

BLACKMER TRUCK PUMPS

960290
INSTRUCTIONS NO. 285/F

INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS

MODELS: TNP
1½, 2, 2½, 3, 4

Section	200
Effective	August 1990
Replaces	September 1978

*These models are obsolete.
Parts availability will be limited.*

WARNING

THIS PRODUCT MUST ONLY BE INSTALLED IN SYSTEMS WHICH HAVE BEEN DESIGNED BY THOSE QUALIFIED TO ENGINEER SUCH SYSTEMS. THE SYSTEM MUST BE IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS AND SAFETY CODES AND WARN OF ANY HAZARDS UNIQUE TO THE PARTICULAR SYSTEM.

TABLE OF CONTENTS

Page

INSTALLATION.....	1
Cleaning Precautions	
Location and Piping	
Truck Mounting	
Pump Drive	
Pump Rotation	
To Reverse Pump Rotation	
OPERATION.....	2
Pre-Start Up Check List	
Start Up Procedure	
Pump Speed	
Running the Pump in Reverse	
Flushing the Pump	
Relief Valve	
Relief Valve Setting and Adjustment	
MAINTENANCE.....	3
Lubrication	
Replacing Vanes Only	
Pump Disassembly	
Optional Shaft Support Bearing	
Parts Replacement	
Pump Assembly	
GENERAL PUMP TROUBLESHOOTING.....	5

INSTALLATION

CLEANING PRECAUTIONS

Foreign matter entering the pump can cause extensive damage. The suction tank should be cleaned and flushed before installing the pump.

LOCATION AND PIPING

Pump life and performance can be significantly reduced when installed in an improperly designed system. Before starting the layout and installation of the pumping system, consider the following suggestions:

1. Locate the pump as near as possible to the source of supply to avoid excessive inlet pipe friction.
2. When locating the pump, safety should be the first consideration. Other considerations include length of drive line, accessibility for maintenance, and convenience of connections.
3. A strainer should be installed in the inlet line to protect the pump from foreign matter. The strainer should have a net open area of at least four times the area of the intake piping. Clean the strainer regularly to avoid pump starvation.
4. The intake system must not contain any air leaks. If practical, this should be verified by applying air pressure to the system.
5. The discharge line and fittings must be large enough to minimize the pressure drop in the system. The lower the friction loss, the higher the flow rate.
6. Flexible pipe connections should be used for all high temperature liquid applications. The flexible connections will compensate for expansion and contraction of the pipes resulting from temperature changes.

TRUCK MOUNTING

The pump will operate satisfactorily in any position. It can be bolted to the frame or on a saddle hung below the frame. It must be securely fastened in a firm support. Thorough draining of the pump may be accomplished when the pump is mounted with the feet down, or with the suction flange up.

PUMP DRIVE

The pump may be driven by a power take-off through universal joints. When using universal joints, a splined slip joint must be used on the connecting jack shaft to prevent end thrust on the pump shaft. If end thrust does develop, the use of an optional shaft support bearing is recommended.

It is very important to install a proper drive line to avoid excessive wear, vibration, and noise (see Figure 1).

A few general guidelines to follow:

1. Avoid square slip joints.
2. Use the least number of jack shafts as is practical.
3. Use an even number of universal joints.
4. The pump shaft and power take-off shaft should be parallel.
5. The yoke of the universals at both ends of the jack shaft should be parallel.
6. The maximum recommended angle between the jack shaft and pump shaft is 15 degrees.

INSTALLATION

Failure to follow any of these guidelines may result in a gallop or uneven turning of the pump rotor, which will in turn cause a surging vibration to the liquid stream and piping system.

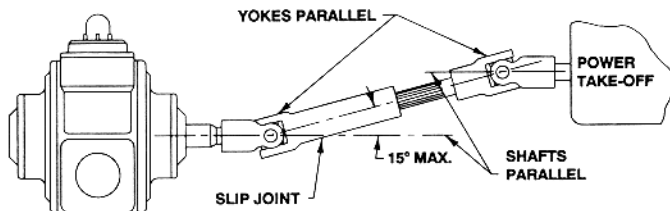


Figure 1 - Pump Drive

PUMP ROTATION

To determine pump rotation:

If the intake port and relief valve are on the right, with the drive end of the shaft pointing towards the observer, the pump is right-hand (clockwise rotation).

