

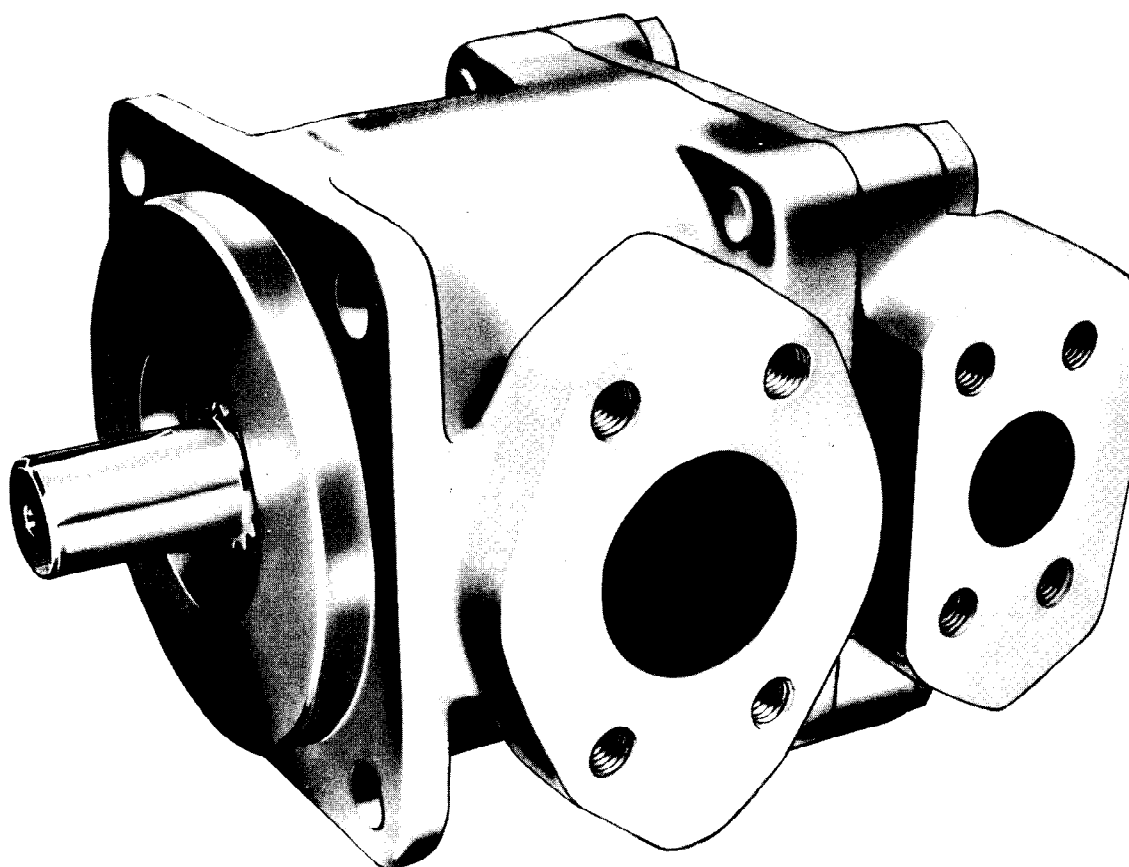
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DENISON

SERVICE LITERATURE

VANE TYPE PUMPS – SERIES T1D

INSTALLATION, OPERATION AND OVERHAUL INSTRUCTIONS



Vane Type Pumps – Series T1D

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SECTION I

INTRODUCTION AND DESCRIPTION

A. GENERAL

This manual covers installation, operation, maintenance, and overhaul instructions for the Denison T1D vane type pump. These pumps are manufactured by the Denison Division of the American Brake Shoe Company, Columbus, Ohio.

B. DESCRIPTION

The Denison T1D vane pump is an efficient, compact unit designed for continuous duty up to 2000 psi and 2000 rpm.

Five models are offered in this series supplying rated deliveries of 20, 28, 31, 35 and 38 gpm at 1200 rpm and zero psi. (See Table I.)

