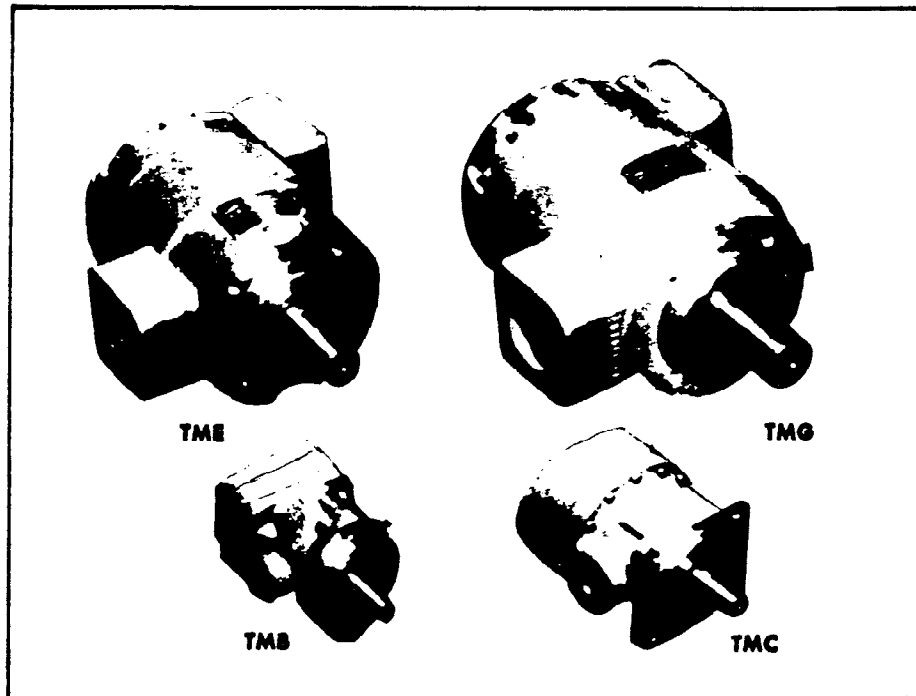


**DENISON** **Hydraulics** **SERVICE LITERATURE**



**TM SERIES**  
**VANE TYPE PUMP-MOTOR**

# THE DENISON VANE TYPE PUMP-MOTOR SERVICE INSTRUCTIONS

## SECTION 1. DESCRIPTION OF THE PUMP/MOTOR

The Denison dual purpose Pump/Motor is of single stage vane type construction. It may be used interchangeably as a pump or fluid motor without adjustment or alteration. The pumping cartridge is designed with perfect radial balance making this multiple usage possible and also permits clockwise or counter clockwise shaft rotation.

The Pump/Motor consists of three major sub-assemblies; 1, a housing, which provides a port connection and also acts as a support for the shaft bearings and shaft assembly; 2, a pumping cartridge, consisting of a rotor, vanes, springs and cam ring and 3, a cap, with a port connection. (See Figure 1.)

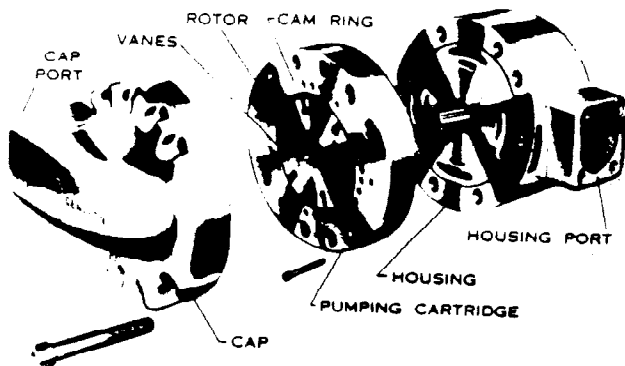


FIGURE 1

The Pump/Motor is made in four basic sizes, the TMB, TMC, TME and TMG. Interchangeable cam rings in each of the basic sizes are used for changing pump volume or motor torque. The major or minor inside diameters of the cam ring track are connected by ramps in regulating the displacement of the Pump/Motor.

## SECTION 2. MODEL NUMBERS

Model numbers of the pump/motor are designated in a simple way. A typical model number is the TME-037-21R (see figure 2). The "TME" indicates the type and size of the unit. The 037 indicates cam ring size 37 GPM @ 1200 RPM @ 100 PSI. The 2 is 2000 PSI maximum. The 1 is keyed shaft for lip type seal. The "R" indicates righthand rotation.

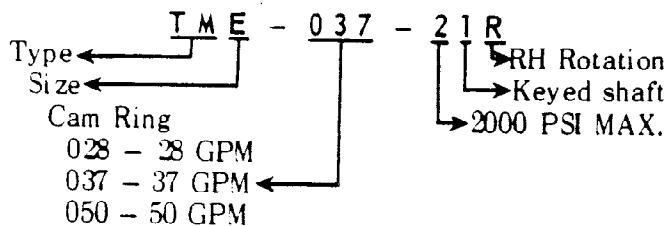


FIGURE 2

The letters "TMB", "TMC", "TME" or "TMG", depending on the Pump/Motor size, are stamped on two sides of the pumping cartridge. Proper

alignment of the Pump/Motor is assured in assembly, when one of the "flow" arrows points to the desired rotation ("ROT") arrow, as shown in Figure 5.

