

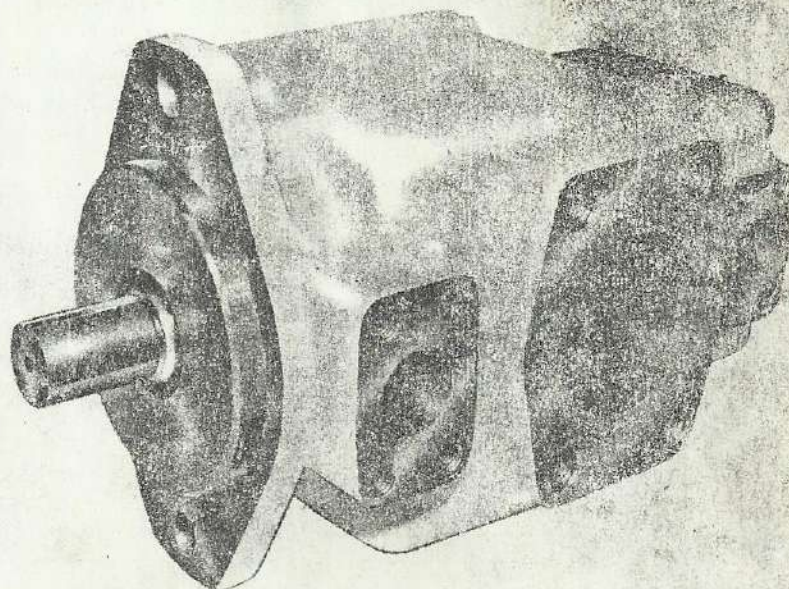
BULLETIN SDP-1-e

Denison Division

service information

DOUBLE PUMPS

Models TDC, TEC & TED



Abex
CORPORATION

SECTION I

INTRODUCTION AND DESCRIPTION

A. GENERAL

This manual contains Operation, Maintenance, Testing, and Overhaul instructions for the Denison Double Vane Pump, model TDC, TEC and TED. These pumps are manufactured by Denison Division of ABEX Corp., Columbus, Ohio.

B. DESCRIPTION

The Double Pump (Figure 1) incorporates the use of a large and small cartridge integral on a single shaft.

The common suction port is in the center housing with internal porting around the cam rings. The outlet ports (P1 and P2) are in the front mounting cap (large cartridge) and rear cap (small cartridge). Both outlet ports can be located independent of the suction port in any of four positions.

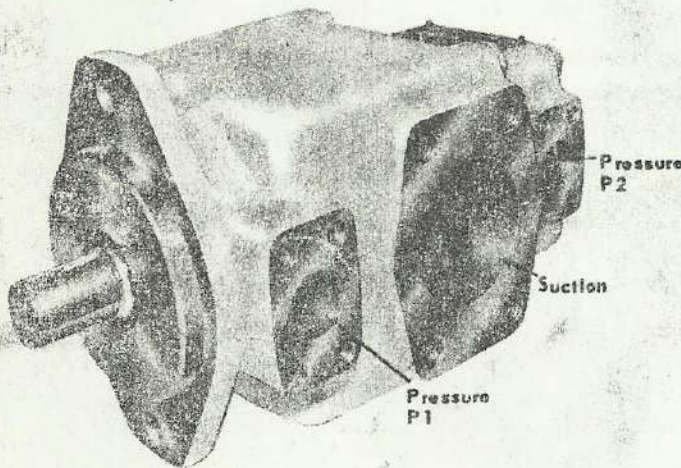


Figure 1 - Model TDC Pump

The bearings are located on both sides of the large cartridge while the small cartridge overhangs the rear bearing. The lip type shaft seal is located outboard the front bearing and is lubricated with the pumping fluid.

The port pads on the pump match the four bolt S.A.E. port pads. Four bolt cast flanges for threaded pipe or socket weld connections are provided as optional equipment along with an alternate S.A.E. splined shaft.

See Table II for the 52 different model numbers and their operating characteristics.

C. OPERATION

In operation, oil enters the suction port in the center housing around the cam rings and enters the pumping cartridge at both sides of the cam rings through cast ports in the port plates. The oil is carried around to the discharge ports through the annular groove in the port plates and out the discharge ports in the end caps. The pump is internally drained at all times. The floating port plates move axially within limits so that hydraulic pressure can be utilized to counteract the internal hydraulic pressure that tends to separate the elements of the pumping cartridge after the pump is primed and delivering hydraulic pressure to the circuit. Light springs are used to hold the pumping cartridges together when there is no pressure in the system.

D. CHANGING ROTATION

1. P1 & P2 CARTRIDGE

To change the rotation of either cartridge, remove the cam ring and flip it over. Align the arrow on the cam ring with the arrow on the port plate indicating the direction of rotation.

NOTE

Be certain both cam rings indicate the same rotation.