If the intake port and relief valve are on the left, with the drive end of the shaft pointing towards the observer, the pump is left-hand (counterclockwise rotation).

NOTE: The pump must be installed to operate in the same direction of rotation as the power take-off. For instance, when looking directly into the power take-off shaft, a counterclockwise or left-hand rotation of the power take-off requires a clockwise or right-hand pump.

TO REVERSE PUMP ROTATION

To reverse the pump rotation, both heads must be removed and the cylinder reversed (rotated 180 degrees). The vanes must also be changed so that the relief grooves face in the direction of rotation. See "Maintenance" for removal and replacement of the pump parts.

OPERATION

PRE-START UP CHECK LIST

1. Check the alignment of the pipes to the pump. Pipes should be supported so that they do not spring away or drop down when pump flanges or union joints are disconnected.
2. Check the entire pumping system to verify that the proper inlet and discharge valves are fully open, and that the drain valves and other auxiliary valves are closed.
3. Install vacuum and pressure gauges on the pump in the threaded connections provided. These can be used to check actual suction and discharge conditions after pump start-up.
4. Connect the hose to the receiving tank.
5. Briefly turn on the power to make sure that the pump rotates in the direction of the rotation arrow.

START UP PROCEDURE

NOTE: If there is a problem with any of the following items, or if the pump is abnormally noisy, see "General Pump Troubleshooting" for possible causes.

1. Start the motor. Priming should occur within one minute.
2. Check the vacuum and pressure gauges to see if the pump is operating within the expected conditions.
3. Check for leakage from the piping and equipment.
4. Check the pump speed. Overspeeding can cause the pump to overheat. Refer to "Pump Speed."
5. If possible, check the flow rate.
6. Check the pressure setting of the relief valve by briefly closing a valve in the discharge line and reading the pressure gauge. This pressure should be 15 - 20 psi (103 - 138 kPa) higher than the maximum operating pressure. **CAUTION: Do not run the pump for more than 10 - 15 seconds with the discharge valve completely closed.** If adjustments need to be made, refer to "Relief Valve Setting and Adjustment."

PUMP SPEED

The truck operator should acquaint himself with the proper engine speed for the best operation of the pump. If the proper take-off has been used, a medium idling speed, which can be gauged by the sound of the engine, should produce approximately the rated capacity of the pump. If the delivery is appreciably more than the pump rating, the engine should be operated slower. If the delivery is appreciably less than rated, check for possible causes listed under "General Pump Troubleshooting."

RUNNING THE PUMP IN REVERSE

It is sometimes desirable to run the pump in reverse to drain a line. The pump is satisfactory for this type of operation, but the flow rate will

decrease, depending on the system conditions and the pump speed. When running the pump in reverse, a separate relief valve is recommended in order to protect the pump from excessive pressures.

FLUSHING THE PUMP

1. To flush the pump, run the pump with the discharge valve open and the intake valve closed. Bleed air into the pump through the intake gauge plug hole or through the larger auxiliary fitting on the intake line. Pump air for 30 second intervals to clean out most of the pumpage.
2. Run cleaning fluid through the pump for one minute to clean out the remainder of the original pumpage. It is recommended to keep the pump full of cleaning fluid until the pump is used again. **NOTE:** The cleaning fluid must be compatible with the vane material if the fluid is to be left in the pump for an extended period of time.
3. Flush out the cleaning fluid using the same procedure as in step 1.

RELIEF VALVE

Blackmer relief valves are designed for satisfactory operation with a partially closed discharge line on most types of installations. This allows for reduction of the flow without slowing down the speed of the pump—for a limited time.

The purpose of the relief valve is to protect the pump or pumping system from excessive pressure. The valve is not meant to be used for prolonged recirculation.

When pumping highly volatile liquids under a high suction lift, and cavitation or starving of the pump exists, partial closing of the discharge valve will result in excessive noise in the relief valve. A separate bypass valve, piped back to the storage tank, is recommended when operating under these conditions.

RELIEF VALVE SETTING AND ADJUSTMENT

The relief valve pressure setting is marked on a metal tag attached to the valve cover. Generally, the relief valve should be set at least 15 - 20 psi (103 - 138 kPa) higher than the operating pressure.