The T1D pump consists of four basic components: (A) a housing (Fig. 2) with a permanently lubricated

ball bearing, shaft, lip seal, and an inlet connection, (B) floating port plate, (C) a cam ring assembly consisting of rotor, vanes, vane springs, spring guides, and cam ring, and (D) an end cap with a needle bearing assembly and an outlet connection.

The shaft is supported by the bearing in the end cap and the ball bearing in the housing. This maximum support feature allows applications with high side loading on the shaft. The T1D pump will support a radial load of 795 lbs. at the center of the keyway.

The port plate is free to move axially within limits. Hydraulic pressure is used to counteract internal hydraulic pressure that tends to separate the elements of the pumping cartridge after the pump is primed and delivering oil under pressure. When the pump is idle and there is zero pressure in the circuit, a light spring provides the necessary clamping force to facilitate starting.

TABLE I
TYPICAL PUMP OPERATING CHARACTERISTICS**

MODEL NO.	RPM	DELIVERY - GPM VS. PRESSURE					HORSEPOWER - INPUT VS. PSI				
		100 PSI	500 PSI	1000 PSI	1500 PSI	2000 PSI	0 PSI	500 PSI	1000 PSI	1500 PSI	2000 PSI
T1D-020-21 *	1200	20.0	19.4	18.8	18.1	17.5	1.4	7.2	13.2	19.2	25.2
	1800	30.0	29.4	28.8	28.1	27.5	2.3	11.2	20.1	28.9	37.8
T1D-028-21 *	1200	28.0	27.4	26.8	26.1	25.5	1.5	9.7	18.0	26.2	34.5
	1800	42.0	41.4	40.8	40.1	39.5	2.4	15.0	27.6	40.2	52.8
T1D-031-21 *	1200	31.0	30.5	30.0	29.2	28.5	1.5	11.0	21.0	30.7	40.1
	1800	46.5	46.0	45.0	44.5	44.0	2.4	17.0	31.2	45.5	60.0
T1D-035-21 *	1200	35.0	34.4	33.8	33.1	32.5	1.5	12.0	22.0	32.5	42.5
	1800	52.5	51.9	51.3	50.6	50.0	2.5	18.1	33.8	49.4	65.0
T1D-038-21 *	1200	38.0	37.4	36.8	36.1	35.5	1.8	12.8	24.0	35.2	46.4
	1800	57.0	56.4	55.8	55.1	54.5	2.5	19.5	36.5	53.5	70.5

* Rotation (Rot.) "R" clockwise "L" counterclockwise.

** Based on the use of fluid with a viscosity of 200 SSU at 100° F. Tested at 130° F.

SECTION II INSTALLATION

A. MOUNTING

These pumps must be mounted on a base of sufficient strength and in such a manner as to maintain a positive alignment with the prime mover. Close shaft alignment with the prime mover is of utmost importance. A flexible-type coupling must be used between the prime mover and the pump to allow for misalignment.

The pump must be installed with the suction line attached to the body, the end cap is the pressure outlet. The T1D pumps are internally drained at all times and drain lines are not required.

The direction of oil flow through the pump cannot be changed, however the direction of shaft rotation can be changed. (See Section VI.)

The outlet port can be assembled in any of four positions in relation to the inlet (suction) port. (See Fig. 3 for porting arrangement.) To change porting

arrangement check the instructions in Section V, paragraph 4 for port plate installation.

