ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION
SERVICE DEPARTMENT

MAINTENANCE INSTRUCTION

FUEL PUMPS

DESCRIPTION

Tuthill and Viking pumps are highly efficient, positive displacement, rotary internal gear types having mechanical seals. The Tuthill pump has an output of 2.5 GPM at 1100 RPM while the Viking pump discharges 4.0 GPM at 1200 RPM. The type of pump employed depends upon the quantity of fuel needed by the particular application.

These pumps provide the very important function of supplying the diesel engine with adequate fuel for operation. In some applications the pump is driven by a small electric motor, however, in other cases it is driven directly by the diesel engine. In the latter instance, a separate priming pump is required to provide the engine with sufficient fuel for starting purposes.

Since the Tuthill and Viking pumps differ somewhat in construction, specific instructions pertaining to each of them is provided in this bulletin. In instances where no particular pump is identified, the information will pertain to both pumps.

OPERATION

The operation of both the Viking and Tuthill pumps is based on the "internal gear" pumping principle. This principle is based upon the use of a rotor, idler gear, and a crescent-shaped partition that is cast integral with the cover, Fig. 1. Thus only two moving parts are responsible for the actual pumping. Power is

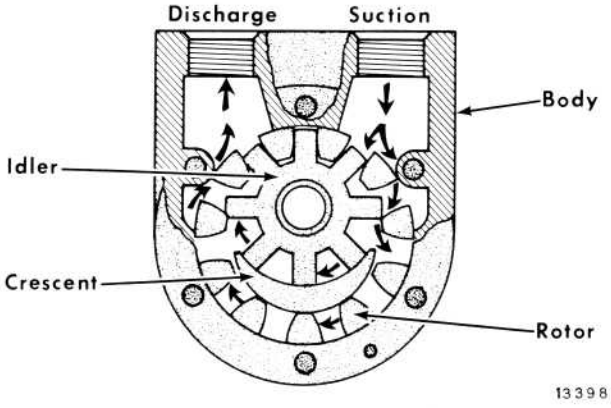


Fig. 1 — Gear Pump Operation

applied to the rotor and transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler gear and the inside diameter of the rotor is sealed by the crescent. When the pump is started, there is an increase in volume as the teeth of the idler and rotor come out of mesh. This creates a partial vacuum, drawing fuel into the pump through the suction port. The fuel then fills all the spaces between the gear teeth. As the pump shaft rotates, the liquid is entrapped between the teeth of the rotor and idler and is carried past the crescent partition to the pressure or discharge side of the pump. When the teeth once again mesh on the pressure side, the fuel is forced from the spaces and out through the discharge port.

NOTE: It is very important the fuel pumps be driven in the direction of the arrow stamped on the pump body.

*This bulletin is revised and supersedes previous issues of this number.

There is a passage from the suction part of the pump to the seal assembly so a partial vacuum is created in the seal which tends to hold the seal faces together. Should the pump rotation be reversed, there will be a pressure on the seal which will force the seal out of its seat as the pump pressure increases.

SEAL

The seal is a device which prevents leakage between the pump body and rotating shaft. This is accomplished by providing a perfectly smooth surface on both the shaft and pump body. The clearance is so small that resistance to fuel flow is great enough to prevent fuel from leaking out or air from entering the pump body.

The Tuthill pump, Fig. 2, employs a rotary seal which turns with the shaft. This assembly is attached to the shaft by a copper washer which when compressed by the hex seal nut prevents fuel and air from leaking down the shaft past the seal. A flexible diaphragm incorporated in the seal is spring loaded to control the tension on the seal face.

Fuel leakage is prevented in the Viking pump, Fig. 3, by a seal which rotates with the shaft and rides against the gland assembly. The seal is secured to the shaft by means of two notches on the seal which mate with two corresponding tangs on the bronze sealing assembly. The shaft is sealed by and secured to the seal assembly by a neoprene seal which is internal to the assembly and is press fitted on the shaft. Tension is provided by a load spring and washer which push the seal against the gland assembly. The entire sealing assembly is contained within the pump by the packing nut.

Both the carbon seal and neoprene seal within the sealing assembly prevent fuel from leaking around the shaft while the gasket on the gland assembly is compressed by the packing nut and prevents fuel from leaking between the gland and pump body.