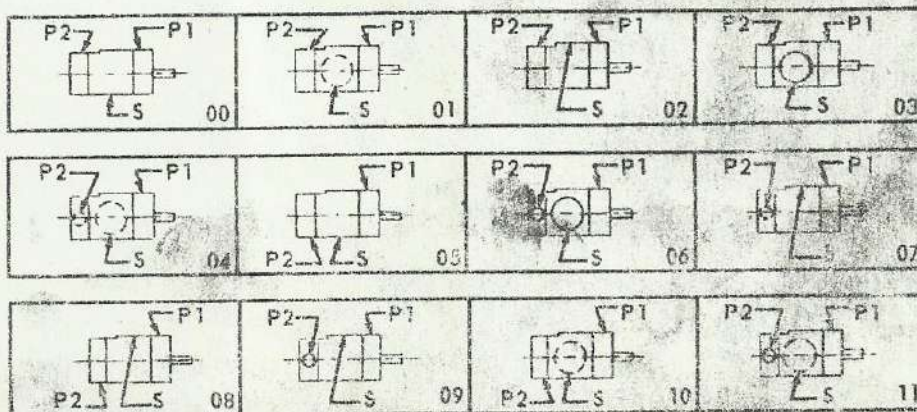


Figure 2 - Porting Combinations

Table I
Recommended Oil Specifications*

Viscosity Range	150 to 300 SUS at 100° F
Viscosity Index	90 or higher
Maximum Viscosity at Starting Temperature	7500 SUS
Minimum Operating Viscosity	70 SUS or as approved by Denison Div.
Rust and Oxidation Inhibitors	Yes
Anti-Foam Additive	Yes
API Gravity, Degrees, Range25 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 150° F for vane 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.

The following data based on pump performance on 200 SUS oil @ 130° F with 2" HG vacuum.

Table II
Typical Pump Operating Characteristics - TDC

MODEL NOS.	P1 CARTRIDGE ("D")			P2 CARTRIDGE ("C")		
	DELIVERY G.P.M.		HP INPUT	DELIVERY G.P.M.		HP INPUT
	1200 RPM 100 PSI SAE RATING	2100 RPM 2000 PSI	2100 RPM 2000 PSI	1200 RPM 100 PSI SAE RATING	2100 RPM 2500 PSI	2100 RPM 2500 PSI
TDC-020-008	20.0	34.0	43.7	8	11.5	24.2
TDC-020-011				11	16.6	33.1
TDC-020-014				14	23.0	41.0
TDC-020-017				17	27.4	48.1
TDC-028-008	28.0	47.0	61.1	8	11.5	24.2
TDC-028-011				11	16.6	33.1
TDC-028-014				14	23.0	41.0
TDC-028-017				17	27.4	48.1
TDC-031-008	31.0	53.2	68.7	8	11.5	24.2
TDC-031-011				11	16.6	33.1
TDC-031-014				14	23.0	41.0
TDC-031-017				17	27.4	48.1
TDC-035-008	35.0	61.0	75.3	8	11.5	24.2
TDC-035-011				11	16.6	33.1
TDC-035-014				14	23.0	41.0
TDC-035-017				17	27.4	48.1
TDC-038-008	38.0	66.9	82.7	8	11.5	24.2
TDC-038-011				11	16.6	33.1
TDC-038-014				14	23.0	41.0
TDC-038-017				17	27.4	48.1

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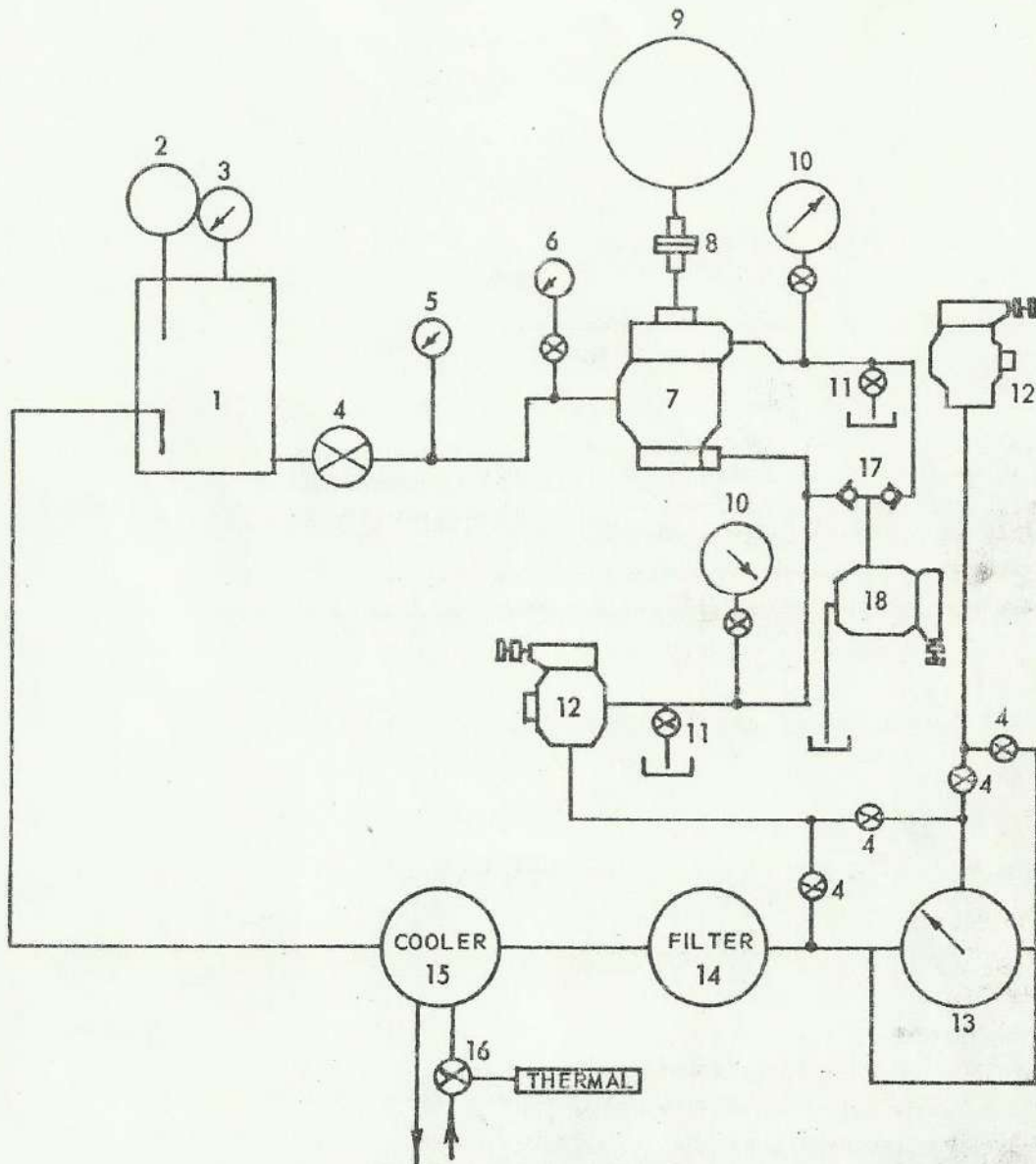
Typical Pump Operating Characteristics - TEC