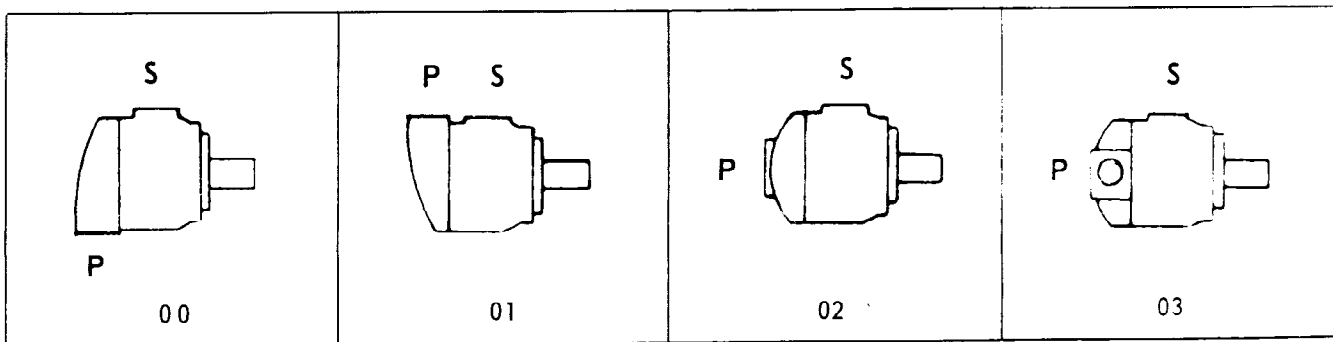
B. PIPING

All piping should be of adequate size and strength to assure free flow at the pressure involved. All system piping must be cleaned with solvent or in accordance with specification MIL-C-17795 before the pump is connected. Piping workmanship must be accurate in order to eliminate any undue strain on the pump when tightening flange bolts.

Be sure that the entire hydraulic system is free from dirt, lint, scale, and other foreign material. **DO NOT USE GALVANIZED PIPE.**

C. FILL PUMP

Immediately before pump installation, fill the pump with clean hydraulic fluid. Use fluid in accordance with specifications given in Table II.



00 IS STANDARD
P IS PRESSURE (outlet) S IS SUCTION (inlet)

FIGURE 1 - PORTING COMBINATIONS

**TABLE II
RECOMMENDED OIL SPECIFICATIONS**

Viscosity Range	150 to 300 SSU at 100° F.
Viscosity Index	90 or above
Maximum Viscosity at starting temperature	7500 SSU
Neutralization Number.	10 or below (when using new oil)
Consult a Denison representative before using fluid which does not meet these specifications or higher temperature operation.	
<i>CAUTION: Temperature of the oil should never exceed 150° F. for most efficient operation.</i>	

SECTION III OPERATION

A. INITIAL STARTING

- a. Be certain that pump is marked to operate in the same direction as the prime mover.
- b. Be certain that the oil used in the system conforms to specifications given in Table II.
- c. Adjust the system relief valves for minimum pressure.
- d. Start the unit and allow it to build up to operating speed.
- e. Increase the system pressure to approximately 500 psi.
- f. At the start there will probably be some air trapped in the system. Purge the air from the system by venting at one of the hydraulic system valves. Operate the pump at low pressures (up to 500 psi) until it has been purged.

B. STOPPING

Reduce the pressure setting for minimum pump delivery and cut the power.

C. LOW TEMPERATURE STARTING

When the temperature conditions are lower than the operating temperature ranges recommended in the oil specifications of Table II, use the following procedure:

- a. Set the system relief valves for minimum pressure setting.
- b. Start the prime mover and allow the pump to reach idle operating speed.
- c. Allow the pump to idle until the oil is warmed within operating specifications.

SECTION IV MAINTENANCE

A. GENERAL

Maintenance is limited to operations which do not require complete system or pump teardown. For example, repair of system, pump leaks, or sticky valves. The first operation in the repair of any leak is to tighten the screws or fittings around the leakage area. If this does not remedy the leak, it may be necessary to open the pump and replace a gasket or "O" ring.

If the pump does not operate properly or there is evidence of damage, overhaul the equipment in accordance with Section V.

Before reassembling any parts, be certain each

part is absolutely clean and free from dirt, lint, or other foreign matter. All parts must be washed in a cleaning fluid such as Stoddard solvent or its equivalent. All "O" rings and gaskets must be clean and carefully examined for cuts or other damage. Replace any damaged parts.

B. TROUBLE SHOOTING

Table III lists probable causes of trouble and possible remedies. Perform only those operations possible under maintenance. Refer to Section V for overhaul procedures.