MAINTENANCE

Fuel pumps should be removed from service and reconditioned at intervals prescribed in the applicable Scheduled Maintenance Program. Procedures for the disassembly, inspection, replacement of worn parts, assembly and testing, are covered below.

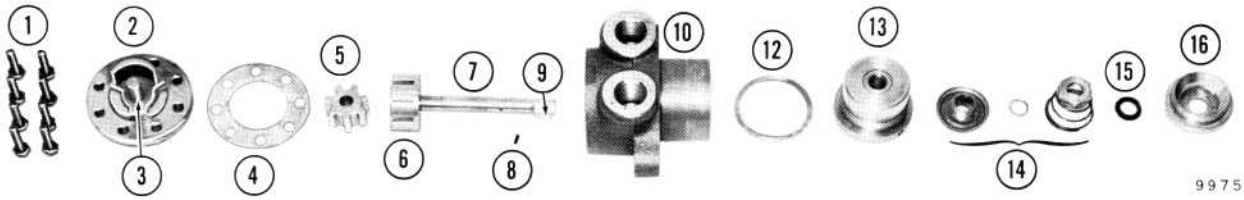
DISASSEMBLY OF TUTHILL PUMP
(Fig. 2)

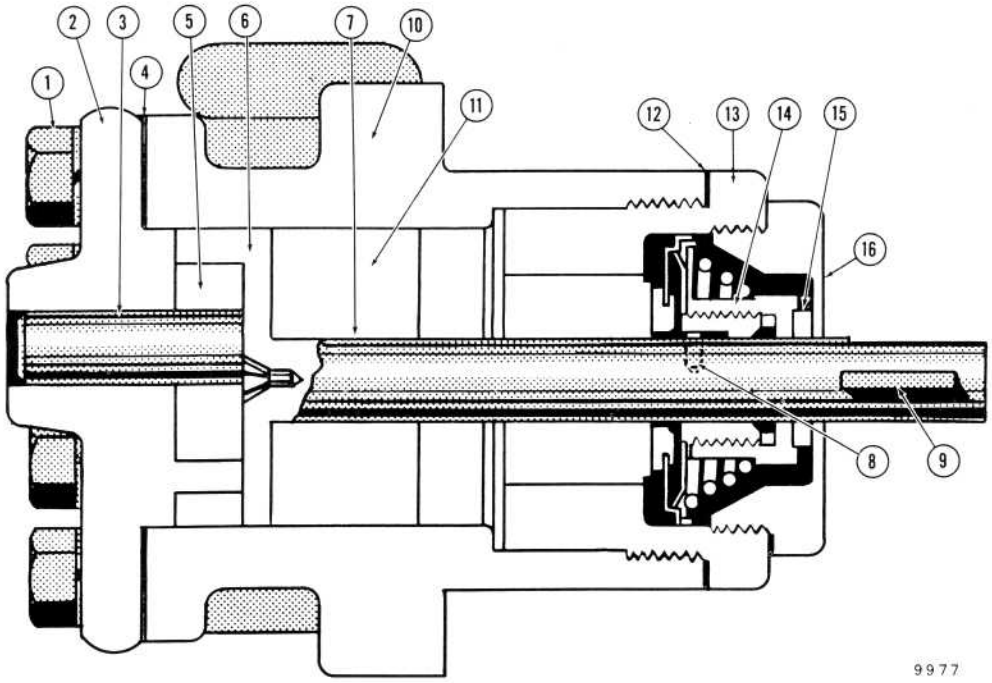
1. Place pump in a vise so that one jaw grips across the two ports. Do not tighten excessively as pump housing may be distorted.
2. Remove housing cap with special spanner wrench 8017824.
3. Slip felt washer off the shaft.
4. Place one wrench on hex seal nut, and another wrench across flat of pump shaft to keep shaft from turning while loosening hex seal nut.
5. Back off hex seal nut five or six turns.
6. Remove pump from vise.
7. Carefully grip hex seal nut in vise and pull oil seal off shaft as one assembly.
8. Remove pin key from shaft using a small pair of tweezers.
9. Inspect shaft where pin key enters. Any small burr will interfere with removal of housing plug. Use a small file to remove burr if necessary.
10. Place pump in vise and remove housing plug with special spanner 8017825.