MODEL NOS.	P1 CARTRIDGE ("E")			P2 CARTRIDGE ("C")		
	DELIVERY G.P.M.		HP INPUT	DELIVERY G.P.M.		HP INPUT
	1200 RPM 100 PSI SAE RATING	2000 RPM 2000 PSI	2000 RPM 2000 PSI	1200 RPM 100 PSI SAE RATING	2000 RPM 2500 PSI	2000 RPM 2500 PSI
TEC-045-008	45.0	70.0	84.0	8	11.0	23.0
TEC-045-011				11	15.8	31.6
TEC-045-014				14	22.0	39.0
TEC-045-017				17	26.0	46.0
TEC-050-008	50.0	76.0	91.0	8	11.0	23.0
TEC-050-011				11	15.8	31.6
TEC-050-014				14	22.0	39.0
TEC-050-017				17	26.0	46.0
TEC-060-008	60.0	93.0	110.0	8	11.0	23.0
TEC-060-011				11	15.8	31.6
TEC-060-014				14	22.0	39.0
TEC-060-017				17	26.0	46.0

Typical Pump Operating Characteristics - TED

MODEL NOS.	P1 CARTRIDGE ("E")			P2 CARTRIDGE ("D")		
	DELIVERY GPM		HP INPUT	DELIVERY GPM		HP INPUT
	1200 RPM 100 PSI SAE RATING	1800 RPM 2000 PSI	1800 RPM 2000 PSI	1200 RPM 100 PSI SAE RATING	1800 RPM 2000 PSI	1800 RPM 2000 PSI
TED-037-020	37.0	51.5	70	20	27.5	37
TED-037-028				28	39.5	58.8
TED-037-031				31	44.0	60
TED-037-035				35	50.0	65
TED-037-038				38	54.5	70.5
TED-045-020	45.0	63.5	79	20	27.5	37
TED-045-028				28	39.5	58.8
TED-045-031				31	44.0	60
TED-045-035				35	50.0	65
TED-045-038				38	54.5	70.5
TED-050-020	50.0	71	88	20	27.5	37
TED-050-028				28	39.5	58.8
TED-050-031				31	44.0	60
TED-050-035				35	50.0	65
TED-050-038				38	54.5	70.5
TED-060-020	60.0	84	105	20	27.5	37
TED-060-028				28	39.5	58.8
TED-060-031				31	44.0	60
TED-060-035				35	50.0	65
TED-060-038				38	54.5	70.5

SECTION II TESTING



LEGEND

- | | |
|---|---|
| 1. Reservoir | 10. Pressure gauge (0 to 4000 psi) |
| 2. Air Filter | 11. Air bleed off for priming pump |
| 3. Oil Volume Gauge | 12. Relief valve (0 to 3000 psi) |
| 4. Gate Valve | 13. Flow meter with inlet strainer |
| 5. Oil Temperature Gauge
(Should not restrict suction) | 14. Oil filter |
| 6. Vacuum gauge (0-30 in. hg.) | 15. Cooler |
| 7. Pump to be tested | 16. Water valve with thermostatic control |
| 8. Flexible coupling | 17. Check valve |
| 9. Electric motor | 18. Relief valve (0 to 5000 psi) |

Figure 3 - Testing Circuit

A. TESTING PROCEDURE

1. a. Check hydraulic circuit and back off relief valves to 0 psi.
- b. Check rotation arrow on nameplate.
- c. Open air bleed (11) until pump primes.

NOTE

Pump and oil must be same temperature to prevent seizing. Soak pump in hot oil if necessary.