TABLE III - TROUBLE SHOOTING CHART

TROUBLE	PROBABLE CAUSE	POSSIBLE REMEDY
EXTERNAL LEAKAGE AROUND SHAFT	Shaft seal worn	Replace shaft seal per preceding instructions.
PUMP NOT DELIVERING OIL	Foot valve in suction line. Pump did not prime. Wrong direction on shaft rotation or incorrect pump model. Tank oil level too low.	These should never be used. Bleed air from pump outlet (install needle valve for this purpose) or Denison air bleed off valve AB04-15. Must be reversed immediately to prevent seizure and breakage of parts due to lack of oil. Check rotation arrows on cam ring. Add recommended oil and check level on both sides of tank baffle to be certain pump suction line is submerged.

TABLE III - TROUBLE SHOOTING CHART (continued)

TROUBLE	PROBABLE CAUSE	POSSIBLE REMEDY
PUMP NOT DELIVERING OIL (continued)	<p>Oil intake pipe or suction filter clogged.</p> <p>Air leak in suction line.</p> <p>Oil viscosity too heavy to pick up prime.</p> <p>Broken pump shaft or rotor.</p> <p>Pump not delivering oil for any of the above reasons.</p>	<p>Filters must be cleaned of lint soon after new oil is added, due to fact new oil contains considerable amount. Check for water pockets around filter. Filter should be at least twice the maximum pump volume in GPM.</p> <p>Tighten and seal connections.</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>Leak in hydraulic control system (cylinders or valves).</p> <p>Free recirculation of oil to tank being allowed through system.</p> <p>Relief valve venting.</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> <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>Test venting circuit (if one is used) by blocking vent line near relief valve.</p>
PUMP MAKING NOISE	<p>Small air leak at pump intake piping joints.</p> <p>Air leak at pump shaft packing.</p> <p>Relief valve chattering.</p> <p>Housing breathing.</p> <p>Partially clogged intake line, intake filter, or restricted intake pipe.</p> <p>Air bubbles in intake oil.</p> <p>Tank air vent plugged.</p> <p>Pump running too fast. (Cavitation)</p> <p>Too high an oil viscosity.</p> <p>Filter too small.</p> <p>Broken spring under vane.</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>Increase housing bolt torque.</p> <p>Pump must receive intake oil freely or cavitation will take place.</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 filter.</p> <p>Check recommended maximum speed from descriptive literature.</p> <p>See oil specification sheet. (Use thinner oil.)</p> <p>Capacity may be adequate only when just cleaned and should have added capacity. (Normal size should be at least twice the maximum pump volume in gpm.)</p> <p>Shut down and replace immediately.</p>

SECTION V OVERHAUL

A. GENERAL

The instructions contained in this section covers a complete teardown of the T1D pumps. Follow the order of consecutive index numbering in Figure 5 to disassemble. For example: by following the index numbers 1 through 18, all parts of the T1D will have been removed.

Prepare a clean, lint-free surface on which to lay the internal parts of the pump. Thoroughly clean areas adjacent to the components being removed so as to minimize the danger of dirt entering the pump.

B. SPECIAL TOOLS

There are no special tools required for the overhaul of this equipment.

C. DISASSEMBLY

1. Drain the pump.
2. Secure the pump in a vise with the shaft (No. 15, Figure 5) extended down.
3. Remove the screws (1) and end cap (2).
(Note position of end cap in relation to dowel pin.)
4. Remove "O" ring (3).
5. Remove bearing (4) only if it is worn. Replace if it feels rough or "catchy."
6. Remove dowel pin (5).
7. Thread two 1/4-20 screws in the tapped holes provided as puller holes in the cam ring. Remove the cam ring, rotor, vanes, vane springs, and spring guides as a unit. (This is the cam ring assembly (6).

WARNING

The vanes are held against the cam ring by tension from the springs in the rotor. If the rotor is pulled from the cam ring with no protection, tension from the springs will throw the vanes out in all directions. Serious damage can be caused to the repairman by the sharp edges of the vanes.

Place the cam ring assembly on a clean, flat surface. Push the rotor and vanes from the cam ring far enough to secure a piston ring compressor over the vanes and around the rotor.

After the compressor is in place, push the rotor and vanes the remainder of the way out of the cam ring.

Release the tension on the compressor and remove the vanes, spring guides, and vane springs from the rotor.

