, and 035-27362 shoe retainer) | 1 |
| 11 | 358-14300 | S.H.C. screw 5/16-18 x 2 3/4 | 4 |
| 12 | 035-28596 | End cap | 1 |
| 13 | 671-00230 | S "O" ring 70-6230-8 (ARP-230) | 1 |
| 14 | 035-12690 | Spring retainer | 1 |
| 15 | 201-14001 | Steel ball 7/16" dia. | 1 |
| 16 | 035-12687 | Cam plate for PA-061-350 (9 gpm @ 1800 rpm) | 1 |
| | 035-13437 | Cam plate for PA-051-350 (7 1/4 gpm @ 1800 rpm) | 1 |
| | 035-13438 | Cam plate for PA-021-350 (3 1/4 gpm @ 1800 rpm) | 1 |
| 17 | 035-19271 | Spring plunger | 1 |
| 18 | 358-14086 | S.H.C. screw 5/16-18 x 1/2 (Nyllok) | 1 |
| 19 | 035-19578 | Shaft key 3/16" sq. x 1 1/4" | 1 |
| 20 | 620-50291 | S Shaft seal 67 x 291 | 1 |
| 21 | 356-11305 | Snap ring - Eaton No. 698-R | 1 |
| 22 | 035-12691 | Seal retainer | 1 |
| 23 | 358-12100 | S.H.C. screw 1/4-20 x 5/8 | 4 |
| 24 | 671-00227 | S "O" ring 70-6230-5 (ARP-227) | 1 |
| 25 & 26 | S15-99891 | Spacers, 1 set (035-14416 & 035-14417) | 1 |
| 27 | 230-07305 | Ball bearing MRC-305-RDB | 1 pr. |
| 28 | 350-01005 | Lock washer W-05 | 1 |
| 29 | 341-10005 | Lock nut N-05 | 1 |
| 30 | 358-14180 | S.H.C. screw 5/16-18 x 1 1/4 | 4 |
| 31 | 035-28532 | Port block | 1 |
| 32 | 671-00238 | S "O" ring 70-6230-16 (ARP-238) | 1 |
| 33 | 035-27678 | Port plate right hand rotation | 1 |
| | 035-27679 | Port plate left hand rotation | 1 |
| 34 | 431-90400 | 1/4" soc. pipe plug | 3 |
| 35 | 035-14422 | Shaft | 1 |
| 36 | 035-28527 | Body | 1 |
| 37 | 035-22136 | Hold down spring | 1 |
| 38 | 035-14413 | Barrel bearing | 1 |
| NS | 035-12946 | Foot mounting bracket | 1 |
| NS | 358-16180 | S.H.C. screws 3/8-16 x 1 1/4 | 4 |
| | S15-15231 | S Seal kit | |

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