2. Start electric motor in cycling manner by alternately pushing start and stop button until pump primes.
3. Increase outlet pressure immediately to 500 psi on both circuits to permit pressure lubrication to rotors and prevent seizing.
4. Check flow meter for delivery on both cartridges immediately to see if oil is being delivered. If no oil is being delivered, shut off motor immediately. Check housing markings and motor rotation for correct assembly. Check pump inlet vacuum.
5. Run pump for minimum of 5 minutes at 2500 psi on small cartridge and 2000 psi on large cartridge.
6. Maintain oil temperature at 145° to 155° F. on 150 SSU oil.
7. Check deliveries at maximum rated rpm and at 0, 500, 1000, 1500, 2000 and 2500 psi on small cartridge and 0, 500, 1000, 1500 and 2000 psi on large cartridge. Deliveries should exceed minimum values.
8. Inspect shaft seal and housing for oil on air leaks.
9. Check pump noise level. If pump is noisy check shaft seal for correct installation and suction line joints for air leaks.
10. If acceptable, remove from stand. Drain housing.
11. If not acceptable, look for cause (See Table III). If trouble cannot be remedied, contact Denison Service Department or Denison Field Engineer.

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 I.
- 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 I, 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	<p>Foot valve in suction line. Pump did not prime.</p> <p>Wrong direction on shaft rotation or incorrect pump model.</p> <p>Tank oil level too low.</p>	<p>These should never be used.</p> <p>Bleed air from pump outlet (install needle valve for this purpose) or Denison air bleed off valve AB04-15.</p> <p>Must be reversed immediately to prevent seizure and breakage of parts due to lack of oil. Check rotation arrows on cam ring.</p> <p>Add recommended oil and check level on both sides of tank baffle to be certain pump suction line is submerged.</p>
PUMP NOT DELIVERING OIL (continued)	<p>Oil intake pipe or suction filter clogged.</p> <p>Air leak in suction line. 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>

TABLE III - TROUBLE SHOOTING CHART (continued)

TROUBLE	PROBABLE CAUSE	POSSIBLE REMEDY
PUMP MAKING NOISE	Small air leak at pump intake piping joints.	Test by pouring oil on joints while listening for change in sound of operation. Tighten as required.
	Air leak at pump shaft packing.	Pour oil around shaft while listening for change in sound of operation.
	Relief valve chattering.	Air being drawn into system at pump intake or pump shaft packing (Check as above.)
	Housing breathing.	Increase housing bolt torque.
	Partially clogged intake line, intake filter, or restricted intake pipe.	Pump must receive intake oil freely or cavitation will take place.
	Air bubbles in intake oil.	Check thoroughly to be certain return lines are below oil level and well separated from intake.
	Tank air vent plugged.	Must be opened through breather opening or air filter.
	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 adequate 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.

SECTION V OVERHAUL

A. GENERAL

The instructions contained in this section cover a complete teardown of the double pumps.

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 - P2 Small Cartridge

1. Drain the pump.
2. Place the pump on a work bench.
3. Remove the screws (1) and end cap (2) and rear port plate.
(Note position of end cap in relation to dowel pin.)
4. Remove "O" ring (3).

5. Insert a 3/8-11 screw into the tapped hole provided in the center of the rear port plate (5) and remove the rear port plate and spring (6).

6. Remove the "O" rings (4) and (7).

7. Remove dowel pin (8).

Thread two 10-24 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 (9) P2.)

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.

DISASSEMBLY - Shaft End - P1 Large Cartridge

1. Remove bolts (10) from center housing (28) and mounting cap (11).
2. Separate mounting cap (11) and the attached shaft assembly from the center housing.

(Notice position of front port plate (13) in relation to dowel pins (22) and cam ring assembly (23).)
3. Remove "O" ring (12).
4. Thread two 10-24 screws in the tapped holes provided and remove the front port plate (13) from the mounting cap (11).
5. Remove "O" rings (14) and (15).
6. Remove the wavy washer spring (16) and snap ring (17) from the mounting cap.
7. Remove the key (29) from the shaft (20).
8. Push the shaft and bearing assembly out of the mounting cap.

CAUTION

Be careful not to damage the shaft seal.

9. Remove the shaft seal (21) by pressing on the back side of the seal from the front of the mounting cap, being certain not to scour the seal bore.
10. Remove the snap ring (18) from the shaft (20).
11. Remove the ball bearings (19) from the shaft by pressing on the inner face of the bearing.
12. Remove dowel pin (22) from (23).

No. 23 is the P1 cam ring assembly.

(Notice position of arrow on the cam ring in relation to the dowel pin and the position of the arrow on the center port plate (26).

13. Thread two screws (use 10-24 for the TDC and 3/8-16 on the TEC and TED) to remove the cam ring assembly (23).

Follow the same procedure to tear down this assembly as used on the P2 assembly.

14. Remove screws (24) and (25).

15. Remove center port plate (26) from the center housing (28).

NOTE

Do not remove roller bearing (27) unless it is worn and must be replaced.

D. CLEANING, INSPECTION, AND REPAIR

1. CLEANING

Wash all metal parts in cleaning solvent, (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, 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.

E. LUBRICATION

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

F. REASSEMBLY

1. Press bearing (27) into center port plate (26) with stamped end of bearing against shoulder of the pressing tool. The near end of bearing must be 11/16" below face of the center port plate on the TDC, 5/8" on the TEC and 1-15/16" on the TED.