8. Thread two 10-24 screws in the tapped holes in the port plate (7) and remove it. Remove the two "O" rings (8) and shaft seal (9).
9. Remove dowel pin (10), "O" ring (11), wavy washer (12), and retaining ring (13).
10. Remove shaft key (14). Press shaft (15) from housing (18). Remove retaining ring (16). To remove bearing (17), support inner race of bearing and press on coupling end of shaft.

D. CLEANING, INSPECTION AND REPAIR

1. CLEANING

Wash all metal parts in cleaning solvent, Federal Specification P-S-661 (Stoddard Solvent or equal) and blow dry with clean compressed air.

CAUTION

Dirt is a major cause of wear and pump failure. Cover all parts after cleaning to prevent dust and dirt from settling on them. All surfaces should be coated with a film of hydraulic lubricating oil, Military Specification MIL-H-5606 after they have been cleaned.

2. INSPECTION AND REPAIR

- a. Inspect the seal for wear and breaks. Replace a defective seal.
- b. Inspect all springs for cracks or permanent set. Replace a defective spring.
- c. Inspect bearings for wear or flat spots. Replace a defective bearing.
- d. Inspect the cam ring for wear. Replace a defective cam ring.
- e. Inspect the rotor for scores or marring on the wear face. Replace a defective rotor.
- f. Inspect the housing for cracks or other possible casting damage. Replace a damaged housing.
- g. Remove all burrs from all parts.

E. LUBRICATION

No lubrication is required for this unit. The normal operation of the pump keeps parts adequately lubricated.

F. REASSEMBLY

1. Install bearing (17) on shaft (15) and secure with retaining ring (16). Press this shaft assembly in housing (18) and secure with retaining ring (13).
2. Install wavy washer (12) against ring (13). Insert "O" ring (11) in groove in the housing and apply heavy grease. Install dowel pin (10) in housing.
3. Install the shaft seal (9), open face first, in the port plate (7), install "O" rings (8) and apply heavy grease to "O" rings and the lips of shaft seal.
4. Thread two 10-24 screws in the tapped holes in port plate (7).

STOP

Before proceeding with the assembly of this pump, you must know where the outlet in the end cap is to be used in relation to the inlet in the housing. Check porting arrangement page 2, Figure 1, also page 7).

If the porting arrangement is to be "02" or "03", then the dowel pin hole in the front port plate marked 90° must be placed over the dowel pin (10) in the housing.

If the porting arrangement is to be "00" or "01", then the dowel pin hole not marked must be placed over the dowel pin (10) in the housing.

The above instructions must be followed to properly align the open ports in the front port plate with the open ports in the end cap.

5. Lift the port plate (7) with the two screws and install by pushing it over the splined end of the shaft. Remove the two 10-24 screws and pour clean oil on the wear surface of the port plate.

6. Place the cam ring, rotor, vane spring, spring guides, and vanes on a clean, flat surface. Arrange the vanes side by side with the three spring holes up. Insert the 30 vane springs in the vanes. Insert the spring guides in the springs. Insert the 10 vanes with guides and springs in the rotor slots. Be certain that the heads on the spring guides and the spring are started in the holes in each rotor slot.

NOTICE

Before installing the cam ring assembly, check to see if the pump is to be operated as a left-hand (CCW) or right-hand (CW) unit. (Shaft rotation is determined from the shaft end of the pump.)

Place the cam ring assembly (No. 6) on a clean, flat surface with the arrow on the cam ring pointing in the direction that the pump is intended to run.

7. Insert the dowel pin (5) in top of the cam ring assembly. Thread two ¼-20 screws in the tapped holes in the cam ring and insert the complete assembly over the spline on the shaft in the housing and against the port plate. Remove the two screws and pour clean oil on the exposed side of the cam ring assembly.
8. Press the bearing (4) in the end cap (2). The stamped end of the bearing must be flush with the counter bore. Install the "O" ring (3) on the end cap and apply heavy grease on the "O" ring.
9. Position the end cap over the cam ring assembly and engage the dowel pin (5) in the proper hole in the cap. Hold the cap firmly against the cam ring assembly and rotate the cap to the correct porting.
(See Figure 1 regarding porting.)
10. Install screws (1) and tighten to 70 ft. lbs. torque. Rotate the pump shaft a few turns by hand; the pump is now ready for test.

