



COACH HYDRAULIC FLUID DRIVE FAN



TRUCK & COACH DIVISION

GENERAL MOTORS CORPORATION

PONTIAC, MICHIGAN 48053

INTRODUCTION

This manual contains replacement, service, and overhaul procedures for the unit indicated on the cover. For all other service and maintenance information and unit replacement procedures related to V-71 engines used in GMC Coach applications refer to Detroit Diesel Maintenance Manual 6SE228.

IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all motor vehicles. The service procedures recommended and described in this service manual are effective methods, for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

It is important to note that some warnings against the use of specific service methods that can damage the vehicle or render it unsafe are stated in this service manual. It is also important to understand these warnings are not exhaustive. We could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, we have not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by the manufacturer must first satisfy himself thoroughly that neither his safety nor vehicle safety will be jeopardized by the service method he selects.

HYDRAULIC FLUID DRIVE FAN

INDEX

Subject	Page No.	Subject	Page No.
Description and Operation	2	Driven Torus	6
Removal and Disassembly of Torus Units	3	Fluid Control (Vernatherm) Valve	7
Driven Torus	4	Maintenance	7
Driving Torus	4	Adjusting Valve	7
Coupling and Damper	5	Element Replacement	7
Inspection	6	Valve Disassembly	8
Assembly and Installation of Torus Units	6	Assembly of Valve	8
Coupling and Damper	6	Specifications	8
Driving Torus	6		