2. Insert the center port plate (26) into the center housing (28) aligning the arrow on the suction ports with the large inlet port. Attach the center port plate to properly align the screw holes. Tighten securely and evenly, being careful not to cock the center port plate. Torque the 5/16" dia. bolts to 20 ft. lbs., and the 3/8" dia. bolts to 40 ft. lbs.
3. Assemble item (9) P2 cam ring assembly and item (23) P1 cam ring assembly in the following manner.

Place the cam ring, rotor, vane springs, spring guides, and vanes on a clean flat surface. Arrange the vanes side by side with the three spring holes up.

Insert the vane springs in the vanes, insert the spring guides in the springs.

Install the vanes with the guides and springs in the slots in the rotor.

WARNING

Be certain that the heads of the spring guides and springs are started in the holes in each rotor slot.

Place a ring compressor around the vanes and tighten the compressor gradually until the springs and vanes are in the position they will occupy while in the cam ring. Install the rotor in the cam ring using a backup plate to prevent the vanes from sliding endwise in the slots and damaging the springs. If the vanes slide endwise, inspect and replace any damaged springs.

WARNING

Be certain that the assembly is inserted far enough in the cam ring so that when the ring compressor is removed the vanes do not fly out of position.

4. Press ball bearing (19) on shaft (20) to shoulder and then install retaining ring (18) to hold bearing in place.
5. Press shaft seal (21) into mounting cap (11).

NOTE

Open face of seal must be toward inside of pump.

CAUTION

Special care must be taken to keep foreign matter from sealing lips of seal to prevent cuts or abrasion of these edges.

6. Completely fill space between seal lips with high temperature grease. Press shaft assembly into mounting cap (11) from cap end of pump and bottom in bearing bore. Apply protective covering (may use tape or special metal tube) over keyway or spline end of shaft.
7. Insert retaining ring (17) in groove against bearing.

CAUTION

Retaining ring (17) must be fully seated in groove.

8. Install "O" rings (12) and (15) in mounting cap (11). Place heavy grease on both "O" rings. Install "O" ring (14) on front port plate (13). Place heavy grease on "O" ring. Position mounting cap and shaft assembly on work bench with coupling end of shaft extended down.
9. Place wavy washer spring (16) against retaining ring (17) and insert front port plate (13) into the mounting cap (11) taking care not to damage the "O" rings. Do not press port plate into position until porting is determined. The arrow on the front port plate (13) must line up with the arrow on the center port plate (26). For proper assembly of TDC pumps see Fig. 4 for right hand operation and Fig. 5 for left hand operation. For proper assembly of TEC & TED see Fig. 6 for right hand operation and Fig. 7 for left hand operation.
10. Insert 1 dowel pin of (22) in proper hole in front port plate (13). Check Fig. 4, 5, 6 or 7 again and place cam ring assembly (13) over pump shaft and over dowel pin (22). Place other dowel pin (22) in cam ring directly over the pin in the front port plate.
11. Place the center housing (28) and the attached parts over the splined shaft. Line up the arrow that is visible thru the large inlet port with the arrow on the center port plate. Dowel pin (22) should be seated in the proper hole in port plate (26) when the arrows match.
12. Rotate the center housing (28), cam ring assembly (23) and front port plate (13) on the mounting cap (11) until the pressure outlet in (11) is in position for the desired porting. Install bolts (10) and tighten evenly. Torque to 130 ft. lbs on the TDC and 230 ft. lbs on the TEC.
13. Check Fig. 4 or 5 and insert 1 of dowel pin (8) in the proper hole in the small side of the center port plate.

Thread two 10-24 screws into P2 cam ring assembly (9) and place over the shaft and on dowel pin (8) as indicated in Fig. 4 or 5.

TDC P1 Cam Ring Assembly and Front Port Plate

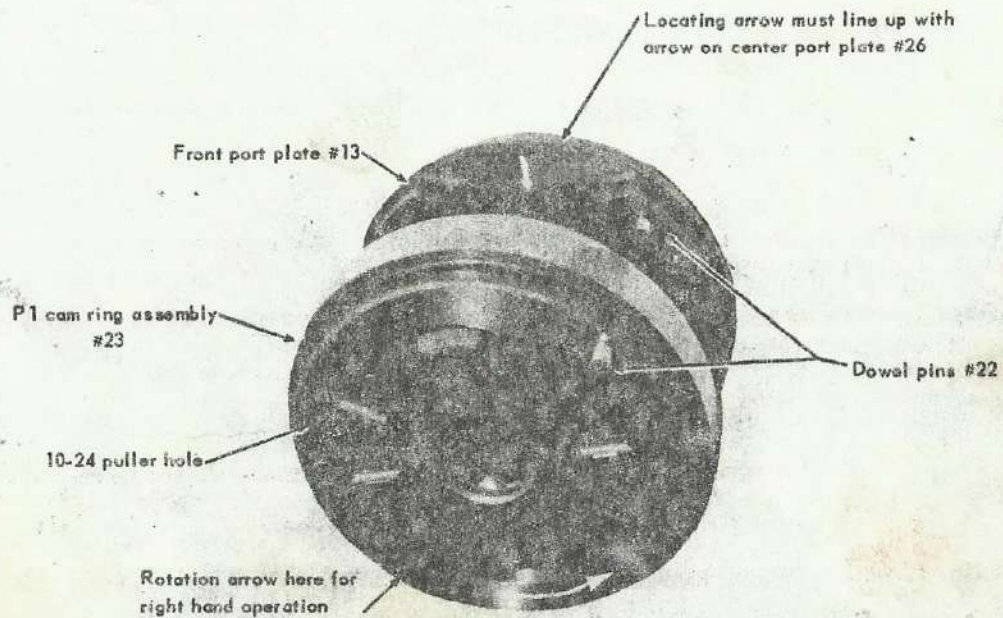


Fig. 4 Above parts must be assembled in this manner in the mounting cap end over the pump shaft for right hand operation.