11. Place matching marks on cover and body of pump for proper reassembly.
12. Remove the eight cover cap screws, then remove pump cover.
13. Remove rotor and idler.
14. Inspect pump components for wear and scored surfaces.

DISASSEMBLY OF VIKING PUMP (Fig. 3)

1. Place pump in a vise so that one jaw grips across the two ports. Do not tighten excessively as pump housing may be distorted.
2. Remove packing nut using a hook spanner wrench.
3. Carefully remove gland assembly with carbon seal.
4. Place matching marks on cover and pump body for proper reassembly.
5. Remove the six cover cap screws, then remove pump cover.
6. Remove idler.
7. Carefully push in on shaft of the pump until rotor extends beyond the pump body. Then carefully grasp rotor and pull shaft completely out of body. As the shaft is removed, the sealing assembly, load spring, and thrust washer will be pulled off the shaft and remain in the pump body.





1. Cover Screws
2. Pump Cover
3. Idler Shaft
4. Cover Gasket
5. Idler
6. Rotor
7. Rotor Shaft
8. Shaft Pin Key
9. Woodruff Key
10. Pump Body
11. Rotor Bushing
12. Lead Washer
13. Housing Plug
14. Seal Assembly
15. Felt Washer
16. Housing Cap

Fig. 2 - Tuthill Fuel Pump — Exploded And Cross-Section Views

8. Remove sealing assembly, load spring, and thrust washer from body.

9. Inspect pump components for wear and scored surfaces.

INSPECTION

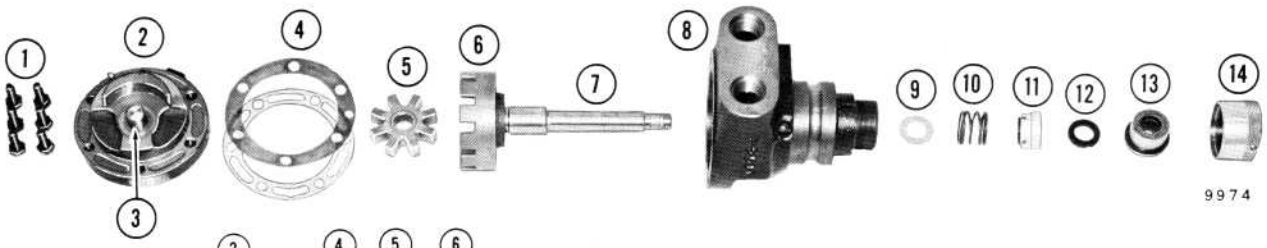
The individual parts of both types of pumps should be inspected for damage. The keyway in the end of the rotor shaft must be in good condition. There must not be any grooves or deep scratches on the following surfaces.

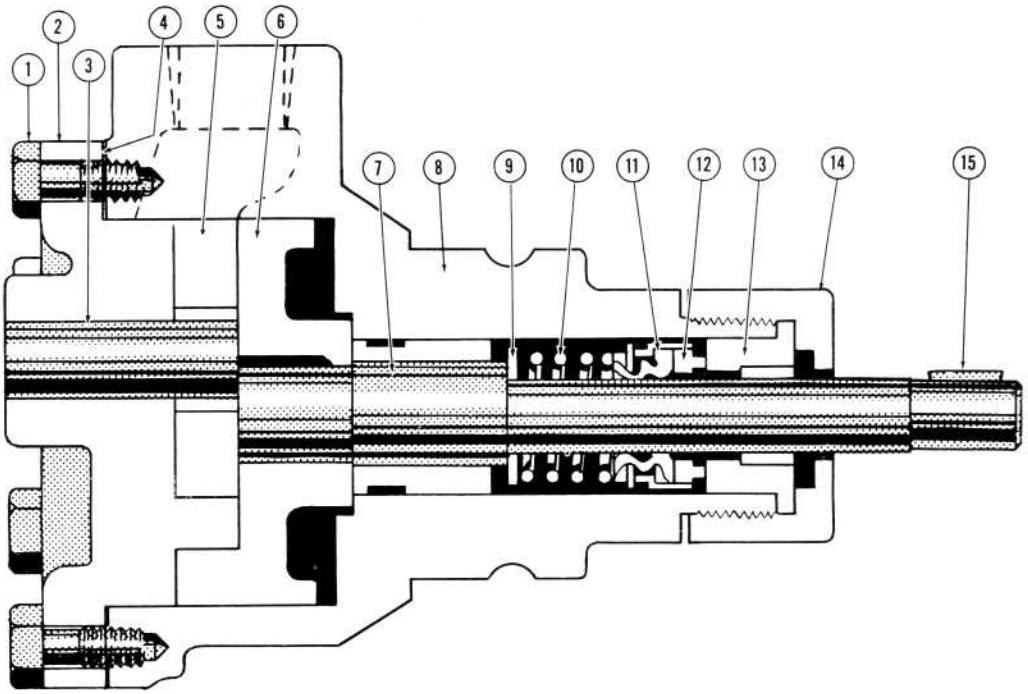
1. The I.D. surface in the housing (the seating surface for the rotor).
2. The O.D. of the rotor.
3. The end face of the rotor.
4. The O.D. of the idler.
5. Both faces on the idler.
6. The tooth surfaces on the idler and rotor.
7. The inside surface of the pump cover including the surfaces of the crescent.