1. To increase the pressure setting, remove the relief valve cap, loosen the locknut, and turn the adjusting screw inward, or clockwise.
2. To reduce the pressure setting, remove the relief valve cap, loosen the locknut, and turn the adjusting screw outward, or counterclockwise.

Refer to the individual pump parts lists for various spring pressure ranges.

MAINTENANCE

MAINTENANCE AND TROUBLESHOOTING MUST BE DONE BY AN INDIVIDUAL EXPERIENCED WITH PUMP MAINTENANCE AND THE TYPE OF SYSTEM INVOLVED.

LUBRICATION

Sleeve bearings (bushings) are lubricated by the liquid being pumped, and additional lubrication is not required.

REPLACING VANES ONLY

1. Remove the head assembly from the **outboard** (non-driven) side of the pump. (Refer to "Pump Disassembly" step 9.)
2. Turn the shaft by hand until a vane comes to the top (12 o'clock) position of the rotor.
3. Remove and replace the vane, making sure the rounded edge is outward to contact the liner, and the relief grooves are facing in the direction of rotation (see Figure 2).
4. Rotate the shaft until the next rotor slot is in the top position, and replace the vane.
5. Continue this procedure until all new vanes are in place. This method of vane replacement prevents the push rods from falling out.

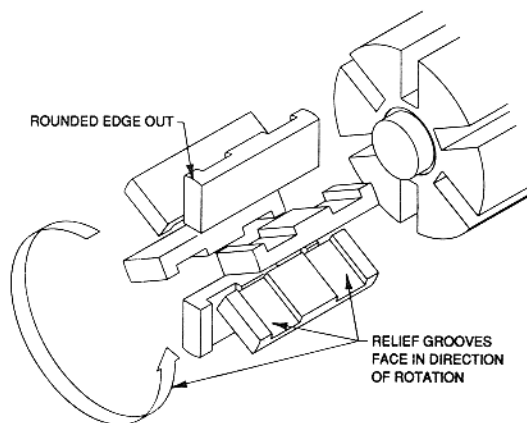


Figure 2 - Vane Installation*

*1-1/2 and 2 - inch models use only four vanes.

PUMP DISASSEMBLY

Before work is started on the pump, make sure the pressure is relieved, and the liquid is drained. During disassembly, be careful of sharp edges on worn or damaged parts.

NOTE: The numbers in parentheses following individual parts indicate reference numbers on the parts list.

1. On the inboard (driven) end of the pump, clean the pump shaft thoroughly, making sure the shaft is free of nicks and burrs. This will prevent damage to the packing or mechanical seal when the inboard head assembly is removed.

NOTE: If the pump is equipped with an optional shaft support bearing, it is easiest to take apart the assembly before removing the inboard head. See "Optional Shaft Support Bearing" for disassembly and assembly instructions.

2. Remove the packing follower stud nuts (18) and slide the packing follower (75) out of the stuffing box. A slight pry with a screwdriver may be necessary.
3. The packing rings (19) and the pack washer (58) can be pulled from the stuffing box with the use of a corkscrew tool or screwdriver. Be careful not to scratch the shaft.
4. If the pump is equipped with a mechanical seal, remove the 1/4" pipe plug from the head and loosen all of the mechanical seal setscrews.

5. Remove the inboard head capscrews (21) and slide the entire inboard head assembly (20) from the shaft (including the mechanical seal, if equipped). It may be necessary to use two large screwdrivers to pry the head away from the cylinder.
 - a. If the pump is equipped with a mechanical seal, be careful not to drop or damage any of the seal components when removing the head.
 - b. The sleeve bearing (24) is press fit into the head and should not be removed unless replacement is necessary (see "Sleeve Bearings").
6. **Mechanical Seal Removal (when equipped)**
 - a. Remove the seal retainer capscrews (16).
 - b. Remove the seal retainer (126) and the mechanical seal (153) from the head, being careful not to drop any of the individual seal components.
7. Gently pull the rotor and shaft (13) out of the cylinder. While one hand is pulling the shaft, the other hand should be cupped underneath to prevent the vanes and push rods from falling out.
8. On the opposite (outboard) side of the pump, remove the bearing cover capscrews (28). Remove the bearing cover (27) and the bearing cover gasket (26) from the outboard head.
9. Remove the outboard head capscrews (21) and the outboard head assembly (23). The sleeve bearing (24) is press fit into the head and should not be removed unless replacement is necessary (see "Sleeve Bearings").

