INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

FOR SERIES 400, 1600, 2500, AND 4000 STANDARD MODEL PUMPS

ALL STAINLESS STEEL PUMPS WITH D-, DM-, G-, GM-, HT-, HU-, HW-, HY-, AND HZ-BEARING FRAMES

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1.0 INTRODUCTION

This manual contains information important to the installation, operation, and maintenance of your Tonkaflo multi-stage, stainless steel centrifugal pump. The Tonkaflo pump has been designed for reliable service in many types of pumping applications. Proper installation and normal maintenance will help insure extended pump life and prevent costly downtime. Before installing and operating your Tonkaflo pump, read these instructions carefully and keep the manual handy for future reference. Further information may be obtained by contacting your local Tonkaflo distributor or Osmonics, Inc., 5951 Clearwater Drive, Minnetonka, MN 55343-8995, USA, Phone: (952) 933-2277, Fax: (952) 933-0141.

This manual is not intended for repair or overhaul of the Tonkaflo pump liquid ends. Only the factory or those who have successfully completed the Factory Service School and have been certified are authorized to repair, service, or overhaul Tonkaflo pump liquid ends.

The Tonkaflo Multi-Stage Centrifugal Pump

Your new Tonkaflo multi-stage stainless steel constructed centrifugal pump is designed for quiet, smooth running and highly efficient operation. The eight series of Tonkaflo stainless steel impeller pumps range in capacities from 2 - 500 gpm (0.5 - 114 m^3/h) with single unit pressures up to 600 psi (41 bar). The materials of construction make Tonkaflo suitable for many chemical and pure water applications.

Applications for Tonkaflo Pumps

Food & Beverage	**Mobile Equipment**	**Electronics & Pharmaceuticals**
Spraying Central Cleaning Injection Container Washing	Vehicle Cleaning Pressure Booster Car Wash Rinse Spraying Jockey Pumps - Fire Systems	DI Rinse Water USP Water Water for Injection
Chemical & Paper	**Pollution Control**	**Metal Finishing**
Spraying, Sampling Chemical Transfer Descaling, Washing DI Water Transfer Injection to Reactors Felt Showers Mixing Seal Flush	Reverse Osmosis Ultrafiltration Spraying Descaling Wet Scrubbing	High-Pressure Cleaning Transfer and Booster Boiler Feed Paint Booth Cleaning Rinse Water Spraying Deburring Plastics

Tonkaflo pump's unique modular design allows the user to choose the number of stages which most closely match the desired performance and, thereby achieve the highest pumping efficiency. Unlike many other pump manufacturers, Tonkaflo will produce pumps to fit your particular applications should a standard model pump not suit your requirements.