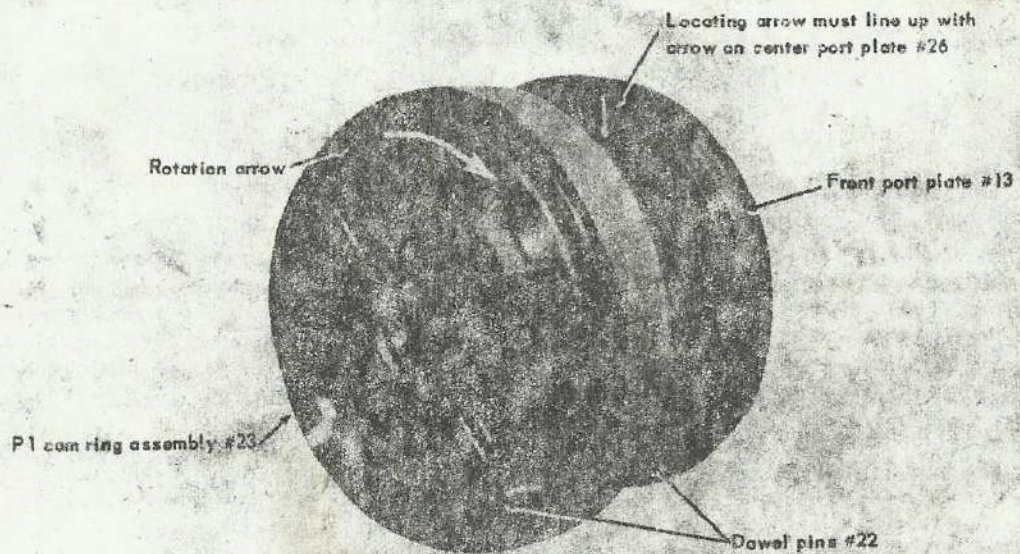


Fig. 5 Above parts must be assembled in this manner in the mounting cap end over the pump shaft for left hand operation.

TEC & TED P1 Cam Ring Assembly and Front Port Plate

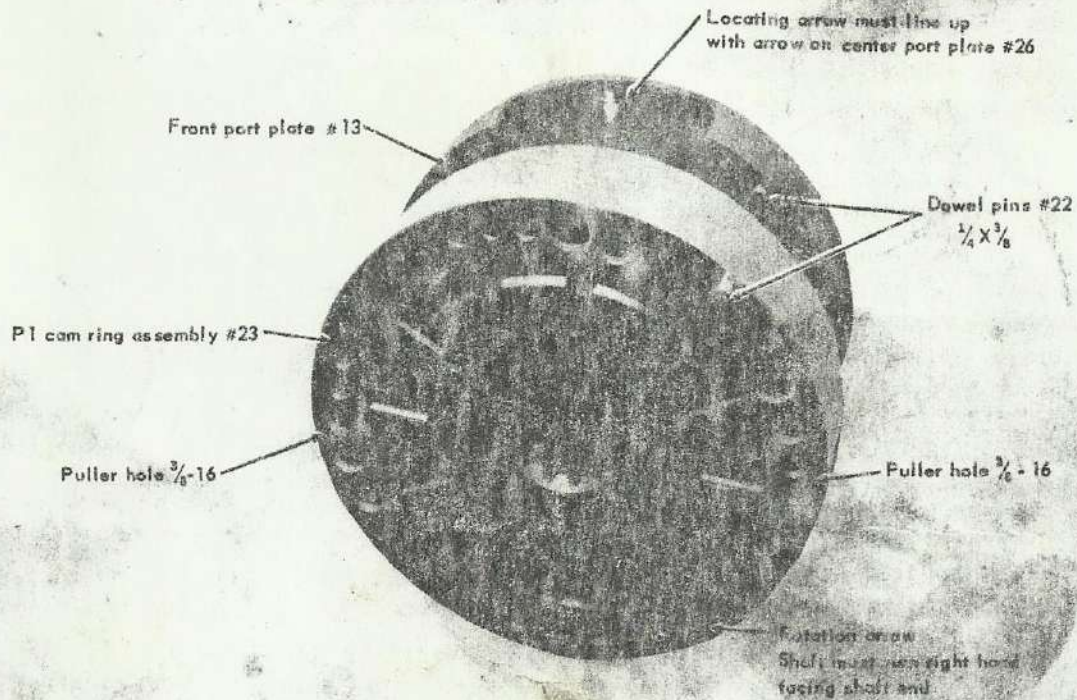


Fig. 6 Above parts must be assembled in this manner in the mounting cap and over the pump shaft for right hand operation.