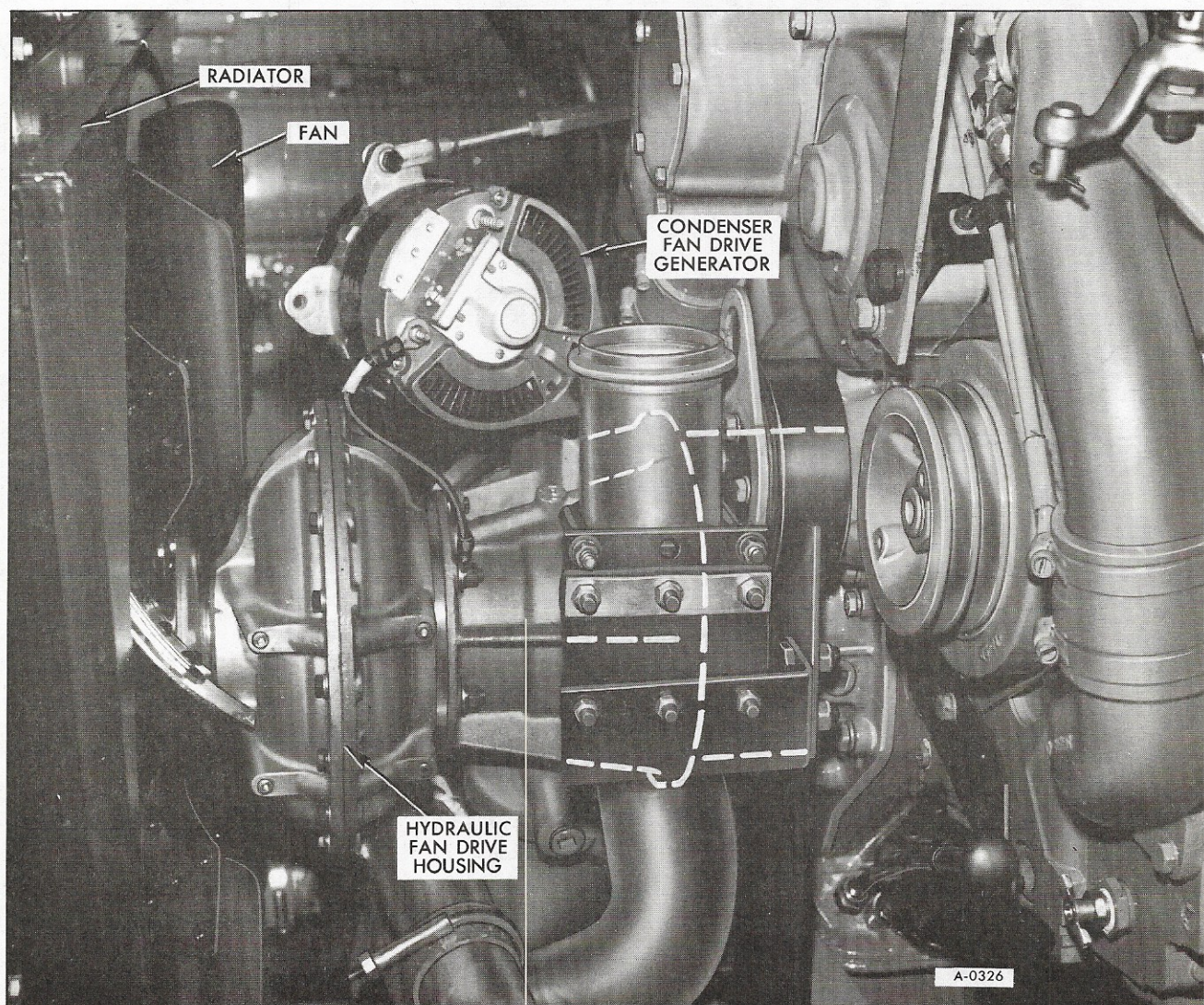


Figure 1—Radiator and Fluid Drive Fan Installed

HYDRAULIC FLUID DRIVE FAN

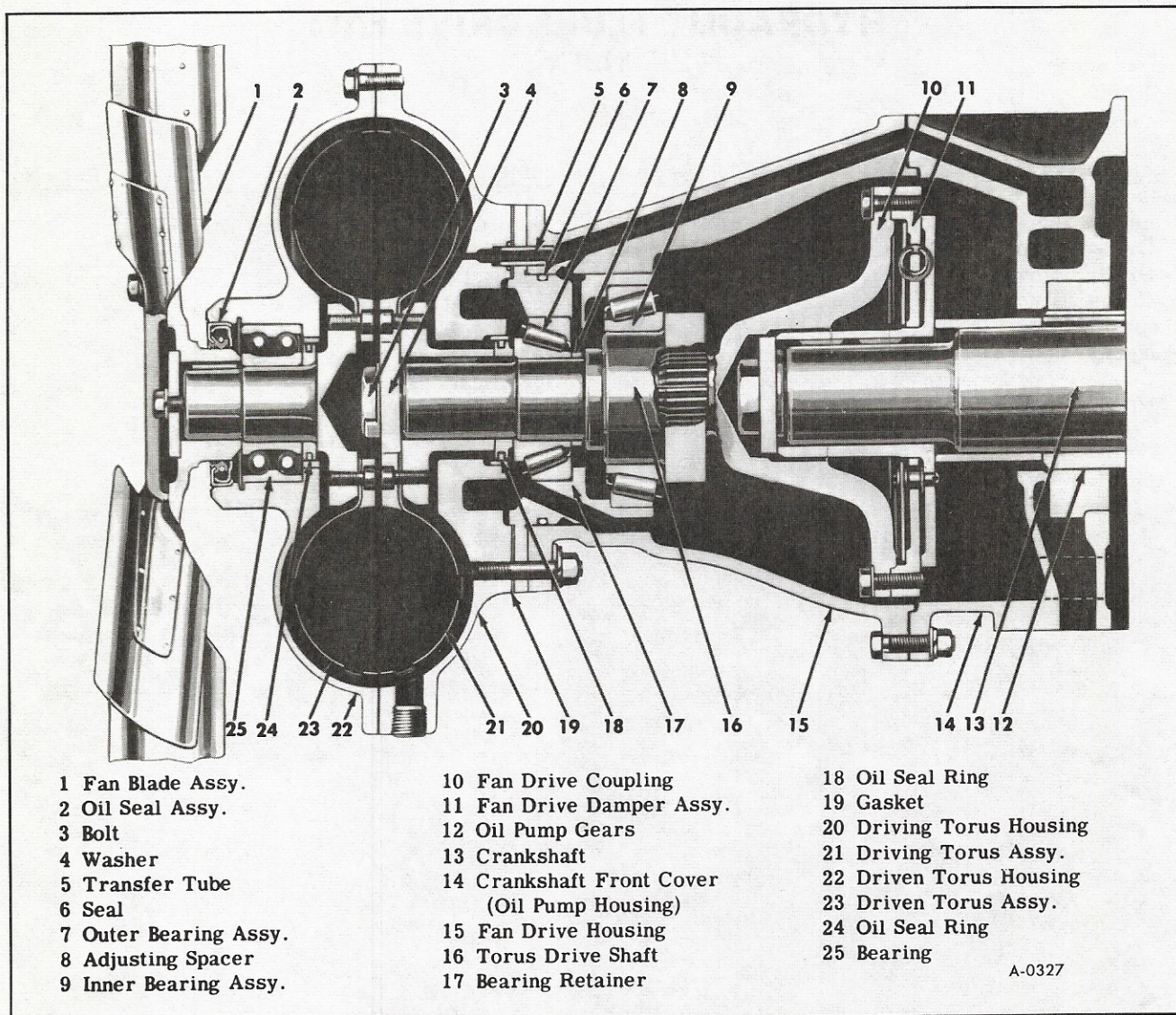


Figure 2—Cross-Sectional View of Fluid Fan Drive (Typical)

DESCRIPTION AND OPERATION

On vehicles with this device, the fan drive system (fig. 1) is thermostatically controlled and operates whenever engine cooling is required. The fan drive system consists of a driving and a driven torus member, a torus drive shaft, a coupling and a damper enclosed within an aluminum fan drive housing. Power is supplied to the driven torus member by the driving torus member through the torus drive shaft which is driven from the engine crankshaft through the damper and coupling (fig. 2). Speed at which fan operates is variable depending upon operating temperatures which affect the amount of oil retained within the torus housing. Oil from engine crankcase is used to fill torus housing to operate the fan.