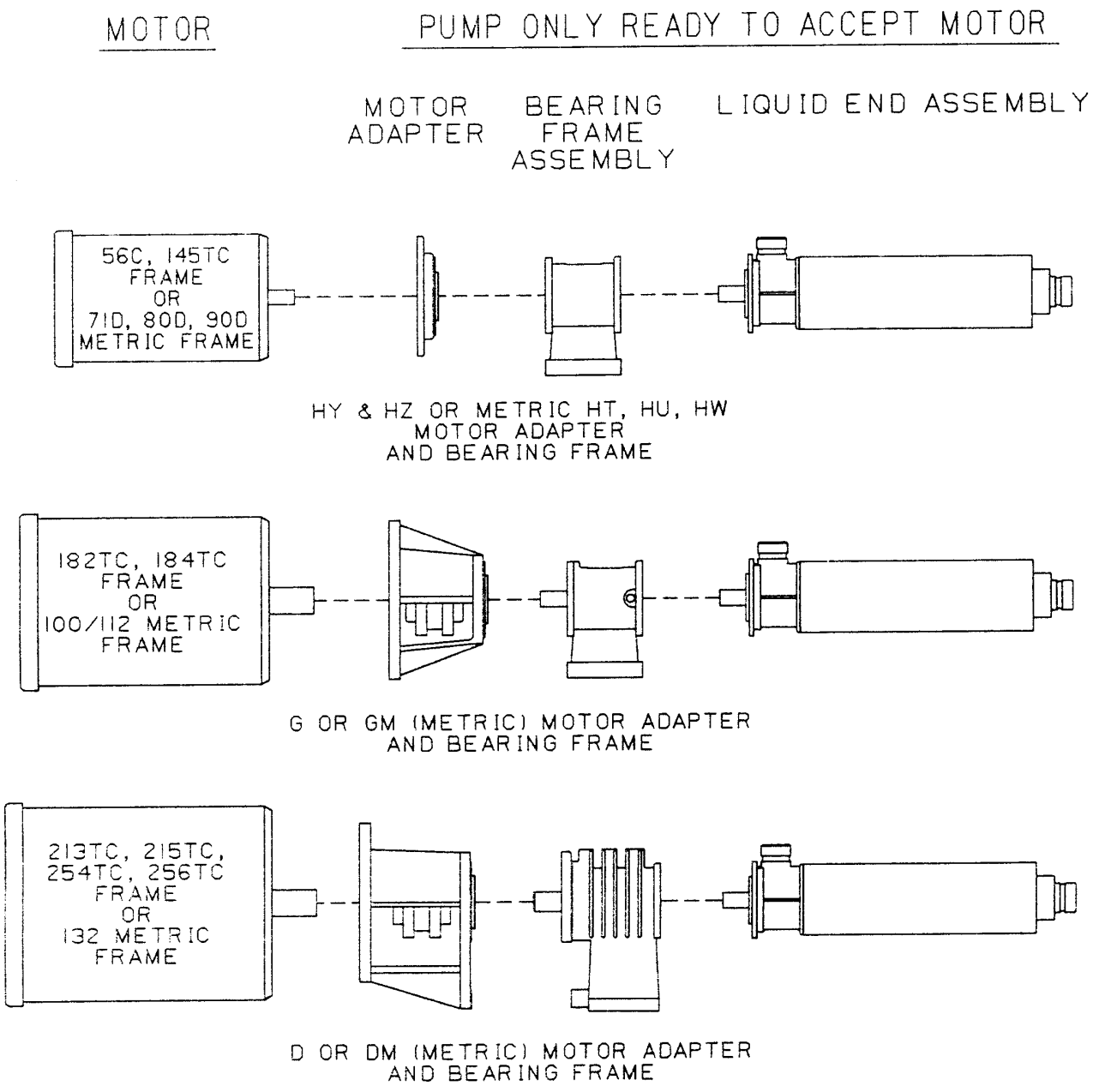

Figure 1.1
Modular Construction, Tonkaflo Pumps 400, 1600, 2500, and 4000 Models

2.0 TONKAFLO SPECIFICATIONS

The Tonkaflo pumps covered in this Installation, Operation, and Maintenance Manual are the lower and medium capacity 400, 1600, 2500, and 4000 Series pumps with D, G, and H family of bearing frames. These four series of pumps cover a flow range of 1.5 - 55 gpm (0.3 - 12.5 m^3/h) at 3450 rpm (60 Hz) with single unit pressures up to 600 psig (41 bar), and 1 - 42 gpm (0.2 - 9.5 m^3/h) at 2875 rpm (50 Hz) up to 500 psig (35 bar). See the table below. The capacity and discharge pressure can be increased by operating the pumps in parallel or series, respectively. There is no maximum limit on capacity when operating Tonkaflo pumps in parallel. When operating pumps in series, a maximum discharge pressure of 1000 psig (69 bar) may be achieved. With inlet pressures of 200 psig (14 bar) or greater, optional high pressure mechanical seals should be used.

2.1 Capacities

Series	3450 rpm - 60 Hz Minimum - Maximum	2875 rpm - 50 Hz Minimum - Maximum	Maximum Efficiency
400	1.5 - 6 gpm (0.3 - 1.4 m^3/h)	1 - 5 gpm (0.2 - 1.1 m^3/h)	34%
1600	5 - 22 gpm (1.1 - 5.0 m^3/h)	4 - 18 gpm (0.9 - 4.1 m^3/h)	61%
2500	10 - 32 gpm (2.3 - 7.3 m^3/h)	8 - 35 gpm (1.8 - 7.9 m^3/h)	60%
4000	0 - 55 gpm (4.5 - 12.5 m^3/h)	15 - 45 gpm (3.4 - 10.2 m^3/h)	58%

NOTE: There must be adequate flow at all times through the pump to prevent excessive heat buildup.

2.2 Maximum Developed Boost Pressure

	Maximum Developed Pressure		Maximum Number of Centrifugal Stages	
Series	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**
400	450 psi (31 bar)	500 psi (34 bar)	45	67
1600	520 psi (36 bar)	450 psi (31 bar)	45	57
2500	500 psi (34 bar)	450 psi (31 bar)	45	57
47000	420 psi (29 bar)	340 psi (23 bar)	42	48

2.3 Maximum Recommended Operating Temperature

The maximum recommended operating temperature for the standard model is 225°F (107°C).

