



MAINTENANCE INSTRUCTION

FUEL AND SOAKBACK PUMPS

INTRODUCTION

The fuel oil pump supplies the diesel engine with adequate fuel for operation. This task is accomplished by positive displacement, rotating internal gear type pumps with mechanical seals. These same type pumps are also used on turbocharged engines to pump lubricating oil to the turbocharger bearings prior to engine start and for a timed period to remove residual heat after engine shutdown. Two different manufacturers supply these pumps - Tuthill and Viking. The quantity of oil needed in a particular application determines which pump will be used.

Ratings; maximum pumping capacity (at 1200 RPM)

Tuthill - 2 and 3 GPM.

Viking - 4 and 6 GPM.

In locomotive applications the fuel pump is driven by a small electric motor, however, in other cases (marine, industrial) 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. When the pump is used as a soak back pump it is always driven by an electric motor.

Since the Tuthill and Viking pumps differ somewhat in construction, specific instructions pertaining to each of them are provided. 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 relies on 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 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

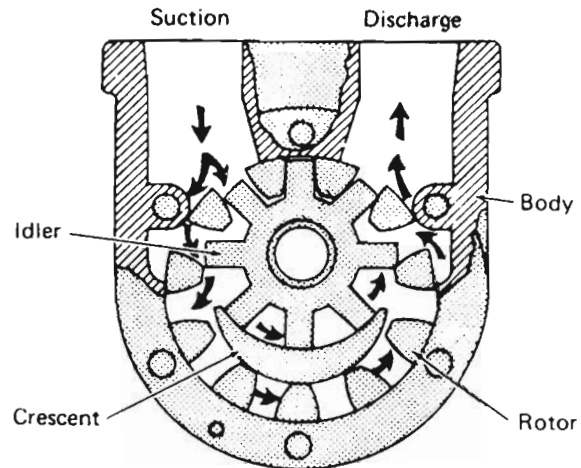


Fig. 1 - Gear Pump Operation

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teeth of the idler and rotor come out of mesh. This creates a partial vacuum, drawing oil into the pump through the suction port. The oil then fills all the spaces between the gear teeth. As the pump shaft rotates, the oil 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 oil is forced from the spaces and out through the discharge port.

CAUTION: It is very important that the old model Tuthill pumps be driven in the direction of the arrow stamped on the pump body. The Viking and new model Tuthill pumps are not sensitive to direction of rotation.

- a. On all pumps manufactured prior to 1974, 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 on the old style Tuthill pumps, there will be a pressure on the seal which will force the seal out of its seat as the pump pressure increases.
- b. On pumps manufactured in 1974, there is a passage from the pressure part of the

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

pump to the seal assembly. This construction enables easy detection of a faulty seal by visible leakage of oil.

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 oil flow is great enough to prevent oil from leaking out or air from entering the pump body.

The old model 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 oil 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.

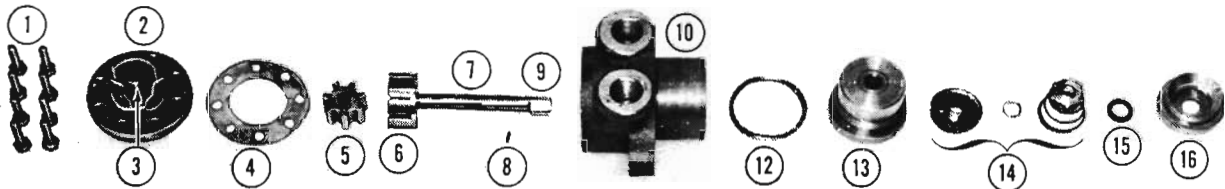
Leakage is prevented in the Viking pump, Fig. 4, and in the new model Tuthill pump, Fig. 3, by a

seal which rotates with the shaft and rides against the gland assembly. The carbon seal is secured to the shaft by means of two notches on the carbon seal which mate with two corresponding tangs on the bronze cup of the seal 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.