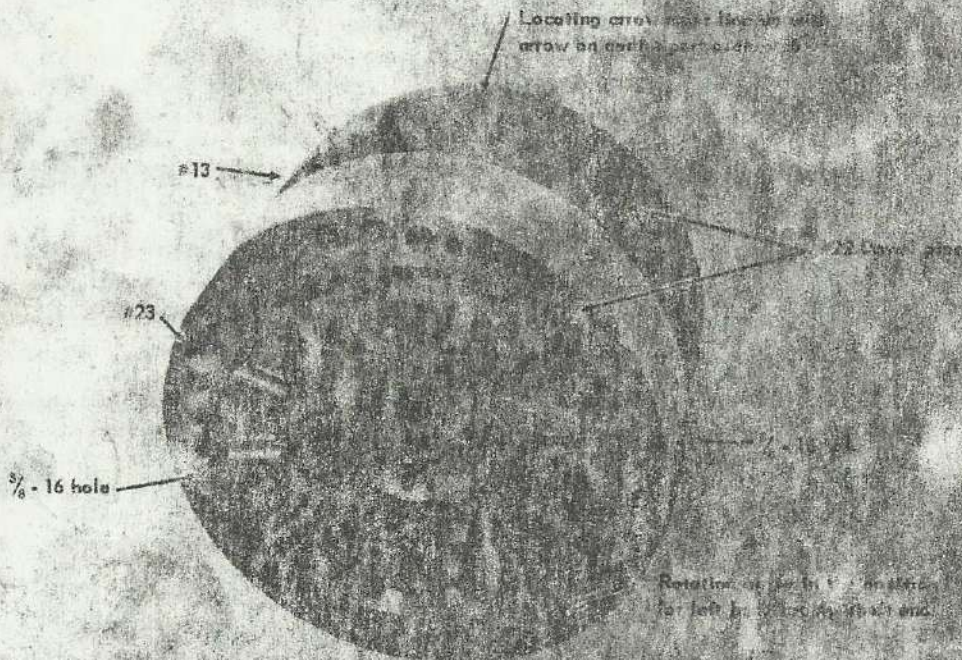


Fig. 7 Above parts must be assembled in this manner in the mounting cap and over the pump shaft for left hand operation.

CAUTION

The arrows on P2 (9) and P1 (23) cam ring assembly must be pointing the same rotation or pump will not function.

15. Insert spring (6) in P2 end cap (2) and insert rear port plate (5) in end cap. Place end cap & port plate on housing (28) and over dowel pin (8). The dowel pin will enter the correct hole in the rear port plate (5) when the arrows on both port plates (5) and (23) are in line.

14. Insert other dowel pin (8) in the cam ring directly over the first pin (8) that was inserted in center port plate.

16. Rotate the end cap (2) only to obtain the proper porting. Install bolts (1) and tighten evenly. Torque to 70-80 ft lbs on the TDC and TEC, 230 ft lbs on the TED.

Place "O" rings (3), (4) & (7) in end cap (2) and rear port plate (5) apply heavy grease.

Pump is assembled and ready for testing

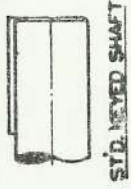
TDC PARTS LIST (see page 13 for Ref. No.)

REF. NO.	PART NUMBER	DESCRIPTION	QUANTITY
1	306-40149	Spec. Hex hd. cap Screw 1/2-13 X 2 1/2	4
2	034-27297	End cap (P2 outlet)	1
3	691-10244	(S) Sq. section seal TS33-244	1
4	691-10238	(S) Sq. section seal TS33-238	1
5	034-27298	Rear port plate	1
6	034-43015	Rear port plate spring	1
7	691-10139	(S) Sq. section seal TS33-139	1
8	324-21210	Dowel pin 3/16 X 5/8	2
9	see below	P2 cam ring assembly	1
10	306-40158	Spec. Hex hd. cap screws 5/8-11 X 6	4
11	034-24689	* Mounting cap (P1 outlet)	1
12	691-10256	(S) Sq. section seal TS33-256	1
13	034-24340	Front port plate	1
14	691-10248	(S) Sq. section seal TS33-248	1
15	691-10149	(S) Sq. section seal TS33-149	1
16	350-10025	Wavy washer No. 2332	1
17	356-32283	Internal snap ring, Walder 5008-213	1
18	356-31137	External snap ring, Walder 5100-137	1
19	230-00207	Ball bearing ND No. 320	1
20	034-27305	Shaft with keyway	1
	034-27306	Shaft with 14 tooth spline	1
21	620-82005	(S) Shaft seal <i>CR-14934</i>	1
22	324-21612	Dowel pin 1/4 X 3/4	2
23	see below	P1 cam ring assembly	1
24	358-14186	S.H.C. screws 7/16-18 X 1 1/2 (Nut)	4
25	358-14146	S.H.C. screws 7/16-18 X 7/8 (Nut)	4
26	034-27296	Center port plate	1
27	230-82013	Needle bearing JM-1312	1
28	034-27293	Center housing (inter)	1
29	034-19579	Shaft key	1
(S)	S14-09687	Seal Kit	

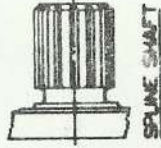
CAM RING ASSEMBLY

		CAM RING	ROTOR	VANES	VANE SPRINGS	SPRING GUIDES	ASSEMBLY NO.
(May be ordered as an assembly)							
P2 No. 9	"C" 008	034-27262	034-27298	034-27257	034-41676	034-40687	S14-06691
	011	034-27277					S14-06692
	014	034-27278					S14-06693
	017	034-27261					S14-06694
P1 No. 23	"D" 020	034-27300	034-21383	034-24478	034-21396	034-24678	S14-08042
	028	034-27301					S14-08043
	031	034-27302					S14-08044
	035	034-27303					S14-08045
	038	034-27304					S14-08046
QTY.		1	1	10	30	30	