For higher temperature applications, consult your local Tonkaflo distributor or the factory for available special materials of construction.

2.4 Standard Materials of Construction, AS Series

Impellers, diffusers, wetted casting, pump shaft, and casing are 304 stainless steel. The standard mechanical seal has a carbon rotating face and a ceramic stationary face. The secondary sealing element of the mechanical seal is Buna-N. The mechanical seal is a Crane Type 21, 5/8-inch diameter, with a material code of BF501C1. The shaft bearings, diffuser bearings, discharge bearings, O-rings, and mechanical seal elastomers are Buna-N.

2.5 Special Materials of Construction

Teflon* shaft bearings and other elastomers are available. Contact your distributor or the factory.

*Teflon is a registered trademark of E.I. du Pont de Nemours and Company, Inc.

2.6 Pump Nomenclature Example

Model AS1634G			**Model AS1657G-50Hz**		
AS	=	All Stainless Steel	AS	=	All Stainless Steel
16	=	Series 1600	16	=	Series 1600
34	=	Number of Stages	57	=	Number of Stages
G	=	Bearing Frame/Motor Adapter	G	=	Bearing Frame/Motor Adapter
			50Hz	=	50 Hz Operation

2.7 Special Liquids

Tonkaflo pumps can handle a variety of liquids. For liquids other than water, aqueous solutions, or corrosive solutes, consult your local Tonkaflo distributor or the factory for compatibility.

3.0 PUMP INSTALLATION

3.1 Inspection

Examine the pump for any visible damage which may have occurred during shipment. Notify the carrier and the factory promptly if any damage has occurred. The pump must always be drained before shipping if exposure to freezing temperatures is likely.

3.2 Pump Mounting and Location

Mount the pump by the bearing frame, by the support bracket at the discharge end (shorter pumps have no discharge bracket), and for 254/256 TC frame motors by the motor feet. In normal use, the pumps do not require a separate support for the motor, except for the 254 and 256 TC frame motors which are heavy and require support.

The pumps are intended for horizontal mounting, but upon special order, may be produced for vertical mounting with the motor up.

3.3 Inlet and Discharge

3.3.1 Piping

For most installations, the pump inlet housing should be rotated to a side position. Remove the four bolts, rotate the inlet to the side position, and install and tighten the four bolts. The inlet port may be left in the vertical position provided that an air pocket is not created in the connecting inlet piping. The pump inlet piping should be designed to avoid areas where air may be trapped and accumulate. It is recommended that the inlet piping not go up, over, and down into the pump, as this likely will result in air accumulation and out-of-balance pump operation.

Pump inlet pipe size changes just ahead of the pump should be tapered. Reducers should be eccentric to avoid air pockets.

Be sure that the pump is not mounted too high above the liquid source and that the inlet (suction) plumbing not too restricted so adequate suction pressure is available.

The inlet piping should be at least as large as the pump inlet port. The discharge piping should be sized to properly handle the maximum flow and pressure developed by the pump.

For most pump applications, it is recommended the pipe size selected result in frictional line loss of 3 psig/100-feet (0.21 bar/meter) or less for suction lines and 10 psig/100-feet (0.69 bar/meter) or less for discharge lines. A larger pipe size will reduce the frictional line loss.

When the pump operates with a suction lift, the suction pipe should slope upward to the pump from the source of supply. Provisions must be made for priming the pump. To maintain pump prime, a foot valve can be used with an opening at least as large as the inlet piping.

When pumping liquid from a tank, the suction line must be submerged enough so air is not drawn into the suction line from a vortex. Increasing the size of the inlet pipe to reduce the velocity will help to prevent the vortex from forming.

Hot liquids within the temperature range of the pump must have sufficient positive head to prevent vaporization at the impeller inlet. Consult the factory or your local Tonkaflo distributor for Net Positive Suction Head (NPSH) requirements of the pump for your application.

The pump must never be throttled on the suction side.

After installation, test the suction line with water with a pressure of 20 - 100 psig (1.4 - 6.9 bar) to detect any leaks.

3.3.2 Pump Piping Connections

The standard inlet and discharge connections for the 400, 1600, and 2500 Series pumps are grooved for 1-1/4-inch Victaulic clamped-union couplings with gasket. The 4000 Series pumps have a 2-inch Victaulic inlet connection and 1-1/2-inch Victaulic discharge connection. These Victaulic couplings are available worldwide. Contact the factory or your local industrial piping wholesaler.