OPTIONAL SHAFT SUPPORT BEARING

The optional shaft support bearing is recommended when there is a danger of side loads (misalignment), or end thrust on the pump shaft exerted from the pump drive.

Disassembly

1. Remove the bearing flange capscrews (106D) and the bearing flange cover (106C).
2. Loosen the setscrew in the lock collar (106B).
3. Using a punch tool and hammer, turn the lock collar in the opposite direction of pump rotation (see Figure 3). Once the collar is removed, the bearing can be pulled from the bearing flange and off the shaft.
4. Remove the locknuts (106A) from the hex flange rods and remove the bearing flange (106).
5. Proceed with steps 2 through 8 of "Pump Disassembly."

Assembly

1. Screw the short threaded ends of the two (2) hex flange rods (106E) firmly into the tapped holes in the head.
2. Place the bearing flange (106) on the studs and tighten the locknuts (106A).
3. Slide the bearing (106B) on the shaft until it is firmly seated in the bearing flange. Install the lock collar over the shoulder on the bearing.
4. Push inward on the bearing and lock collar assembly (106B) while turning the lock collar by hand in the direction of shaft rotation. Lock the collar to the shaft with a punch tool and hammer (see Figure 3).
5. Attach the bearing flange cover (106C) and install the bearing flange capscrews (106D). **NOTE:** After installation of the support bearing, the rotor and shaft should turn freely when rotated by hand. If it does not turn freely, loosen the lock collar and make sure the bearing is firmly seated in the flange. Retighten the lock collar.

MAINTENANCE

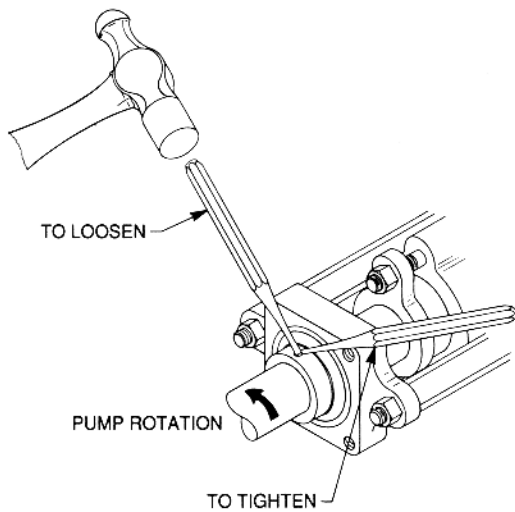


Figure 3 - Bearing Lock Collar

PARTS REPLACEMENT

Excessive or continuous leakage from the stuffing box in the head or around the pump shaft may be an indication of worn packing, a damaged mechanical seal, or a damaged or worn sleeve bearing.

1. If the packing is leaking excessively refer to "Packing Adjustment." If this does not solve the problem, a complete new set of packing rings should be installed. (See "Pump Assembly" steps 7 and 8.)
2. If the mechanical seal has been leaking it is recommended the entire seal be replaced. Refer to "General Pump Troubleshooting" for possible causes of seal leakage.
3. If the pump shaft indicates an excessive amount of radial "play," the sleeve bearing in the head should be replaced. (See "Pump Assembly" step 1.)

PUMP ASSEMBLY

Pump assembly is generally the opposite of pump disassembly. Before reassembling the pump, clean each part thoroughly. Wash out the stuffing box and remove any burrs from the rotor and shaft.

1. SLEEVE BEARINGS

If the sleeve bearing (24) has been removed from either head, a new bearing must be installed before reattaching the heads to the cylinder.

- a. To aid installation and prevent bearing damage, heat the head in an oven at 200°F (93°C) before installing the bearing.
- b. Coat the bearing with grease and place it in the bearing bore on the inside face of the head. Align the notch in the bearing with the groove in the head.
- c. Using an arbor press, press the bearing into the head in one continuous motion, until it is flush with the inside face of the head. Starting and stopping the pressing motion may result in a cracked bearing.