## SECTION 3. OPERATING THE PUMP/MOTOR

The Pump/Motor will operate in either direction of rotation as a pump or fluid motor. When used as a pump, direction of flow may be reversed by changing direction of shaft rotation. When used as a fluid motor, direction of shaft rotation may be reversed by changing the direction of flow through the unit. A directional valve may be used to reverse the direction of shaft rotation when the unit is used as a fluid motor.

## SECTION 4. DRAINING THE PUMP/MOTOR

Normally, the Pump/Motor is externally drained, but provisions have been made for internal drainage under certain conditions. If the housing port is the low pressure port and never subject to more than 20 psi, static or surge pressure, the Pump/Motor may be internally drained. If the housing port is subjected to any pressure higher than 20 psi, it must be externally drained. This is done by removing outside drain plug (24) and connect to tank or another part of the system, subjected to the same pressure limits. For best results, the drain line should extend below the oil level.

## SECTION 5. DIRECTION OF SHAFT ROTATION

Direction of shaft rotation may be changed in two ways: 1, by flipping over the pumping cartridge so that the stamped letters, designating the type of Pump/Motor, on the other side of the pumping cartridge, are aligned to complete the model numbers (See Figure 3 and Figure 4); and, 2, by reversing the piping.

A series of arrows (See Figure 5), are stamped on the pumping cartridge (cam ring) and housing, to indicate direction of flow and shaft rotation.

Two pair of arrows stamped "Flow" are located on opposite sides of the pumping cartridge (See Figure 4). Each pair of arrows point in opposite directions, to indicate direction of flow through the Pump/Motor. Two raised cast arrows and the letters "ROT", appear on only one side of the housing, indicating rotation of the shaft, when the pumping cartridge and housing are properly aligned, the arrows indicating flow will appear directly opposite the arrows indicating shaft rotation (See Figure 4).

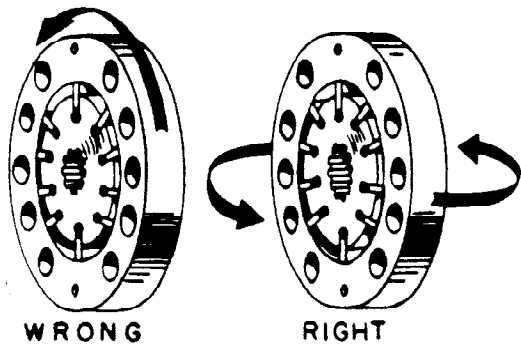


FIGURE 3

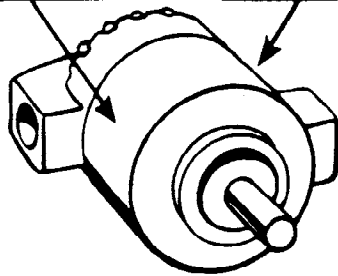


FIGURE 4

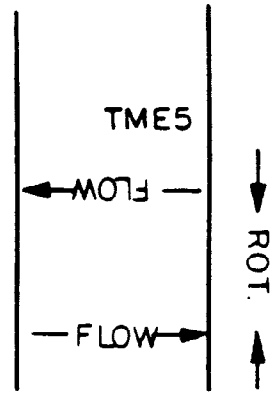


FIGURE 5

### SECTION 6. OIL SPECIFICATIONS

Clean oil is essential to get maximum service from the Pump/Motor. Oil used in the system incorporating these units must be of the type recommended and should be kept free of dirt, lint, scale and other foreign materials which may damage the critical machined surfaces of parts within the Pump/Motor. Oil filters are often necessary to insure having a clean hydraulic system, and should be installed. Filters should be used at the reservoir breather and the oil filter openings.

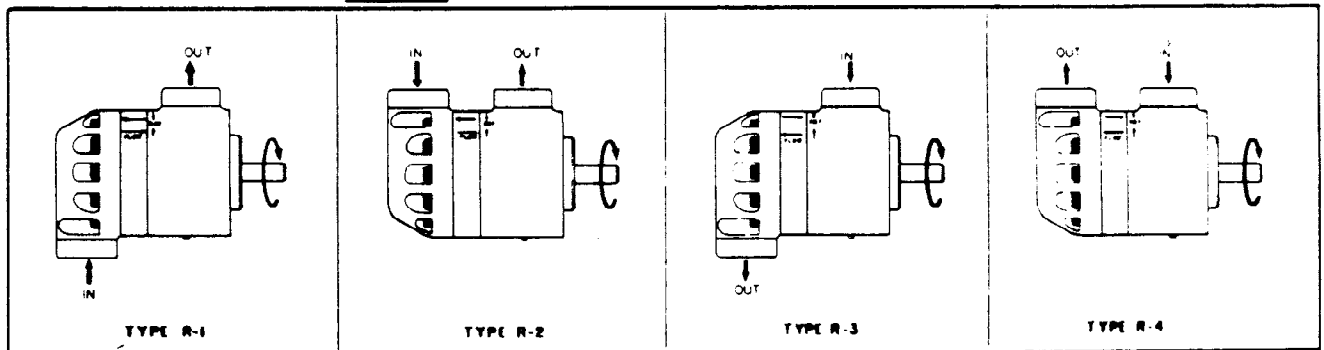
#### RECOMMENDED OIL SPECIFICATIONS

Viscosity Range	150 to 300 SSU at 100° F.
Viscosity Index	90 or above
Maximum Viscosity at starting temperature	3000 SSU
Neutralization number	10 or below (when using new oil)
Additives - Recommend Rust and Oxidation Inhibitors and minimum 0.06% W Zinc Dithiophosphate Anti-wear. Consult a Denison representative before using fluid which does not meet these specifications or higher temperature operation.	