A thermostatically-operated fluid fan control valve (fig. 3) is installed in the returnline between the radiator and water pump. The amount of oil retained in the torus housing is controlled by the valve which is actuated by temperature of water in pipe between engine water pump and oil cooler.

The fan should not run at engine speed when engine is cold but must operate when engine has reached a normal operating temperature of approximately 170°F. Before engine reaches normal operating temperature, engine thermostats will be closed and fan control valve will be open (fig. 4), thus permitting oil to return to the crankcase and little or no power is transmitted to the fan by the torus driven member.

When engine temperature reaches approximately 172°F., engine thermostats will open and

HYDRAULIC FLUID DRIVE FAN

coolant begins to flow through the radiator. Heat at this time is sufficient to cause fan control valve to close (fig. 4). Oil is retained in the torus housing and power is gradually transmitted to the fan. Coolant continues to circulate through the air compressor, heat exchanger at transmission, coach heating system and surge tank.

The fan speed varies with the amount of oil retained in the coupling as determined by temperature of water in return line between radiator and water pump. The fan speed is varied gradually as temperatures change due to operating conditions.

REMOVAL AND DISASSEMBLY OF TORUS UNITS

The following instructions apply to the fluid fan system used on coaches with or without air conditioning. The fluid fan used on coaches without air conditioning is illustrated in figure 5 and the fan used on coaches equipped with air conditioning is illustrated in figure 6.

NOTE: For information relative to the accessory drive used on air conditioned coaches, refer to