The rotor assembly should be positioned in the housing and checked for clearance in the bearing. The shaft must turn freely without any detectable side play. Any side play will require replacement of the housing, the shaft, or both. The condemning limit for the clearance between the rotor and the housing is .002". The bushing in the Tuthill pump must be positioned with the 3/32" R oil groove on the suction side of the pump.

The idler and bushing assembly must turn freely on the idler pin in the pump cover without any detectable side play.

Obtain the correct end clearance of the rotor on the Viking pump (.001") by adjusting the thickness of the cover gaskets that





1. Cover Screws
2. Pump Cover
3. Idler Shaft
4. Cover Gaskets
5. Idler
6. Rotor
7. Rotor Shaft
8. Pump Body
9. Thrust Washer
10. Load Spring
11. Sealing Assembly
12. Carbon Seal
13. Gland Assembly
14. Packing Nut
15. Woodruff Key

Fig. 3 - Viking Fuel Pump — Exploded And Cross-Section Views

will result in the rotor shaft turning freely without any detectable end play. This is done without installing the seal assembly. Gaskets are added or removed until when the rotor is pushed back and forth no end play is detected. The remainder of the pump may then be assembled and must meet the 3 in.-lbs of torque requirement listed under "Testing."

Obtain the correct end clearance of the rotor on the Tuthill pump (.001") by adding a .001" spacer between the rotor and bushing, installing the pump cover and gasket, and tapping the bushing until the rotor is tight. Disassemble the pump to remove the .001" spacer and reassemble. As an alternate, the spacer could be omitted and the cover gasket replaced with a .001" thicker gasket using the same procedure outlined above.

ASSEMBLY OF TUTHILL PUMP (Fig. 2)

1. Install idler and rotor in pump body.
2. Install cover gasket.

NOTE: If pump has had a loss of capacity a thinner body gasket may be used to reduce excessive clearance (should be .001").

3. Install cover and idler on pump, being sure to align the matching marks made before disassembly.
4. Install housing plug in pump body. Be sure lead washer is in place.
5. Assemble parts of rotating seal before placing on pump shaft. If any one part of the seal needs replacement, an entire new seal assembly should be used. (Do not compress copper washer.)
6. Test seal on shaft. It should be free from binding and be able to slide freely so seal faces make contact.
7. Install pin key.
8. Clean seal faces thoroughly using great care to eliminate all dirt.
9. Install seal assembly so seal faces are in contact.
10. Compress spring in seal assembly. This is done by pressing on hex seal nut.

    The amount of movement should be .040". This will produce approximately 7 lbs. of spring pressure. (If no means is available to measure the .040" compression, press in on the hex seal nut until it bottoms; then release a few thousandths for clearance.

11. Hold spring compressed and tighten hex seal nut which locks the seal assembly to the shaft. Use a wrench on the shaft so that the hex seal nut is tightened securely.
12. Install felt washer, gasket and housing cap. Be sure the gasket is under the cap.
13. Place a small quantity of light lube oil in the pump body for initial lubrication.
14. Refer to test instructions.

ASSEMBLY OF VIKING PUMP (Fig. 3)

1. Insert spring thrust washer, load spring, and sealing assembly into pump shaft housing.

CAUTION: Care must be taken not to forget installing the bronze thrust washer in combination with the load spring. The washer, because it rotates with the spring, rubs against the bronze bushing insert in the pump body and serves as a wear plate. If the washer is left out, the sharp end of the spring will rub against the bronze bushing, scoring it severely.