CAUTION: Temperature of the oil should never exceed 150° F. for most efficient operation.

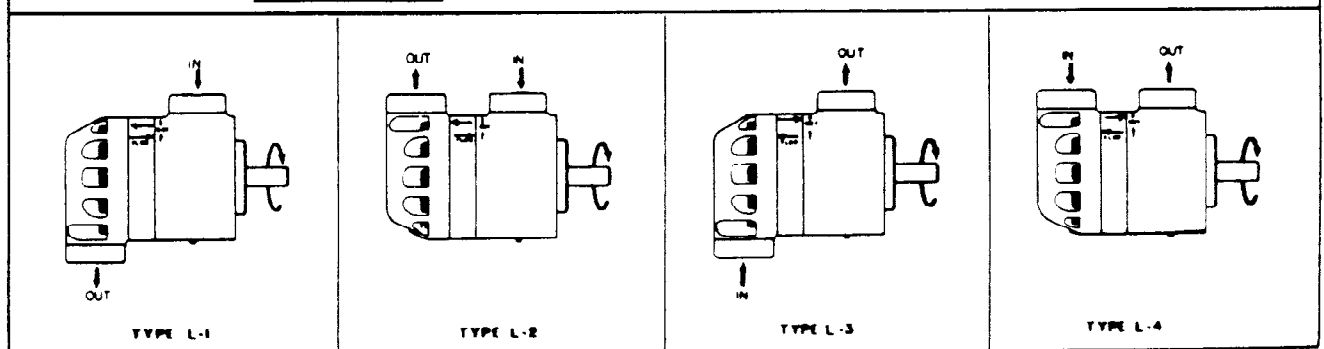
#### CLOCKWISE

#### TM SERIES PUMPS



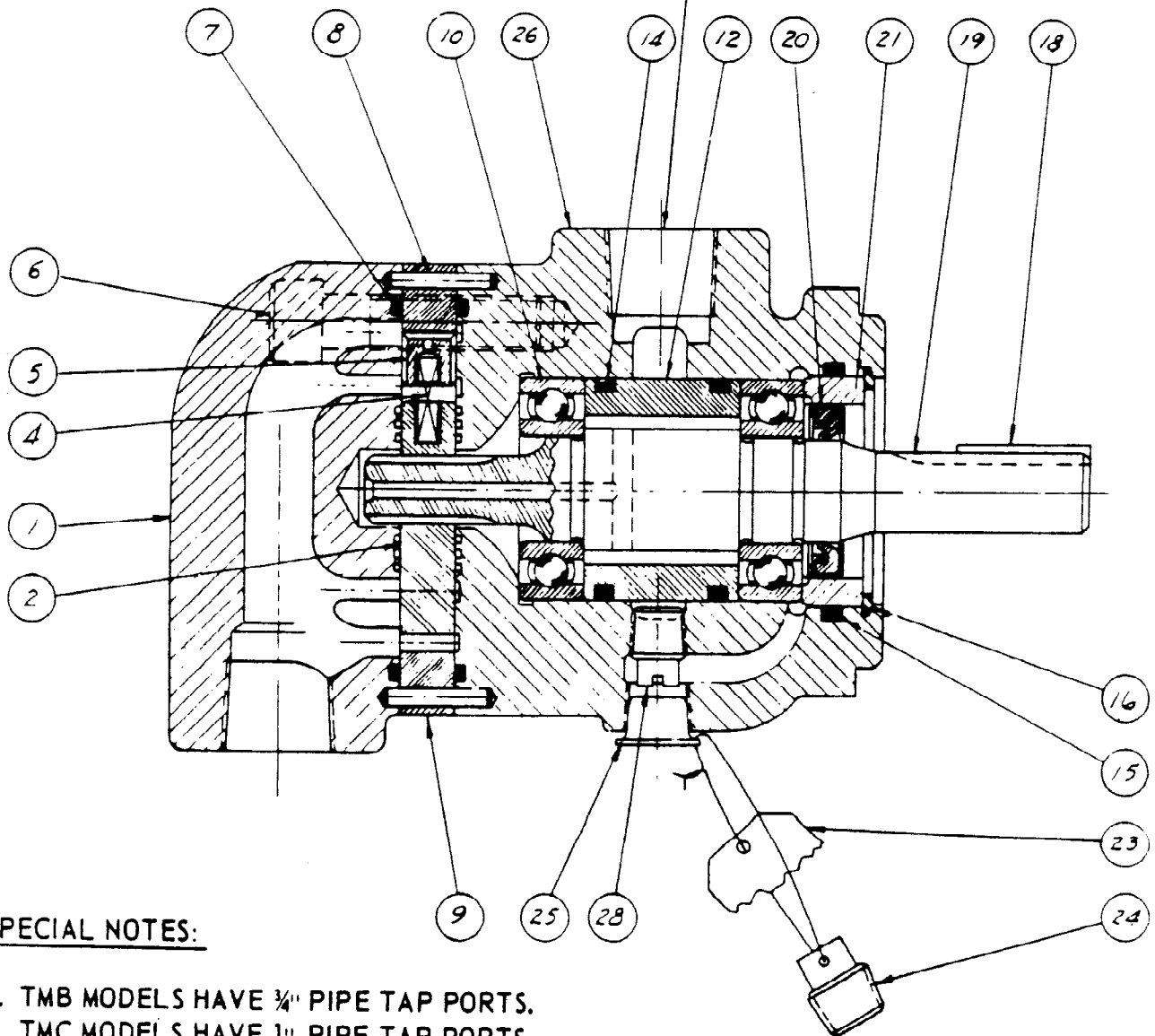
#### COUNTER CLOCKWISE

#### TM SERIES PUMPS



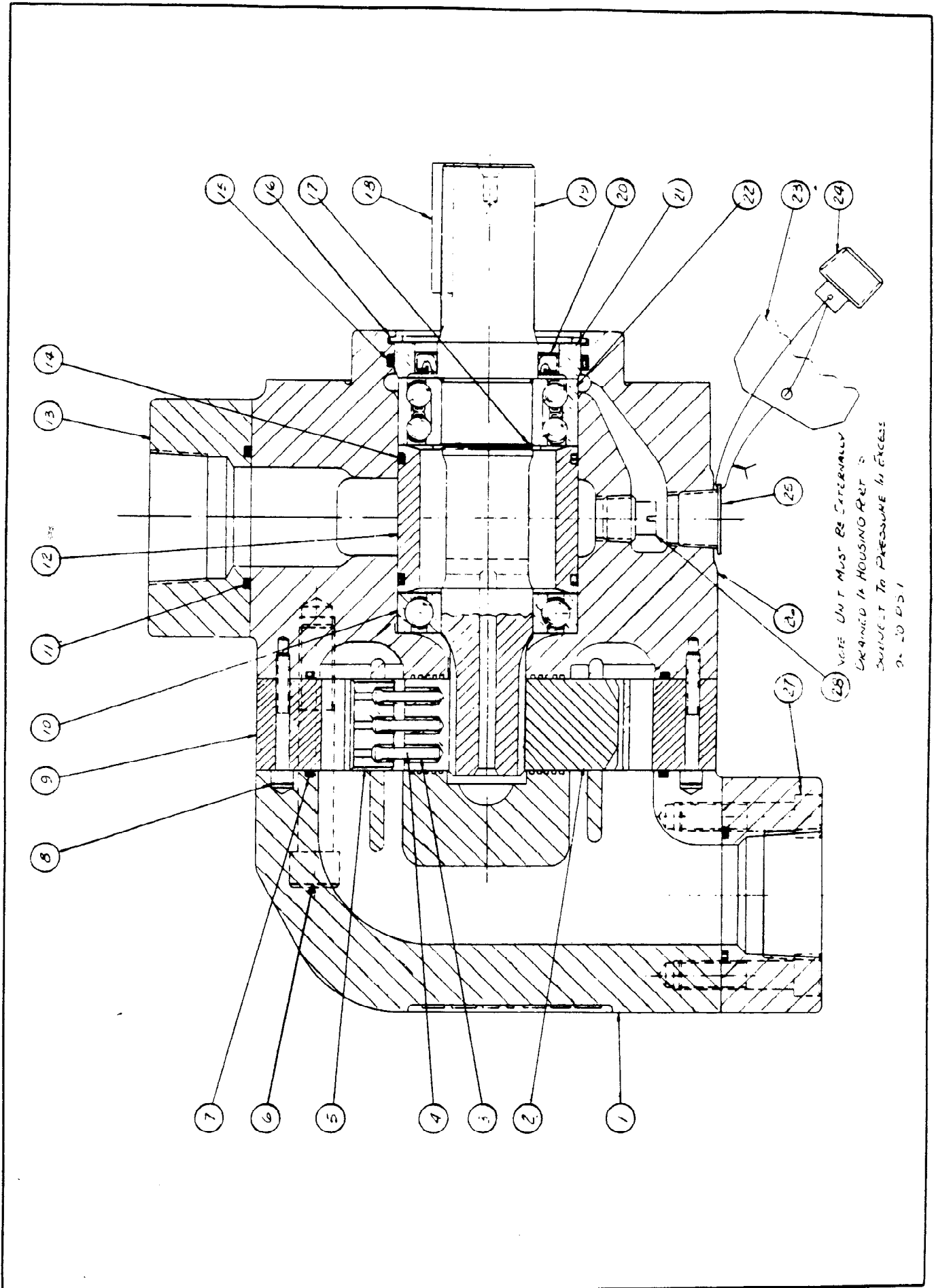
NOTE:

UNIT MUST BE EXTERNALLY  
DRAINED IF HOUSING PORT  
IS SUBJECT TO PRESSURE IN  
EXCESS OF 20 PSI



TMB PUMP/MOTOR ASSEMBLY DRAWING

FIGURE 6



TME PUMP/MOTOR ASSEMBLY DRAWING

FIGURE 7

## SECTION 7. DISASSEMBLY

Refer to Figures 6, 7, 8 and 9. If the unit is internally drained, remove pipe plug (24) and drain the oil from the unit. On the TME and TMG units only, remove the socket head cap screws (27), pressure and suction flanges (13) and "O" rings (11).