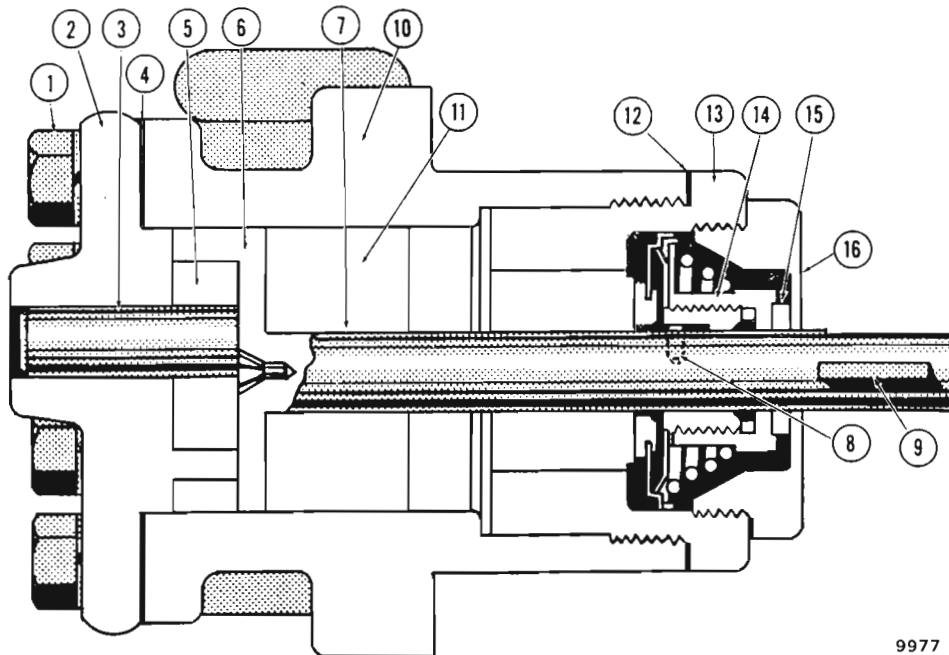
Both the carbon seal and neoprene seal within the sealing assembly prevent oil from leaking around the shaft while the gasket on the gland assembly is compressed by the packing nut and prevents oil from leaking between the gland and pump body.

MAINTENANCE

Pumps should be removed from service and reconditioned at intervals prescribed in the applicable Scheduled Maintenance Program. Procedures



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

Fig. 2 - Old Model Tuthill Pump - Exploded And Cross Sectional Views

for the disassembly, inspection, replacement of worn parts, assembly and testing, are covered below.

DISASSEMBLY

TUTHILL PUMP (OLD MODEL WITH SHAFT SEAL), 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 wrench 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.

TUTHILL PUMP (NEW MODELS), Fig. 3

1. Place pump in a vise so that jaws grip ports or port flange. Do not tighten excessively as pump housing may be distorted.