2. Place pump in vise as for disassembly. Grasp rotor and push shaft through the rotor housing and into the shaft housing. Using the other hand, hold the washer, spring, and seal assembly in the shaft housing while continuing to push the shaft through. Pushing the shaft will require some pressure as the neoprene seal in the seal assembly must be pressed on the shaft.
3. Place idler over idler shaft in the cover.
4. Place cover with proper gasket thickness and idler over housing, being sure to align the matching marks on the cover and housing which were made before disassembly.

CAUTION: Before replacing cover it is necessary to have determined the thickness of cover gaskets needed to allow the shaft to rotate freely without any detectable end play. (This was outlined under "Inspection.")

5. Carefully slip the carbon seal over the shaft making sure the two notches fit the tangs on the sealing assembly.
6. Place a small amount of light oil on the carbon seal face and corresponding sealing face of the gland assembly.
7. Slip gland assembly over shaft and seat sealing faces.
8. Place packing nut over shaft and tighten to compress gland gasket using a hook spanner wrench.
9. Refer to test instructions.

TESTING

The shaft should be checked for ease of operation, and the torque required to turn the shaft must not exceed 3 in.-lbs in either direction.

The pump should then be run at 1100 RPM for 15 minutes with full fuel flow and no restriction on suction or discharge. (This may be done by installing on the pump motor or using some type of test stand.) This 15 minutes of running serves to seat the new seal against the mating seat.

The seal may leak slightly when the pump is first started after a new seal is installed. The seal, if properly installed, will adjust itself in a minute or two and the leaking will stop.

When the 15 minute run is completed the pump should be tested for output. This may be performed using a graduated container and a clock or watch. The pump must meet the following specifications:

Tuthill	Viking
2.0 GPM (minimum) @ 1100 RPM	3.5 GPM (minimum) @ 1100 RPM

The seal may be tested by performing pressure and suction tests.

Suction

A hose should be connected from the suction port to some type of suction gauge or manometer tube capable of indicating up to 30" mercury, and the discharge port should be vented to atmosphere. The pump should build up to at least 25" of mercury at 1100 RPM with partial fuel flow. The duration of this test should not exceed 15 seconds.

CAUTION: The suction line should be restricted until the 25" of mercury are attained. This continuance of restriction will allow the partial fuel flow desired to lubricate pump. At no time, however, should the restriction be complete and cut off the fuel supply. This would cut off lubrication and could damage the pump.

If the hose is progressively restricted until up to the point of complete restriction and the 25" of mercury are not reached, the seals should be investigated for leakage.

Check the seal by applying a restriction to the suction line. There must not be any air drawn through the seal at a vacuum of 10" of mercury.

Pressure

The suction line should be restricted to build up at least 25" of vacuum and maintain the vacuum for at least 5 minutes. Open suction valve and restrict the discharge line to build up the discharge pressure to 60 psi.

Excessive end clearance will appear as reduced capacity of the pump while a leaking seal will show up as poor vacuum and/or pressure.

STORAGE

Upon completion of the testing, if the pump will not be used immediately, the pump ports should be filled with SAE 10 or 20 oil and pipe plugs applied to the ports.

INSTALLATION OF PUMP TO MOTOR

Install pump to motor and check coupling end clearance.

It is very important that proper clearance is provided in the coupling between the two coupling halves and the center piece to prevent end thrust on the pump shaft, which in turn, can damage the pump cover.

Both single and double pump units are equipped with a coupling, which should have a distance of 1/2" between the two coupling halves with the end play of the motor armature taken into consideration.

There should be approximately 1/16" clearance between the composition center piece and the two die cast coupling halves with the pump bolted in place and the motor armature pulled toward the pump shaft to its farthest position.

It is a very common error, in assembling not to take into consideration the end play of a motor armature, which may cause end thrust on the pump shaft. These pumps are not designed to take end thrust toward the pump cover, and extreme care must be taken to prevent thrust in this direction.

INSTALLATION OF PUMP TO ENGINE

On units where the fuel pump is driven by the diesel engine, instructions for removal and installation will be found in the applicable Engine Maintenance Manual.

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