Remove the socket head cap screws (6) and take off cap (1).

Remove the socket head cap screws or dowel pins (8) and slide pumping cartridge off shaft (19). Be careful that rotor (2) does not fall out of cam ring (9) so the vanes (5) and springs (4) fly out of place. Remove "O" rings (7) from the sides of the cap (1) and housing (26).

Remove snap ring (16) from housing (26) and remove seal retainer (20) with enclosed seal (20). Seal (20) is press fit into seal retainer (21). The two tapped holes on the face of seal retainer (21) are tapped for No. 10-24 N. C. screws as a service aid in pulling seal retainer (21) from the housing (26). Grasp housing (26) with both hands and with spline end of the shaft down bump shaft (19) lightly on a block of wood. Once the shaft assembly is loose remove it carefully from the housing.

Remove inner bearing (10) and spacer (12). Snap ring (17) and outer bearing (10) may now be removed from the shaft (19).

Note: Snap ring (17) is used only on the TME and TMG series.

Place pumping cartridge flat on a clean surface and pull the rotor (2) out far enough so that a hose clamp or ring compressor can be securely fastened over the vanes (5) and around the rotor (2). Once the hose clamp or compressor is in place, remove the rotor (2) from the cam ring. Release the tension on the hose clamp or ring compressor slowly so that the spring loaded vanes (5) do not fly out of the rotor. After the hose clamp or ring compressor is removed, remove the vanes (5) and springs (4). Remove the check valve (28) from the housing drain hole. Before attempting to clean any of the parts be sure that all "O" rings are removed.

## SECTION 8. REASSEMBLY

Refer to Figure 6, 7, 8 and 9. Be sure all parts are thoroughly cleaned and oiled before reassembling. Press outer bearing (10) on shaft (19). Install snap ring (17) to hold bearing (22) in place on shaft (19). (TME and TMG series only). Install the two "O" rings (14) on the spacer (12).

Place spacer (12) over shaft (19) and press in the inner bearing (10).

Place heavy grease on all the "O" ring seals. Carefully push shaft assembly into the housing (25), do not damage "O" rings (14). Place grease on shaft seal (20) and press into retainer (21). Grease the "O" ring (15) and insert into housing bore groove.

Push retainer (21) into bore of housing being careful not to damage the "O" ring (15). Install snap ring (16). If the Pump/Motor is to be internally drained, install check valve (28) and pipe plug (24) in housing (26).

Lay rotor (2) face down on a clean flat surface. Install the springs (4) into the slots provided in the base of the rotor slots. On the TME and TMG units, be sure roll pins (3) are in place. Place vanes (5) carefully over the springs and into the rotor slots.

Place ring compressor or hose clamp around the edge of the rotor-spring-vane assembly and draw up to compress vanes (5) into the rotor. Carefully insert the rotor-vane assembly into the cam ring (9). Be certain that the assembly is inserted far enough into the cam ring (9) before the compressor is removed.

Place the two "O" rings (7) into the grooves on the sides of the cap (1) and housing (25). Be very careful that the rotor-vane assembly does not slide out of the cam ring at this point. Wash assembly in solvent, then oil thoroughly. Push rotor (2) on the shaft spline (19). Install the socket head cap screws or dowel pins (8) and tighten.

Secure cap (1) to housing (26) with socket head

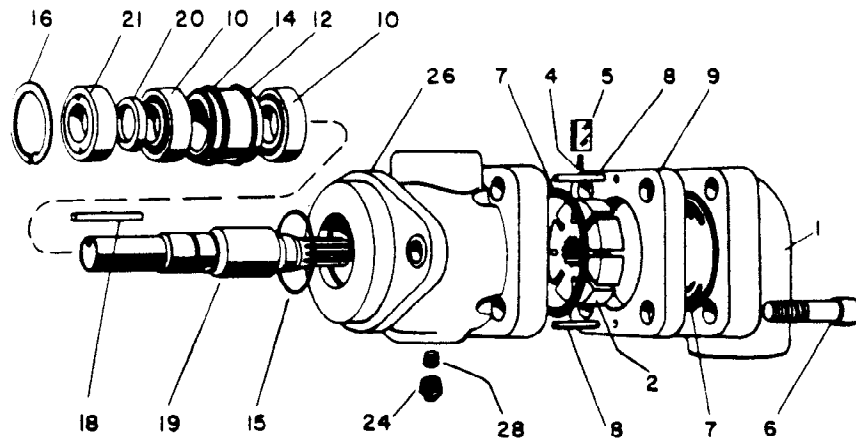
cap screws (6). Counterbores in the cap must line up with the heads of the socket head cap screws (6). For the convenience of piping, the cap (1) may be mounted in any one of two positions 180° from each other, without affecting the pumping action of the Pump/Motor. Be sure to tighten all socket head cap screws (6) evenly around the bolt circle. These should be tightened as per normal cap screw recommendations.