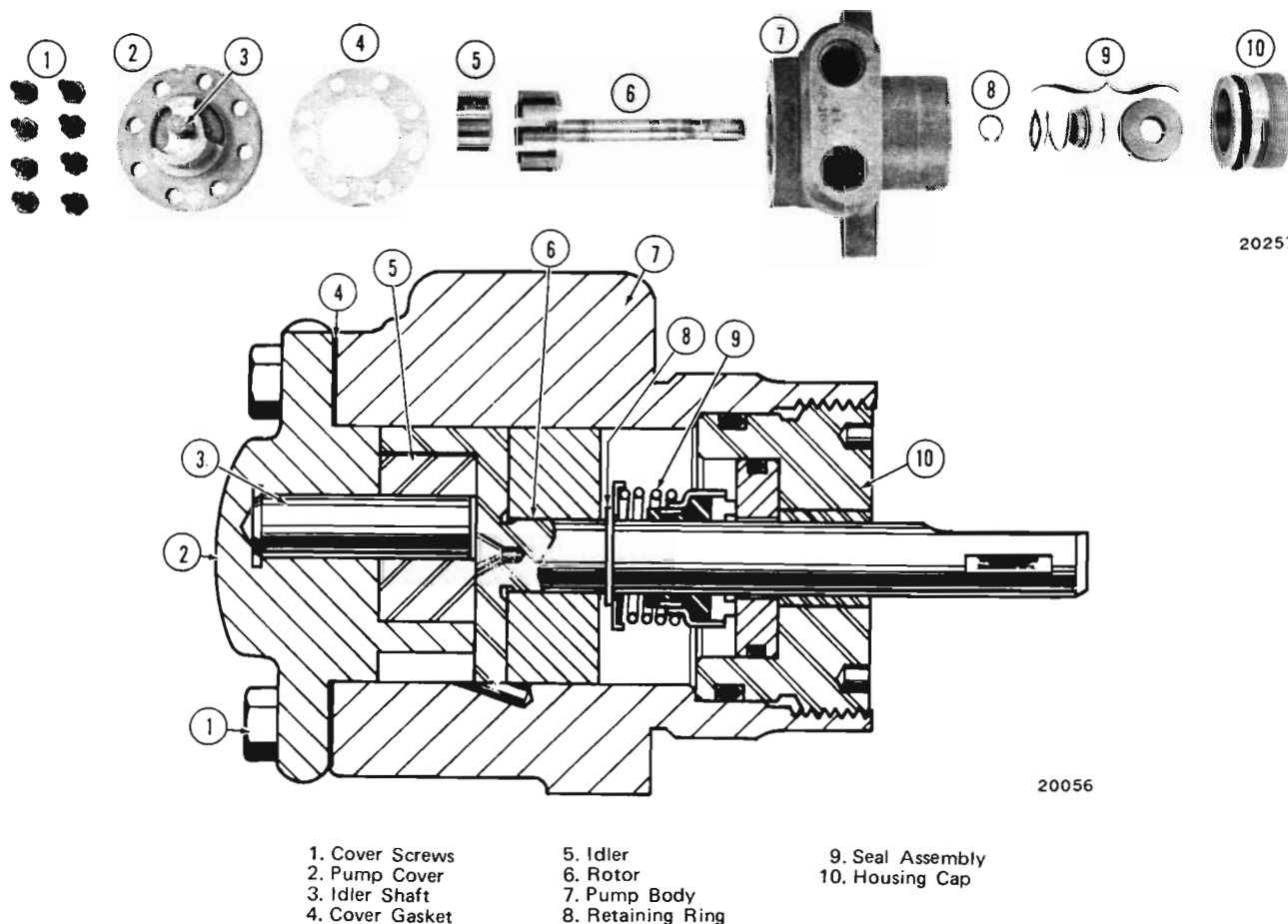


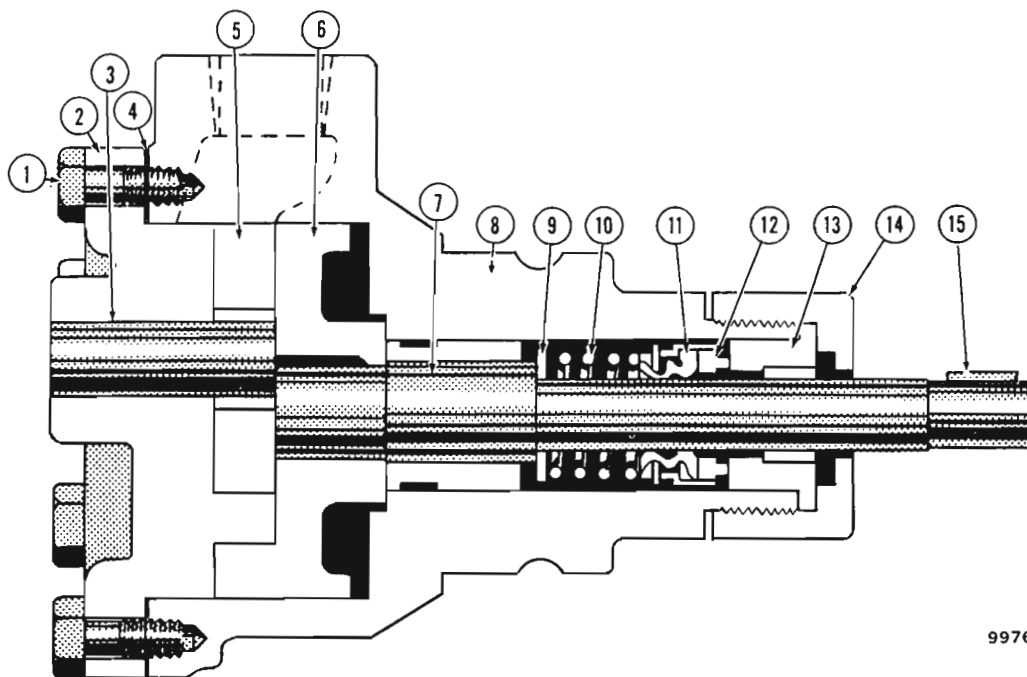
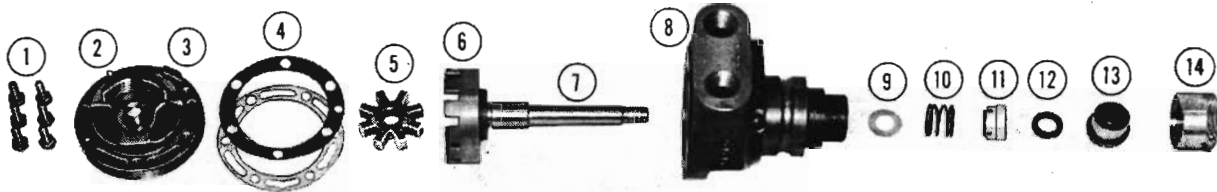
Fig. 3 - New Model Tuthill Pump - Exploded And Cross-Section Views