SECTION VI - CHANGING ROTATION

REVERSING ROTATION OF PUMP

- A. Remove the end cap.
- B. Remove the dowel pin.
- C. Thread two ¼-20 screws in the tapped puller holes in the cam ring and remove the cam ring assembly.
- D. Remove the two screws used to pull the cam ring assembly and thread the same screws in the tapped holes in the opposite side of the cam ring assembly.
- E. Insert the assembly in the housing, remove the screws and replace the dowel pin in the cam ring assembly.
- F. Position the end cap with the hole in the cap marked "CW" over the dowel pin if the pump is to turn right-hand. Use the hole marked "CCW" if the pump is to turn left-hand.
- G. Hold the cap over the pin and against the cam ring assembly and rotate the cap and cam ring assembly to locate the pressure outlet in the same position as it was before the rotation was changed. (The cap could be rotated 180° from the first position if required.)
- H. Replace four screws in end cap.
- I. Change the nameplate and point the arrow to match the change in rotation. Change rotation letter in model number.
- J. Pump is now ready for use.

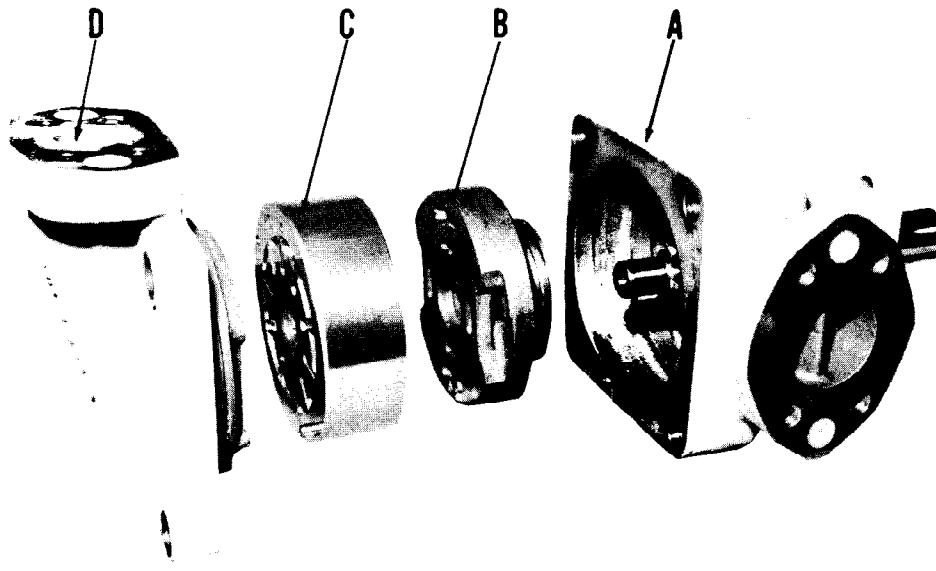
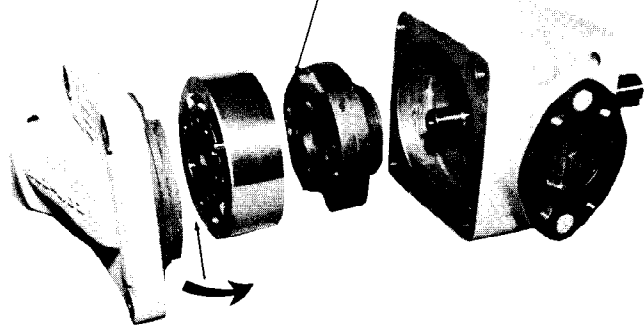


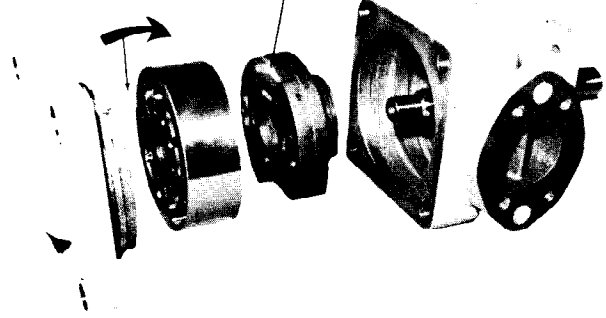
FIG. 2

Install port plate in this manner for 00 and 01 porting.