No shims or loose housing bolts are necessary in assembling this Pump/Motor, since all clearances are held by the close tolerances in machining the component parts.

The port flanges (13) are interchangeable in the two larger series Pump/Motors, TME and TMG. The caps and housings of the small Pump/Motors are drilled and tapped for piping.

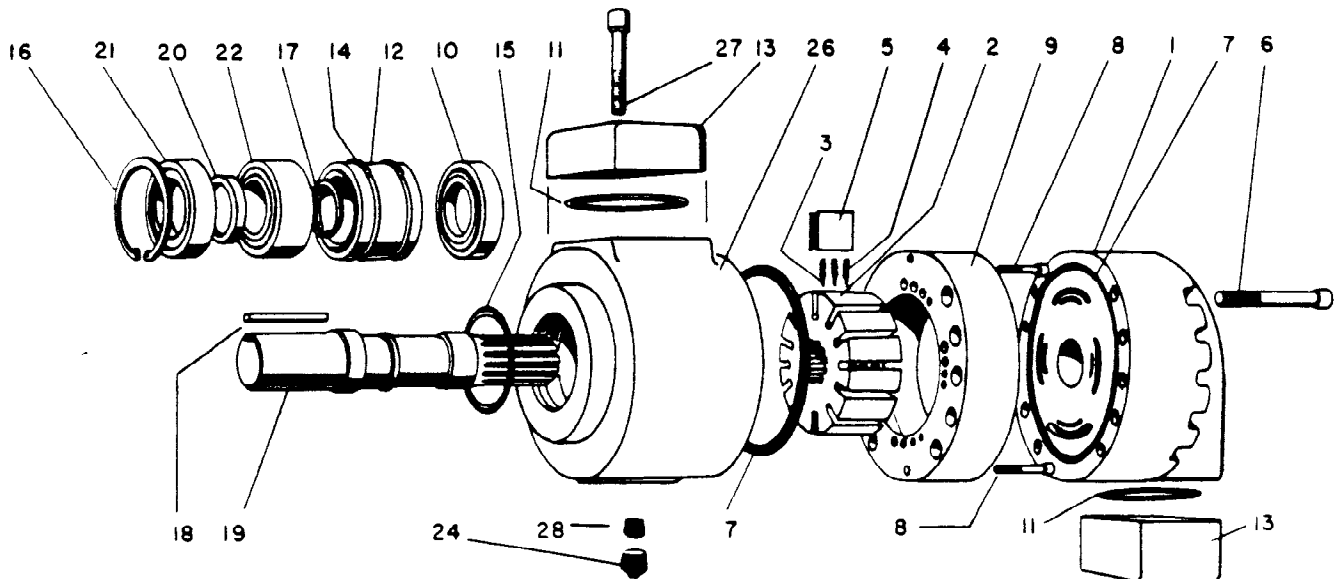
The flanges with the large pipe tap should be used at the inlet for pump operation. Install the "O" rings (11) in the flange grooves on the larger series pumps and secure each flange to the housing with the socket head cap screws (27).

Fit key (18) to shaft (19). Replace check valve (28) and pipe plug (24) if the Pump/Motor is internally drained. The Pump/Motor must prime itself immediately when it is started again.