2. Remove housing cap with special spanner wrench 8017824.
3. Remove seal from housing cap.
4. Remove shaft seal stationary bushing from inside of housing cap.
5. Remove the other half of the shaft seal from the shaft.
6. If there is a snap ring under the shaft seal, remove it. Some pumps have a step in the rotor shaft and do not require a snap ring to position the shaft seal.
7. Remove the cover cap screws. Mark pump cover and body for reapplication.
8. Remove the pump cover.
9. Remove the rotor and idler.

10. Inspect the pump components for wear and scored surfaces.

VIKING PUMP, Fig. 4

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 gaskets on cover and pump body for proper reassembly.
5. Remove the six cover cap screws, then remove pump cover.
6. Remove idler.



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

Fig. 4 - Viking Pump - Exploded And Cross Sectional Views

7. Carefully push in on shaft of the pump until rotor extends beyond the pump body. Then carefully grip 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.
8. Remove sealing assembly, load spring, and thrust washer from body.
9. Inspect pump components for wear and scored surfaces.

INSPECTION OF PUMPS

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" for Tuthill pumps and .005" for Viking pumps.

The bushing 8017806 in the old model Tuthill pumps must be positioned with the 3/32"R oil groove on the suction side of the pump.

The bushing in the new model Tuthill pumps must be positioned with the oil groove away from the pump ports.

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"-.002") by adjusting the thickness of the cover gaskets that 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 torque requirement listed under Testing Instructions.

Obtain the correct end clearance of the rotor on the Tuthill pumps (.001") by adding a .001" spacer between the rotor and bushing 8017806, 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.

A new seal is then installed. The spring in the old model Tuthill pumps should be compressed .040" and the seal in the Viking and new model Tuthill pumps should be compressed approximately 3/16". The bronze bushing in the seal nut of the Tuthill pump should be either refaced or replaced.

ASSEMBLY OF PUMPS

TUTHILL PUMP (OLD MODEL WITH METAL SHAFT SEAL), 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 are 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 Testing Instructions.

TUTHILL PUMP (NEW MODEL)

1. Install idler and rotor in pump body.
2. Install a .005 cover gasket.
3. Install cover on pump housing, being sure to align the matching marks made during disassembly.
4. Rotor must turn freely with cover applied. If rotor does not turn freely, remove .005" gasket and tighten cover. Then reapply gasket, and rotor should turn freely.
5. Install snap ring for shaft seal on rotor shaft. (If shaft does not have a step to locate shaft seal.)
6. Apply that portion of the shaft seal with the spring on to the shaft; apply with the spring end away from the end of the rotor shaft.

7. Apply the stationary bushing to the inside of the housing. Cap with lapped surface towards the opening (carbon seal rides on lapped surface of stationary bushing).
8. Apply new seal on housing cap.
9. Apply housing cap on housing.
10. Lubricate pump rotor and idler with a light lubricating oil to provide initial lubrication.
11. Refer to test instructions.

VIKING PUMP

1. Place pump in a vise as for disassembly. Grasp rotor and push shaft through the rotor housing and into the shaft housing.
2. Place idler over idler shaft in the cover.
3. Place cover with proper gasket thickness and idler over the housing, being sure to align the matching marks on the cover and housing which were made before disassembly. Some pumps have locator pins or notches which provide alignment during assembly. In this case, matching of the marks is unnecessary.

NOTE: Before placing 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 of Pumps.)

4. Insert spring thrust washer and load spring on the shaft in that order.

CAUTION: Care must be taken not to forget to install 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.