2. OUTBOARD HEAD ASSEMBLY

If both head assemblies have been removed, it is easiest to install the outboard head assembly first. **NOTE:** When installing the outboard head, the relief valve and intake port on the cylinder should be towards the left for clockwise (right-hand) rotation, or towards the right for counterclockwise (left-hand) rotation.

- a. Apply a uniform coat of sealing compound (e.g. Thred Gard or Gasoil) to the face of the cylinder (12). Avoid excess coverage which could squeeze into the pumping chamber.
- b. Place the outboard head (23) on the cylinder with the hole and groove (located on the inside face of the head) towards the intake side of the pump. In this position, the word "INTAKE" (cast on the head) will also be towards the intake side of the pump.
- c. Install the head capscrews (21) and uniformly tighten.

3. BEARING COVER

Attach the bearing cover gasket (26) and the bearing cover (27) to the outboard head. Install and uniformly tighten the bearing cover capscrews (28).

4. VANES AND PUSH RODS

It is necessary to install the bottom vanes and push rods prior to inserting the rotor and shaft into the pump.

- a. Insert vanes (14) into the bottom three rotor slots with the rounded edge facing outward, and the relief grooves facing in the direction of rotor rotation. (Refer back to Figure 2.)
- b. Hold the vanes in place while inserting the push rods (77) from the top, as shown in Figure 4.

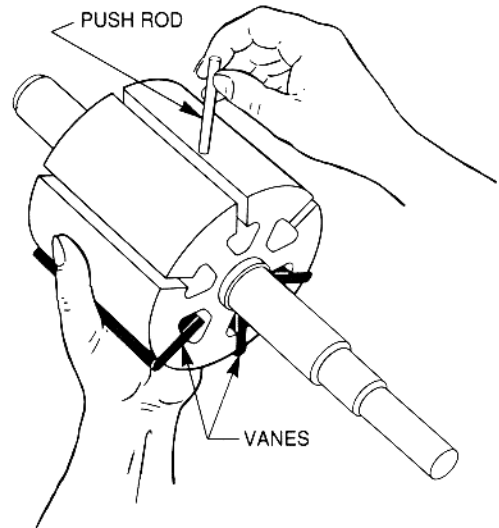


Figure 4 - Push Rod Installation*

*1-1/2 and 2 - inch models use four vanes and two push rods.

5. ROTOR AND SHAFT

- a. While holding the vanes in place, carefully slide the non-driven end (shorter end) of the pump shaft into the open end of the pump cylinder and into the installed outboard head.
- b. Install the remaining vanes into the top slots of the rotor with the relief grooves facing in the direction of rotation and with the rounded edges outward.

6. INBOARD HEAD ASSEMBLY

- a. Apply a uniform coat of sealing compound (e.g. Thred Gard or Gasoil) to the face of the cylinder. Avoid excess coverage which could squeeze into the pumping chamber.
- b. Attach the inboard head (20) to the cylinder with the hole and groove (located on the inside face of the head) towards the intake side of the pump.
- c. Install and uniformly tighten the head capscrews (21).

7. PACKING AND PACKING FOLLOWER

When necessary to re-pack, use a full set of new packing rings. Packing is furnished in sets with the correct number of rings. Never add new rings to an old set of packing.

- a. Insert the pack washer (58) into the stuffing box of the inboard head (20).
- b. Insert each of the packing rings (19) separately into the stuffing box, staggering the split joints 180 degrees so that they are not overlapping or near the joint of the preceding ring. Use the packing follower to properly seat each ring after placement.
- c. After all of the packing rings are in place, slide the packing follower (75) against the packing. Install and hand-tighten the stud nuts (18) evenly.

NOTE: Adjustment to the packing follower should be made while pumping liquid (see "Packing Adjustment").

MAINTENANCE

8. PACKING ADJUSTMENT

It is important that the packing be properly adjusted to prevent overheating.

- a. While the liquid is being pumped, uniformly tighten the packing follower stud nuts (18) a very small amount at a time.
- b. Check the stuffing box temperature several minutes after each adjustment for signs of overheating.
- c. Adjust the nuts until leakage is controlled, and no excess heat develops.