Assemble in this manner for right hand rotation.

Install port plate in this manner for 00 and 01 porting.



Assemble in this manner for left hand rotation.

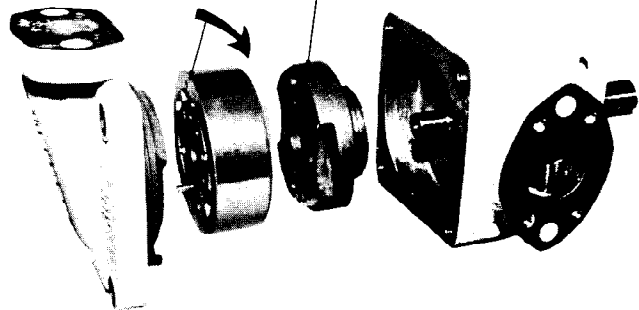
Install port plate in this manner for 02 and 03 porting.



Assemble in this manner for right hand rotation.

Fig. 3

Install port plate in this manner for 02 and 03 porting.



Assemble in this manner for left hand rotation.

Fig. 4

TABLE IV - PARTS LISTING

ITEM	DESCRIPTION	PART NO.	QTY
(s) 1	hex hd cap screw, 5/8-11 x 1 1/4 (spec.)	306-40003	4
2	end cap	034-24209	1
(s) 3	"O" ring 70-6230-26	671-00248	1
4	needle bearing No. BH-1312	230-82002	1
5	dowel pin, 1/4 x 3/4	324-21612	1
6	cam ring assembly	(See below)	1
7	front port plate	034-24368	1
(s) 8	"O" ring 70-914-46	671-00146	2
(s) 9	shaft seal (1 1/2 x 2 1/4 x 3/8)	620-82005	1
10	dowel pin, 1/4 x 1 1/4	324-21620	1
(s) 11	"O" ring 70-6230-24	671-00246	1
12	wavy washer No. 2332	350-10025	1
13	internal snap ring - Waldes 5008-283	356-32283	1
14	shaft key	034-19579	1
15	shaft w/keyway	034-21774	1
	shaft w/14 tooth spline	034-21775	1
16	external snap ring - Waldes 5100-137	356-31137	1
17	shaft bearing ND 99507	230-99507	1
18	body	034-21776	1
(s)	Seal Kit (S1 standard hydraulic fluids)	S14-08756	1

ITEM 6 ASSEMBLY MODEL NUMBER	CAM RING	ROTOR	VANES	VANE SPRINGS	SPRING GUIDES	ASSEMBLY NO.
	May be ordered as an assembly →					
T1D-020	034-21846	034-21383	034-24478	034-21396	034-24678	S14-08448
T1D-028	034-21847	034-21383	034-24478	034-21396	034-24678	S14-08449
T1D-031	034-24133	034-21383	034-24478	034-21396	034-24678	S14-08450
T1D-035	034-21848	034-21383	034-24478	034-21396	034-24678	S14-08451
T1D-038	034-21849	034-21383	034-24478	034-21396	034-24678	S14-08452
QTY	1	1	10	30	30	

FLUID CONNECTIONS			FLANGES	(s) - SEALS	SCREWS	CODE NO.
			May be ordered as an assembly →			
1 1/4" NPT 1 1/4" IPS 1 1/4" SAE-20	} Outlet or Pressure	} Soc. weld 1-5/8-12 thrds.	034-24189	671-00223	306-40000	S14-06617
			034-24163		358-18200	S14-07560
			034-24162		358-18200	S14-07561
2" NPT 2" IPS 2" SAE-32	} Inlet or Suction	} Soc. Weld 2 1/2" - 12 thrds.	034-21993	671-00231	358-20200	S14-07556
			034-24161		358-20200	S14-07557
			034-24160		358-20200	S14-07558
Quantity per unit			1	1	4	