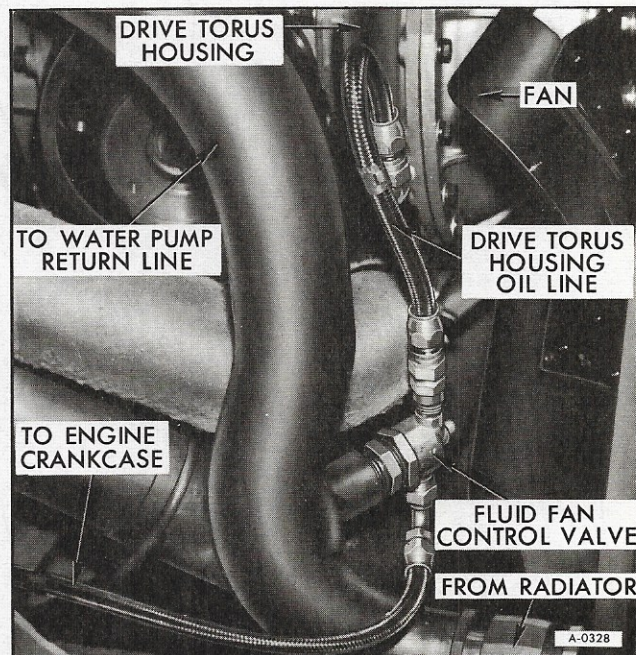


Figure 3—Fluid Fan Control Valve Installed

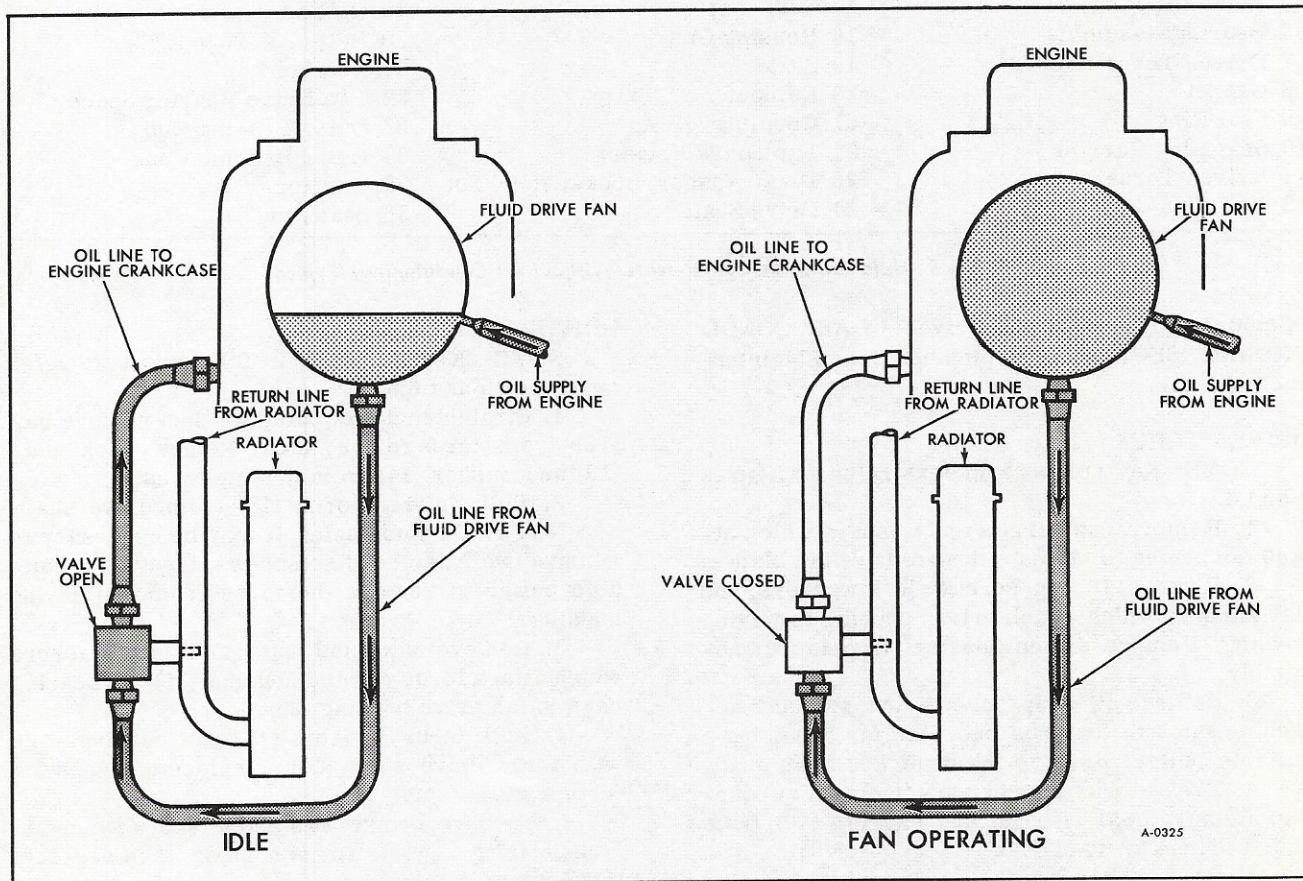


Figure 4—Schematic of Fluid Fan Operation

HYDRAULIC FLUID DRIVE FAN

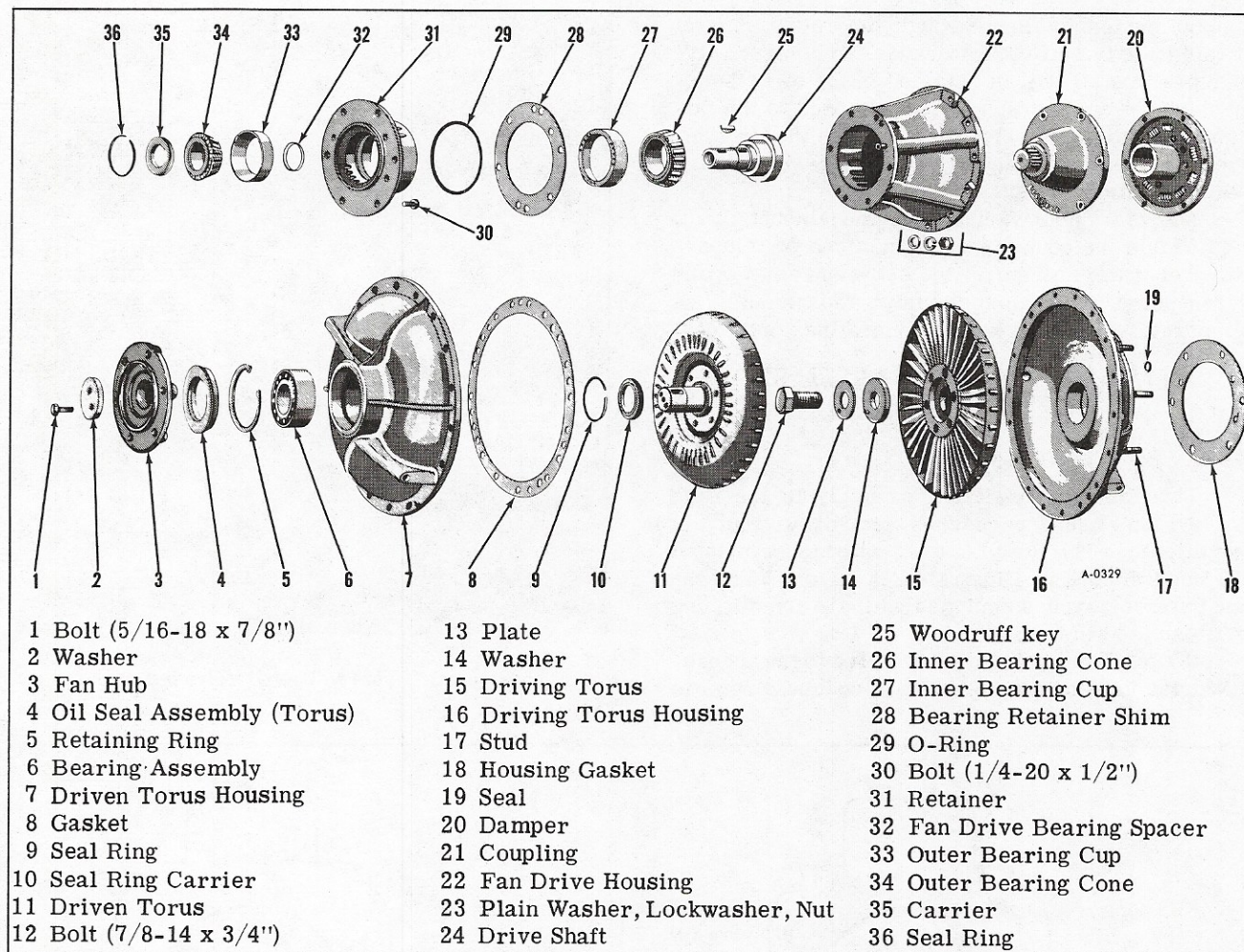


Figure 5—Fluid Fan Drive Components (Without Air Conditioning) (Typical)

"Compressor Accessory Drive" in AIR CONDITIONING (SEC. 26) of applicable Coach Maintenance Manual.

DRIVEN TORUS

NOTE: Key numbers in text refer to figures 5 and 6.

1. Remove cap screws and washers which attach fan blades to fan hub, then remove fan blades.

2. Remove 18 cap screws, lock washers, and flat washers which attach driven housing to driving housing. Remove driven housing (7) and torus assembly.

3. Remove two cap screws and washers attaching fan hub to torus hub. Pull fan hub using a suitable puller. Remove woodruff key from shaft.

4. Press torus member assembly from bearing. Remove seal ring (9) and carrier (10) from hub of driven torus (11).

5. Remove oil seal (4) from driven housing (7). Remove snap ring (5) from torus housing (7); then press bearing (6) from housing.

DRIVING TORUS

NOTE: Key numbers in following text refer to figures 5 and 6.

1. Straighten lock plate tab, then remove bolt (12) from torus drive shaft. Remove lock plate (13) and washer (14) from driving torus.

2. Pull driving torus (15) from drive shaft.

NOTE: On some units, it may be necessary to remove two Allen head setscrews, then use a suitable puller to remove the torus from the driving housing.

3. Remove six stud nuts and lock washers which attach torus driving housing (16) and bearing cage to fan drive housing (22).