TDC

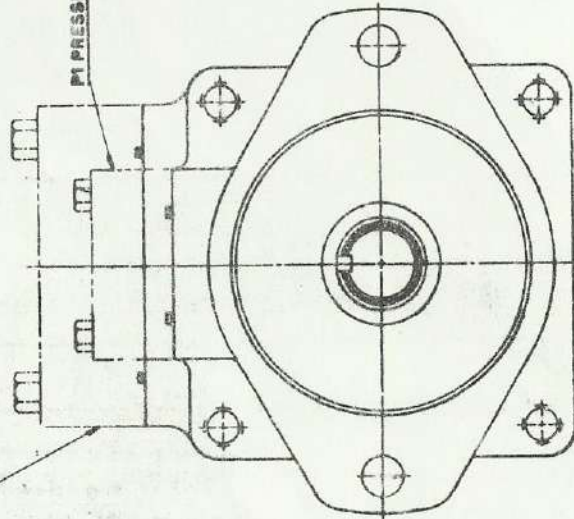


STD. KEYED SHAFT

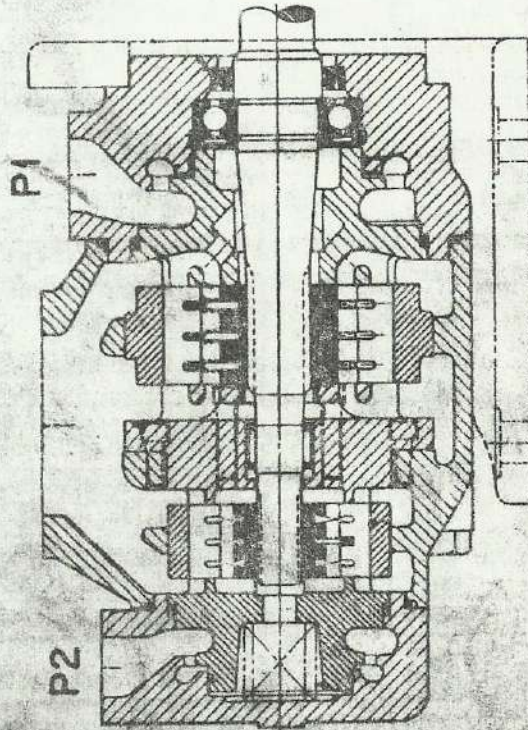
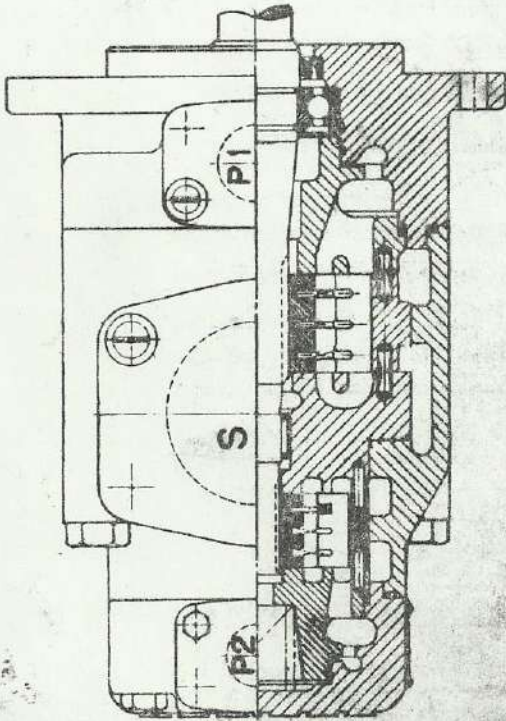


SPLINE SHAFT

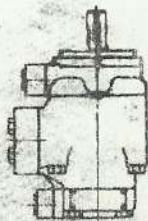
SUCTION CONNECTION



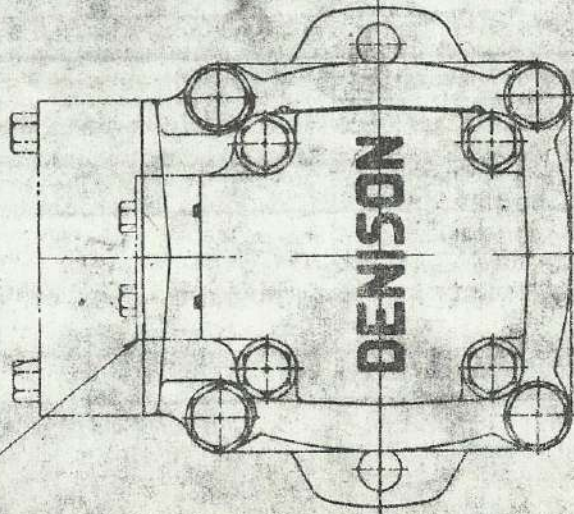
P1 PRESSURE CONNECTION



034-24342 FOOT
BRACKET
306-24180 H. H. CAP
SCREW-2 REQ. - 5/8-11.5-1/2



P2 PRESSURE CONNECTION



DENISON