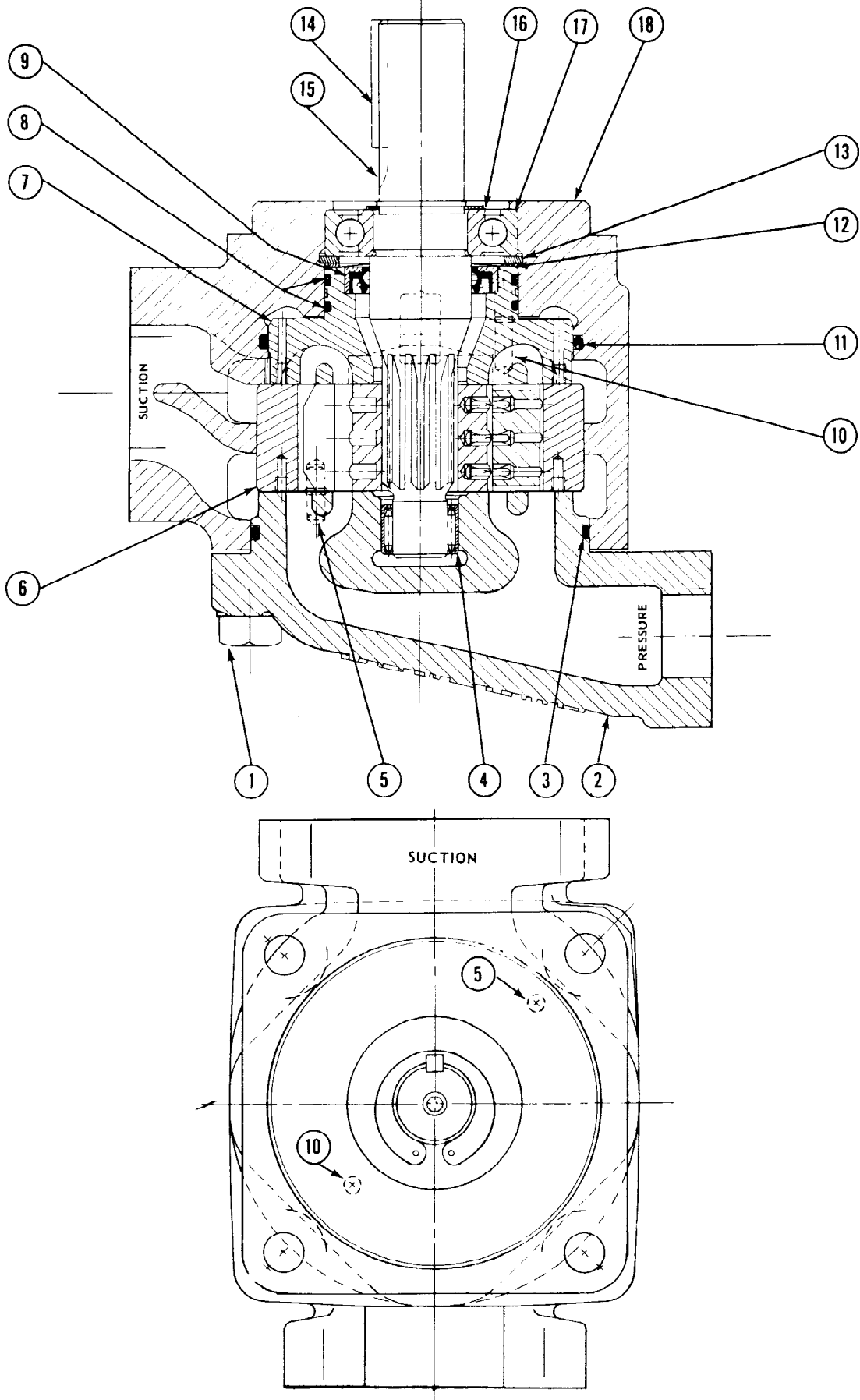


Fig. 5