4. Pull torus housing (16) and bearing cage with torus drive shaft (24) and place on bench for further disassembly.

5. Remove two screws and washers which attach bearing cage to torus housing, then separate these parts.

6. Position cage and bearing assembly in an arbor press. Press torus drive shaft (24) from

HYDRAULIC FLUID DRIVE FAN

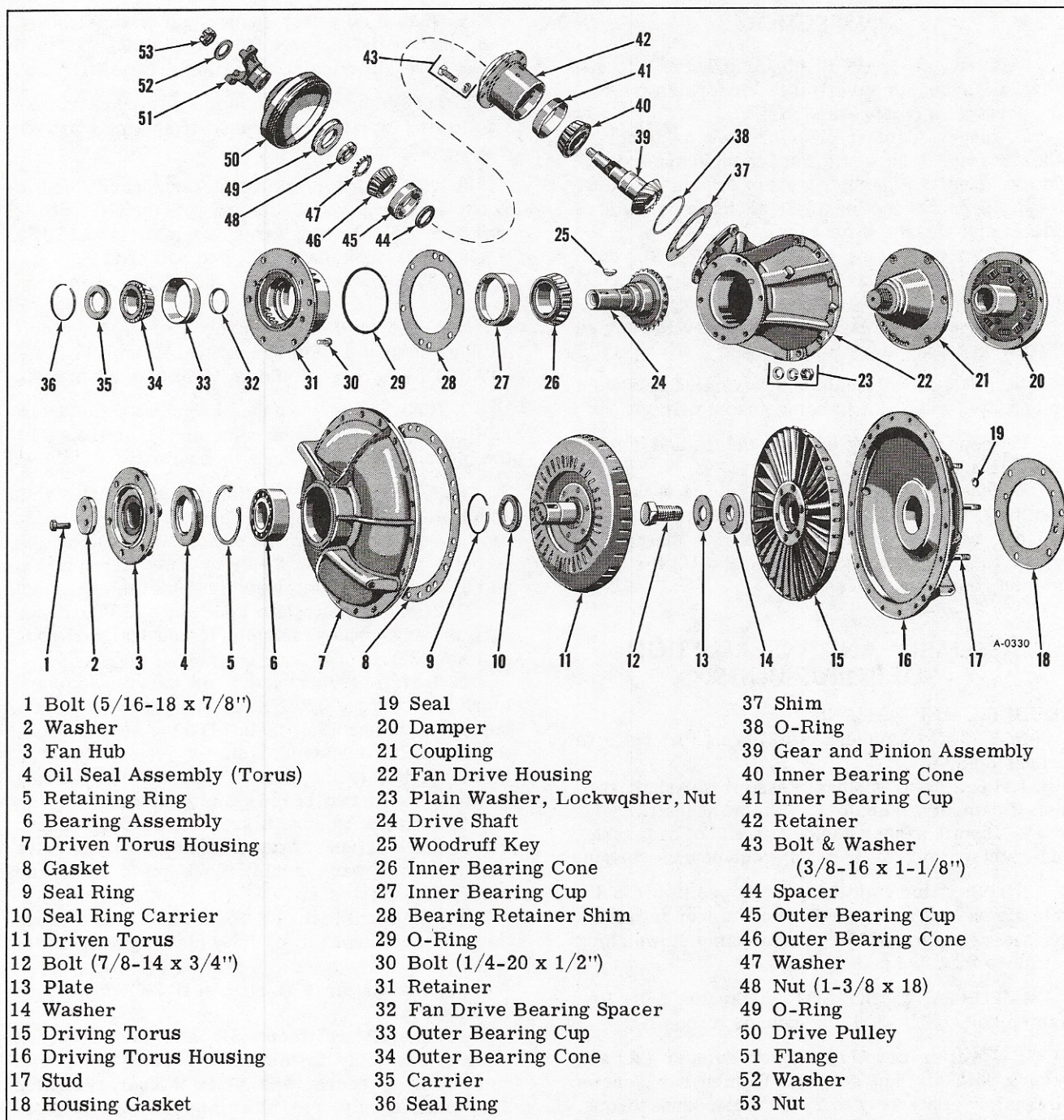


Figure 6—Fluid Fan Drive Components (With Air Conditioning) (Typical)

cage. Remove seal ring (36), ring carrier (35), and bearing cone (34) from bearing cage.

7. Remove bearing adjusting spacer (32) from drive shaft. Tag spacer for assembly reference.

COUPLING AND DAMPER

NOTE: Key numbers in following text refer to figures 5 and 6.

1. Remove eight cap screws which attach fan

drive housing (22) to crankshaft front cover (oil pump housing), then remove housing.

2. Remove six cap screws and lock washers which attach coupling (21) to damper assembly (20), then remove coupling.

3. Remove bolt and washer from end of crankshaft. Use a suitable available puller and remove damper assembly (20) from crankshaft. Remove two woodruff keys from crankshaft, if necessary.

HYDRAULIC FLUID DRIVE FAN

INSPECTION

1. Clean all parts in cleaning solvent to remove all accumulated oil, dirt, or foreign matter. Dry parts with compressed air.

2. Inspect damper (20) for broken springs or other damage that would render the damper ineffective. Replace damper assembly if necessary.

3. Inspect coupling (21) for worn or twisted splines and replace if necessary.

4. Inspect bearing cones (26 and 34) and cups (27 and 33) for wear or damage and replace if necessary.

5. Inspect oil seal ring carriers and replace if worn or damaged.

NOTE: New oil seals and O-ring seals should be installed when unit is being assembled.

6. Inspect bushing in torus driven and driving housings and replace if necessary.

7. Inspect torus vanes for evidence of damage resulting from being bent or bright areas which indicate they have been in contact with other parts.

8. Inspect torus housings (7 and 16) for damage and replace if necessary.

ASSEMBLY AND INSTALLATION OF TORUS UNITS

COUPLING AND DAMPER

NOTE: Key numbers in following text refer to figures 5 and 6.

1. Install two woodruff keys in crankshaft, then install damper assembly (20) on crankshaft.

2. Install washer and bolt in end of crankshaft and tighten bolt to 250-300 foot-pounds torque.

NOTE: After tightening bolt, position a suitable sleeve against outer edge of washer and strike the sleeve a sharp blow using a hammer weighing not more than two pounds.

IMPORTANT: DO NOT strike the bolt. Retighten bolt to 250-300 foot-pounds torque.

3. Position coupling (21) on damper (20) and secure with six cap screws. Tighten cap screws alternately and evenly to 25-30 foot-pounds torque.

4. Position a new gasket on crankshaft front cover, then install fan drive housing (22) using bolts, nuts, and washers as required. Tighten nuts on bolts and studs to 25-30 foot-pounds torque.

DRIVING TORUS

NOTE: Key numbers in following text refer to figures 5 and 6.