5. Coat the shaft and the inside of the rubber bellows of the sealing assembly with light oil. 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 and gaskets over and seat sealing faces.

NOTE: Two gaskets are required for the working length of the seal.

8. Place packing nut over shaft and tighten to compress gland gasket using a hook spanner wrench.
9. Refer to Testing Instructions.

TESTING INSTRUCTIONS

PUMP SHAFT ROTATION

The pump shaft on all pumps should rotate in either direction with the application of a 5 in.-lb torque.

TEST PARAMETERS

The pump test speed, inlet suction, and outlet pressure all affect the pump flow. To reduce the number of variables the following recommendations are made: The pump speed for the tests should be 1200 RPM with a 3/4 horsepower AC motor turning the pump. Pump outlet pressure and inlet suction should be read as close to the pump as possible. Fuel oil at room temperature (50°-90° F) should be used. Use a one inch pipe on the suction side of the pump. The device used for restricting the suction line to the pump should be located as far from the pump as possible. There should be a sight glass before and after the pump for visual inspection for air bubbles. The pump should be run at 1200 RPM, in the direction marked on the pump, for 15 minutes with full oil flow and no restrictions on the pump, suction or discharge.

This running serves to seat the new seal against the mating seat.

On application of a new seal some leakage may occur when the pump is first started. 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.

PUMP OUTFIT

The pump output should be checked with a suction head of 10 inches of mercury on the inlet of the pump and a 80 PSI pressure on the outlet of the pump. Fuel oil temperature should be 70 to 80° F. The flow can be checked by any of the following ways; weight of fuel oil per time interval, with a flow meter, or with an orifice. Which ever means is used must be calibrated with fuel oil. The following chart gives the pump part number, nominal flow, vendor, and minimum output.

PART NO.	NOMINAL FLOW (GPM)	VENDOR	MINIMUM FLOW AT 1200 RPM (GPM)
8080284	4	Viking	3.8
8386440	4	Viking	3.8
8410219	4	Viking	3.8
8422951	6	Viking	6
8498099	2	Tuthill	1.7
8498154	2	Tuthill	1.7
8498155	2	Tuthill	1.7
8498156	3	Tuthill	2.9

Old style Tuthill pumps should have same rating as their replacement. Reduced pump flow is probably caused by excessive clearances in the pump.

PUMP SECTION TEST

With no restriction on the pump outlet, restrict the pump inlet until the inlet suction becomes 25 inches of mercury. The pump should still flow a limited amount of oil. The duration of this test should not exceed 15 seconds. Failure to develop the 25 inches of mercury suction indicates a suction leak exists (seal leaks on pumps built prior to 1974).

STORAGE

Upon completion of the testing, if the pump will not be used immediately, the pump ports should be filled with SAE No. 10 or No. 20 oil and plugged with pipe plugs or stoppers.

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 1/32" 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. The two pump bracket bolts should be torqued to 5 to 8 ft-lbs.

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.

MODIFICATIONS

All pumps manufactured in 1974 were changed to incorporate pressurized seal chambers. This means that the fuel pump shaft seal chamber is now being vented to the pressure port of the pump. Shaft seal failures now will result in oil dripping from around the rotor shaft. Previous production pumps had the seal chamber vented to the inlet (suction) port. In this case shaft seal failures resulted in suction leaks which were very difficult to locate.

Specific Viking pumps (8080284) have been furnished with two different idler bushings and heads. Prior to 1957 this pump had a long idler bushing that extended outside the idler into the pump head. The head was counterbored to receive this bushing. Between 1957 and January 1960, this pump was furnished with the bushing the same width as the idler and no counterbore in the head. It was previously allowed to install flush bushing idlers in pumps with either flush or counterbored heads, but in the future all pumps must be rebuilt with the extended idler and counterbored head.

Tuthill pumps were redesigned to incorporate an improved shaft seal. This change will become effective in the summer of 1974.

TUTHILL GEAR PUMPS

NEW MODEL LINE PUMP PART NO.	REPLACES OLD MODEL PUMP PART NO.	DESCRIPTION
8498099	8432896 and 8452409	2 GPM pump with flanged outlet (engine driven fuel pump)
8498154	8020257 and 8102911	2 GPM pump with threaded fuel fittings
8498155	8411540	2 GPM pump
8498156	8436302	3 GPM pump