NOTE: Some leakage is desirable to lubricate the packing, but in some cases it is unacceptable, depending on the application.

9. OPTIONAL LIP SEALS

- a. Insert the pack washer (58) into the stuffing box of the inboard head. Apply a small amount of grease to the pump shaft to facilitate installation of the teflon lip seals.

- b. Slide one gasket, then one lip seal (19A), lip inward, into the stuffing box of the inboard head. Follow this procedure until the entire set of lip seals is installed. Use the packing follower to properly seat each ring against the previous ring.
- c. After the entire set is installed, slide the packing follower (75) against the lip seals and tighten the stud nuts (18) evenly.

NOTE: Once installed and clamped properly with the packing follower, teflon lip seals should require no adjustment. If leaking occurs, tighten the packing follower slightly. Do not overtighten. If leakage becomes excessive, replace the entire set of lip seals.

10. COMMERCIAL MECHANICAL SEAL

On pumps equipped with a commercial mechanical seal, refer to the separate literature accompanying the mechanical seal for installation instructions.

GENERAL PUMP TROUBLESHOOTING

SYMPTOM

PROBABLE CAUSE

Pump Not Priming

1. Pump not wetted.
2. Suction valve closed.
3. Air leaks in the suction line.
4. Suction line or valves clogged or too restrictive.
5. Wrong rotation on motor.
6. Broken drive train.
7. Pump vapor-locked.
8. Pump speed too low for priming.
9. Worn vanes.

Reduced Capacity

1. Pump speed too low.
2. Suction valves not fully open.
3. Air leaks in the suction line.
4. Excessive restriction in the suction line (i.e.: undersized piping, too many elbows & fittings, etc.).
5. Damaged or worn parts (refer to "Parts Replacement").
6. Excessive restriction in the discharge line causing partial flow through the relief valve.
7. Relief valve worn, set too low, or not seating properly.
8. Vanes installed backwards (see "Replacing Vanes Only").

Noise

1. Excessive vacuum on the pump due to:
 - a. Undersized piping or restrictive fittings in the suction line.
 - b. Pump speed too fast for the viscosity being handled.
 - c. Pump too far from the fluid source.
2. Running the pump for extended periods with a closed discharge line.
3. Pump not securely mounted.
4. Improper drive line (see "Pump Drive").
5. Sleeve Bearings worn or damaged (refer to "Parts Replacement").
6. Vibration from improperly anchored piping.
7. Bent shaft, or drive coupling misaligned.
8. Excessively worn rotor.
9. Malfunctioning valve in the system.
10. Damaged vanes (see the following category).

GENERAL PUMP TROUBLESHOOTING

SYMPTOM

PROBABLE CAUSE

Damaged Vanes

1. Foreign objects entering the pump.
 2. Running the pump dry for extended periods.
 3. Cavitation.
 4. Viscosity too high for the vanes and/or the pump speed.
 5. Incompatibility with the liquids pumped.
 6. Excessive heat.
 7. Worn or bent push rods, or worn push rod holes.
 8. Settled or solidified material in the pump at start-up.
 9. Hydraulic hammer - pressure spikes.
 10. Vanes installed backwards or upside down (see "Replacing Vanes Only").
-

Broken Shaft

1. Foreign objects entering the pump.
 2. Viscosity too high for the pump speed.
 3. Relief valve not opening.
 4. Hydraulic hammer - pressure spikes.
 5. Pump-driver misalignment.
 6. Excessively worn vanes or vane slots.
 7. Settled or solidified material in the pump at start-up.
-

Mechanical Seal Leakage (when applicable)

1. Seal faces cracked, scratched, nicked, dirty, or worn.
2. O-rings not compatible with the liquids pumped.
3. Shaft at seal area damaged, worn, or dirty.
4. Seal faces pitted due to corrosion or cavitation.
5. O-rings nicked, cut, or twisted.
6. Pump sleeve bearings (bushings) worn excessively.

NOTES

blackmer / A  **DOVER RESOURCES COMPANY**

1809 Century Avenue, Grand Rapids, Michigan 49509, U.S.A. • (616) 241-1611 • Telex: 4320148 • Fax: (616) 241-3752