1. If bearings were removed from retainer (31), press new bearing cups (27 and 33) into retainer. Press inner bearing cone (26) on drive shaft (24).

2. Install adjusting spacer (32) on drive shaft, then install drive shaft (24) in retainer (31) and press outer bearing cone (34) on drive shaft.

NOTE: Information contained in Steps 3 through 7 following are for the purpose of obtaining proper bearing adjustment:

3. In the order indicated, temporarily install the following parts: Seal ring carrier (10), woodruff key (25), driving torus assembly (15 and 16), washer (14), lock plate (13), and bolt (12).

4. Tighten bolt (12) to 200-225 foot-pounds torque.

5. Wrap cord or wire around retainer and pull on horizontal line with spring scale. Rotating (NOT STARTING) torque should be 10 to 20 inch-pounds.

NOTE: The inch-pounds torque is achieved by multiplying the radius of retainer (31) in inches by the pounds pull required to rotate the retainer.

6. Whenever the rotating torque is not within specified limits, it will be necessary to increase or decrease the thickness of adjusting spacer (32) at outer bearing cone. Refer to "Specifications" at end of this manual for available spacer thicknesses.

7. Remove bolt (12), lock plate (13), washer (14), driving torus assembly (15 and 16), and woodruff key (25).

8. Install seal ring (36) in carrier (35) and lubricate thoroughly. Install new gasket (18) on bearing retainer (31). Install O-ring seal in counterbore of drive housing (16).

9. Install torus drive housing (16) to bearing retainer using two screws and lock washers.

10. Install woodruff key (25) in drive shaft, then install driving torus assembly (15) to drive shaft. Install washer (14), lock plate (13), and bolt (12) in drive shaft.

11. Tighten bolt (12) to 200-225 foot-pounds torque, then bend tab of lock plate against flat of bolt.

12. Install large O-ring seal (29) on bearing retainer.

13. Install retainer (31) and driving torus housing assembly to fan drive housing using stud nuts, lock washers, and plain washers. Tighten stud nuts evenly and alternately to 25-30 foot-pounds torque.

NOTE: In some instances, it may be necessary to heat the fan drive housing and chill the bearing retainer and shaft sub-assemblies in order to facilitate assembly of retainer in housing.

DRIVEN TORUS

NOTE: Key numbers in following text refer to figures 5 and 6.

1. Install ball bearing assembly (6) in driven torus housing (7) with shielded side of bearing toward inside, then secure with snap ring (5).

HYDRAULIC FLUID DRIVE FAN

2. Install seal ring (9) in seal ring carrier (10) and lubricate freely with engine oil. Install seal ring and carrier in driven housing (7) with chamfered inner edge away from bearing.

CAUTION: If seal ring and carrier are first installed on driven torus shaft, damage may result as seal ring starts to enter seal ring bushing.

3. Support bearing at inner race while driven torus shaft is pressed through seal ring carrier

(10) and into bearing.

4. Install woodruff key in torus member hub, then press seal (4) into housing.

5. Press fan hub and wear sleeve assembly (3) onto torus member shaft. Coat inner surface of retainer washer and bolt heads lightly with sealer, then install washer and bolts. Tighten bolts securely.

6. Position new gasket (8) on driving housing (16), then install driven housing (7) using cap screws, lock washers and plain washers. Tighten cap screws evenly and alternately to 20-25 foot-pounds torque.

FLUID CONTROL (VERNATHERM) VALVE

A fluid control (vernatherm) valve is mounted in water return line between radiator and engine water pump as shown in figure 3. A cross-sectional view of the valve is shown in figure 7.

Purpose of the valve is to control the flow of oil from the torus housing. When temperature of water is such that cooling is required, the valve starts to close thereby restricting the flow of oil from the torus units. The fan speed is variable depending upon the amount of oil being retained in the torus units.

MAINTENANCE

Ordinarily the valve requires only a minimum amount of maintenance.

1. After prolonged use, wear within the element may occur, resulting in the valve closing at a slightly higher temperature. Should this occur, it may be advisable to readjust the valve as directed under "Adjusting Valve" later.

2. Whenever it is believed that valve is not seating, due to dirt or other foreign matter, the inlet and outlet lines should be disconnected and the valve flushed with fuel oil and blown out with compressed air.

ADJUSTING VALVE

NOTE: Key numbers in following text refer to figure 7.

Suitable test equipment should be available, which provides water under pressure; also, a means of immersing element in water heated to at least 175°F.

1. Connect valve inlet to water source which will provide 30 psi pressure.

2. Immerse power element in water heated to 172°F. - 174°F.

3. Maximum leakage past valve should not exceed one pint per minute with element heated to 172°F. - 174°F., and with 30 psi pressure at valve inlet.