**EXPLODED VIEW OF TMB TYPE PUMP/MOTOR**

**FIGURE 8**



**EXPLODED VIEW OF VANE TYPE PUMP/MOTOR TMC, TME AND TMG SERIES**

**FIGURE 9**

## SECTION 9. PARTS LIST

### DENISON VANE TYPE PUMP/MOTOR

Ref. No.	Part Name	TMB PART NO.	TMC PART NO.	TME PART NO.	TMG PART NO.	Qty.
1	Cap	034-16113	034-18358	034-17601	034-17591	1
2	Rotor (C)	034-16111	034-15943	034-15954	034-15934	1
3	Spring Guide (C)	None	None	034-42561	034-42561	36
4	Vane Spring (C)	034-16118 (8 req.)	034-16118 (16 req.)	034-17031 (36 req.)	034-17031 (36 req.)	**
5	Vane (C)	034-16112 (8 req.)	034-15944 (8 req.)	034-15955 (12 req.)	034-15935 (12 req.)	**
6	Screw, Socket Head	358-20240 1/2"-13 x 2" (4 req.)	358-16300 3/8"-16 x 2-3/4" (10 req.)	358-24360 5/8"-11 x 4" (10 req.)	358-24380 5/8"-11 x 4-1/2" (10 req.)	**
7	"O" Ring - (S)	691-00236 (6230-14)	671-00243 (6230-21)	671-00258 (6230-36)	691-00262 (6230-40)	2
8	Locating Screw or Dowel Pin	324-21216 3/16" Dia. x 1"	034-18525	358-12240 1/4"-20 x 2"	358-12240 1/4" x 20 x 2"	2
9	Cam Ring (C) GPM @ 100. PSI	034-16115 (11) 4.0 gpm @ 1200 rpm TMB-004	034-18366 (3) 12.1 gpm @ 1200 rpm TMC-012	034-17603 (4) 28.0 gpm @ 1200 rpm TME-028	034-17595 (8) 82.0 gpm @ 1200 rpm TMG-082	1
	Cam Ring (C) GPM @ 100. PSI	034-16116 (12) 6.0 gpm @ 1200 rpm TMB-006	034-18365 (2) 8.7 gpm @ 1200 rpm TMC-008	034-17604 (5) 37.0 gpm @ 1200 rpm TME-037	034-17593 (7) 60.0 gpm @ 1200 rpm TMG-060	1
	Cam Ring (C) GPM @ 100. PSI	034-15989 (13) 1.7 gpm @ 1200 rpm TMB-001	034-18364 (1) 7.7 gpm @ 1200 rpm TMC-007	034-17605 (6) 50.0 gpm @ 1200 rpm TME-050	034-17594 (10) 70.0 gpm @ 1200 rpm TMG-070	1
	Cam Ring (C) GPM @ 100. PSI	034-15990 (14) 2.5 gpm @ 1200 rpm TMB-002				1
	Cam Ring (C) GPM @ 100. PSI	034-17102 (15) 5.1 gpm @ 1200 rpm TMB-005				1
10	Bearing	230-03205 (3205) (2 req.)	230-03205 (3205) (2 req.)	230-03208 (3208) (1 req.)	230-03208 (3208) (1 req.)	**
11	"O" Ring -(S)	None	None	671-00227 (6230-5)	691-00233 (6230-11)	2
12	Spacer	034-16110	034-15942	034-15952	034-15936	1
13	Suction Flange	None	None	034-15958 2" NPTF	034-15930 2-1/2" NPFT	2
	Pressure Flange	None	None	034-15956 1-1/4" NPTF	034-15931 1-1/2" NPTF	1

\* Not Shown

\*\* See Columns Part Size or Drawing Number for Quantity.



## SECTION 9. PARTS LIST

DENISON VANE TYPE PUMP/MOTOR						
Ref. No.	Part Name	TMB PART NO.	TMC PART NO.	TME PART NO.	TMG PART NO.	Qty.
14	"O" Ring -(S)	671-00224 (6230-2)	671-00224 (6230-2)	671-00233 (6230-11)	691-00239 (6230-17)	2
15	"O" Ring -(S)	671-00227 (6230-5)	671-00227 (6230-5)	671-00238 (6230-14)	671-00242 (6230-20)	1
16	Internal Snap Ring	356-36212 (5002-212)	356-36212 (5002-212)	356-36325 (5002-325)	356-36400 (5002-400)	1
17	External Snap Ring	None	None	356-37156 (5102-156)	356-37215 (5102-215)	1
18	Key	034-19578	034-19578	034-19580	034-19577	1
19	Keyed Shaft Splined Shaft	034-16109 034-24869	034-15945 034-44904	034-15951 034-44955	034-15933 034-44962	1
20	Shaft Seal -(S)	620-50273	620-50273	620-50904	620-51807	1
21	Seal Retainer	034-15941	034-15941	034-15953	034-15932	1
22	Bearing	None	None	230-05208 (5208)	230-05211 (5211)	1
23	Tag	034-16868	034-16868	034-16868	034-16868	1
24	Pipe Plug	488-13034 3/8" (AN913-3D)	488-13034 3/8" (AN913-3D)	488-13069 3/4" (AN913-6S)	488-13069 3/4" (AN913-6S)	1
25	Shipping Plug	#6X	#6X	#12	#12	1
26	Housing	034-16108	034-18357	034-17600	034-17590	1
27	Screw Socket Head	None	None	358-20240 1/2" x 13 x 2"	358-24240 5/8"-11 x 2"	8
28	Check Valve	S14-01257	S14-01257	S14-01258	S14-01258	1
*29	Bracket (optional)	034-16117	034-12946	034-11980	034-11980	1
*30	Screw Socket Head	358-16160 3/8"-16 x 1"	308-16160 3/8"-16 x 1"	358-20240 1/2"-13 x 2"	358-20220 1/2"-13 x 1-3/4"	4
*31	Flange Mounting (optional)	Integral with housing	Integral with housing	034-12036	034-12036	1
*32	Screw	None	None	358-20240 1/2"-13 x 2"	358-20240 1/2"-13 x 2"	4
(S)	Seal Kit	S14-08843	S14-08844	S14-08845	S14-08846	1
(C)	Cartridge Subassy Kit	Code    P/N	Code    P/N	Code    P/N	Code    P/N	
		001    S14-07121	007    S14-01163	028    S14-07124	060    S14-07127	
		002    S14-07122	008    S14-04606	037    S14-07125	070    S14-07128	
		004    S14-07119	012    S14-01164	050    S14-07126	082    S14-07129	
		005    S14-07123				
		006    S14-07120				