4. If valve requires adjustment, loosen element

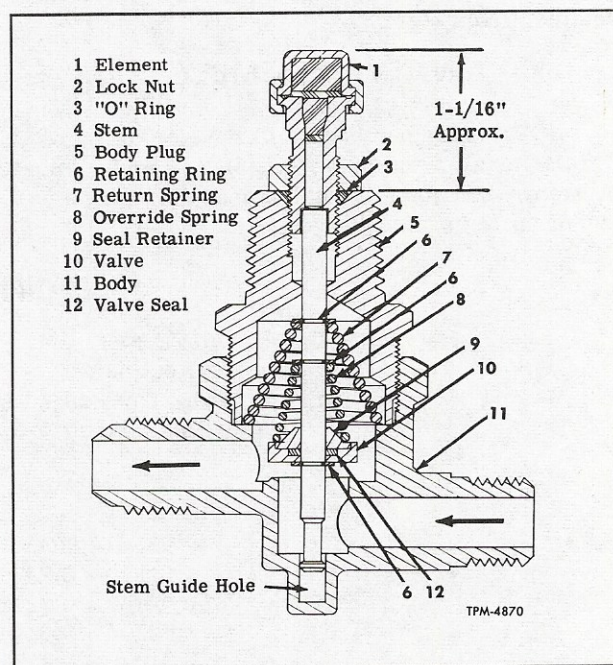


Figure 7—Sectional View of Hydraulic Fan Control Valve (Typical)

lock nut (2) and turn element (1) in to decrease or out to increase closing temperature.

IMPORTANT: Use a wrench on flats of element stem. Do not grasp element with pliers. Each full turn of element will change operating temperature approximately five degrees.

ELEMENT REPLACEMENT

1. Loosen lock nut (2), then thread element out of body plug (5). Remove O-ring (3) and lock nut (2) from element.

2. Apply a thin coating of thread compound on element threads, then thread nut and O-ring onto element.

HYDRAULIC FLUID DRIVE FAN

3. Thread element into body plug. When element projects 1-1/16-inch above plug it is in its approximate correct location. Adjust as previously instructed under "Adjusting Valve."

VALVE DISASSEMBLY

NOTE: Key numbers in text refer to figure 7.

1. Loosen lock nut (2), then thread element (1) out of body plug (5).

2. Temporarily place assembly in vise while body plug (5) is loosened.

3. Remove body plug (5) from body (11), then lift valve, stem, and springs from body.

4. Remove three retaining rings which will permit removal of springs, valve, seal, and valve retainer from stem.

VALVE ASSEMBLY

NOTE: Key numbers in text refer to figure 7.

1. Install retaining ring (6) in center groove of stem, then install small spring (8) with small end of spring against ring.

2. Install seal retainer (9) over stem with flat side down, then install seal (12) and valve (10). Compress spring and secure these parts to stem using retainer ring (6) in stem lower groove.

3. Position large spring (7) over small spring and valve and secure with retaining ring (6) in stem upper groove.

4. Place body (11) in vise, then position stem and spring assembly in body. Apply a thin coating of thread compound, then thread body plug (5) into body until it can be felt that lower end of stem is bottoming in body. Back off plug slightly.

5. Using a small (1/4") rod, press down on upper end of stem until it can be felt that lower end of stem is entering guide hole in bottom of body. While holding stem down, tighten body plug securely.

6. Again press down on upper end of stem to be sure it is free to move up and down.

7. With lock nut (2), and O-ring (3) in place on element stem, thread element into body plug. When element projects 1-1/16-inch above plug it is in approximately the correct location.

8. Adjust valve as previously instructed under "Adjusting Valve" earlier.

SPECIFICATIONS

FLUID DRIVE FAN

Bearing Retainer

Rotating Torque (In.-Lbs.) 10-20

Adjusting Method Spacer

SPACER THICKNESSES

<u>DIMENSION</u>	<u>STAMPED</u>
0.223" - 0.222"	F-23
0.2215" - 0.2205"	F-215
0.220" - 0.219"	F-20
0.2185" - 0.2175"	F-185
0.217" - 0.216"	F-17
0.2155" - 0.2145"	F-155
0.214" - 0.213"	F-14
0.2125" - 0.2115"	F-125
0.211" - 0.210"	F-11
0.2095" - 0.2085"	F-095
0.208" - 0.207"	F-08
0.2065" - 0.2055"	F-065
0.205" - 0.204"	F-05
0.2035" - 0.2025"	F-035
0.202" - 0.201"	F-02
0.2005" - 0.1995"	F-005
0.199" - 0.198"	F-99
0.1975" - 0.1965"	F-975
0.196" - 0.195"	F-96
0.1945" - 0.1935"	F-945
0.193" - 0.192"	F-93

FLUID SEAL RING THICKNESS 0.122"-0.124"

FLUID FAN CONTROL VALVE

CLOSES AT 172°F.-174°F.