**SECTION 10. SERVICE HINTS**

<b>TROUBLE</b>	<b>CAUSE</b>	<b>REMEDY</b>
External leakage around shaft.	<p>Shaft packing worn.</p> <p>Head of oil on suction pipe connection.</p>	<p>Replace shaft packing per preceding instructions.</p> <p>Sometimes necessary but will usually cause slight leakage.</p>
Pump not delivering oil.	<p>Foot valve in suction line.</p> <p>Pump did not prime.</p> <p>Wrong direction on shaft rotation.</p> <p>Tank oil level too low.</p> <p>Oil intake pipe or suction filter clogged.</p> <p>Air leak in suction line.</p> <p>Oil viscosity too heavy pick up prime.</p> <p>Broken pump shaft or rotor.</p> <p>Pump not delivering oil for any of the above reasons.</p>	<p>These should never be used.</p> <p>Bleed air from pump outlet (install needle valve for this purpose).</p> <p>Must be reversed immediately to prevent seizure and breakage or parts due to lack of oil. Check flow and rotation arrows on housing.</p> <p>Add recommended oil and check level on both sides of tank baffle to be certain pump suction line is submerged.</p> <p>Filters must be cleaned of lint soon after new oil is added, due to fact new oils contains considerable amount. Check for water pockets around filter.</p> <p>Will prevent priming or cause noise and irregular action of control circuit.</p> <p>Thinner oil should be used, per recommendation for given temperature and service.</p> <p>Refer to preceding service data for replacement instructions.</p> <p>Check oil circulation by watching oil in tank, or removing plug in pressure line near pump.</p>
Pump not developing pressure.	<p>Relief valve setting not high enough.</p> <p>Relief valve sticking open.</p>	<p>Block machine travel, or oil circulation, and test with pressure gauge.</p> <p>Dirt under pressure adjustment ball or cone. (See relief valve instructions.)</p>

SECTION 10. SERVICE HINTS

TROUBLE	CAUSE	REMEDY
<p>Pump not developing pressure.</p>	<p>Leak in hydraulic control system (cylinders or valves.)</p> <p>Free recirculation of oil to tank being allowed through system.</p> <p>Pump shaft sheared due to rotor seizure.</p> <p>Relief valve venting.</p>	<p>Must be tested independently by blocking off circuit progressively.</p> <p>Directional control valve may be in open center, neutral or other return line open unintentionally.</p> <p>Disassemble and repair pump.</p> <p>Test venting circuit (if one used) by blocking vent line near relief valve.</p>
<p>Pump making noise.</p>	<p>Small air leak at pump intake piping joints.</p> <p>Air leak at pump shaft packing.</p> <p>Relief valve chattering.</p> <p>Porous pump casting.</p> <p>Coupling misalignment.</p> <p>House breathing.</p> <p>Partially clogged intake line, intake filter, or restricted intake pipe.</p> <p>Restriction pulled into intake cores (rags or paper).</p> <p>Air bubbles in intake oil.</p> <p>Tank air vent plugged.</p>	<p>Test by pouring oil on joints while listening for change in sound of operation. Tighten as required.</p> <p>Pour oil around shaft while listening for change in sound of operation.</p> <p>Air being drawn into system at pump intake or pump shaft packing. (Check as above.)</p> <p>Pour oil over pump to locate. Replace casting.</p> <p>Realign and replace shaft packing per preceding instructions.</p> <p>Increase housing bolt torque.</p> <p>Pump must receive intake oil freely or cavitation will take place.</p> <p>Disassemble and clean pump. Remove head and clean carefully after valve plate bushings are removed.</p> <p>Check thoroughly to be certain return lines are below oil level and well separated from intake.</p> <p>Must be opened through breather opening or air filler.</p>

**SECTION 10. SERVICE HINTS**

<b>TROUBLE</b>	<b>CAUSE</b>	<b>REMEDY</b>
Pump making noise.	Pump running too fast. (cavitation)	Check recommended maximum speed from descriptive literature.
	Too high an oil viscosity.	See oil specification sheet. (use thinner oil)
	Filter too small.	Capacity may be adequately only when just cleaned and should have added capacity. (normal size should be at least twice the maximum pump volume in gpm.
	Broken spring under vane.	Shut down and replace immediately.
	Pump drain line not below tank oil level.	Drain line must extend below oil level to prevent air being drawn into pump inlet.
	Cam ring not properly aligned.	Check cam to rotor concentricity with feeler gages. Both lips of vanes must seal on constant radius portion of cam.

**Cam ring not centered properly.**

**Center rotor to cam ring clearance by:  
At 0° PSI back off 1/2 turn.  
Loosen four bolts on the TMB units.**

**Loosen the three middle bolts on both sides of the end cap, leave the four corner bolts tight on the TMC, TME and TMG units.**

**At 500 PSI tap around the surface of cam ring until best operation is obtained.  
Tighten all bolts:  
TMB-75 ft/lbs.  
TMC-30 ft/lbs.  
TME-85 ft/lbs.  
TMG-90 ft/lbs.**



**DENISON HYDRAULICS INC.  
14249 INDUSTRIAL PARKWAY  
MARYSVILLE, OH 43040-9551**

TELEPHONE: (513) 644-3915  
FAX: (513) 642-6927