3.3.3 Suction Screen (Strainer)

This is a precision multi-stage centrifugal pump with close tolerances to provide maximum efficiency.

It is good practice to install a large area 30-mesh or finer screen or a cartridge filter in the suction line to collect any foreign objects or large particles (but the screen or filter must be large enough to prevent excessively low inlet pressure). The pump must not be operated with a restricted suction line (inlet) flow. It is desirable to maintain a positive gauge pressure at the pump inlet (downstream from a filter or screen). If a negative gauge

pressure at the pump inlet exists, it must exceed the $NPSH_R$ requirements of the pump. A clogged screen or filter will result in a greater pressure drop.

A low pressure alarm or shut-off switch located between the screen or filter and the pump should always be used in conjunction with a suction line screen or filter.

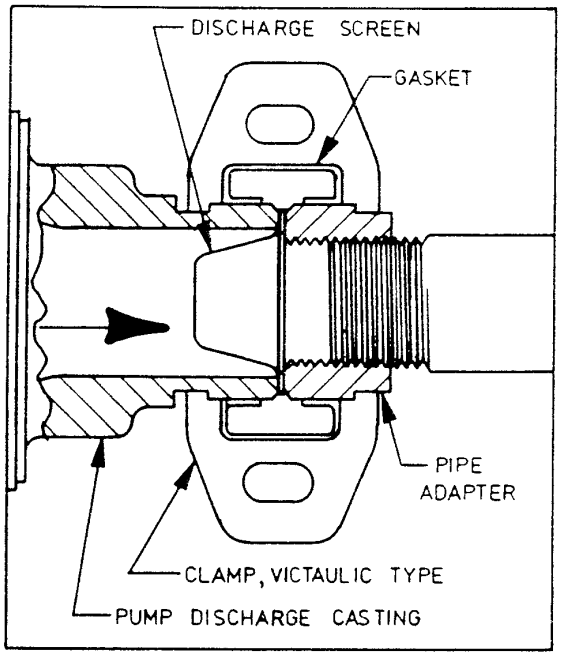

Figure 3.2
Installation of Discharge Screen

3.3.4 Discharge Screen (Strainer)

A 30-mesh screen (available as an accessory for 400, 1600, and 2500 Series pumps) located in the discharge piping will protect your process fluid should the pump be damaged due to improper operation or other causes. The installation of the screen is shown in Figure 3.2.

3.4 Pump Priming

THE INLET PIPING AND PUMP MUST BE FILLED WITH LIQUID (i.e., PRIMED BEFORE START-UP). If the pump is below the liquid source or connected to a positive pressure source, the pump may be primed from that source.

If the pump is above the liquid source, fill the pump and supply line with liquid from an external source.

The pump should be shut off immediately if prime is lost to avoid possible damage to the internals of the liquid end.

The pump should not run with a closed discharge valve for more than 10 minutes (less time if the water is already hot) as the liquid can heat up and exceed the maximum operating temperatures, causing irreversible damage to the wetted internal parts of the liquid end.

CAUTION: NEVER RUN THE PUMP DRY

The liquid end of the Tonkaflo pump is lubricated by the process fluid. The pump must never be run dry to avoid damage to the liquid end.

3.5 Protection Against Running Dry

It is suggested that controls to protect the pump from running dry be used. These controls include: pressure switches, flow switches, and temperature switches.

3.6 Motor Wiring

3.6.1 Single-Phase Motors

When initially connecting to the power source, be certain that the motor voltage connections and available line voltage are the same.

3.6.2 Three-Phase Motors (Refer to wiring diagram on motor)

The wiring diagram located on the motor name plate, electrical junction box, or junction box cover should be used to correctly wire the motor according to the line voltage available.

BEFORE STARTING 3-PHASE MOTORS

1. Prime pump before applying power to avoid damage to pump.

2. Apply power for ONE SECOND MAXIMUM to check direction of motor shaft rotation. The motor shaft should turn in a clockwise direction as viewed from the motor end. The direction of rotation for 3-phase motors may be reversed by interchanging any two leads.

3.7 Belt Drive Operation

Bearing frames designated as DD or GD are for belt drive or bedplate applications. Sixty Hz model pumps should not be operated over 3600 rpm, and some 50 Hz model pumps should not be operated over 3000 rpm. Contact the factory before operating a 50 Hz pump over 3000 rpm.

A BELT GUARD is required to prevent injury. The belt tension should be adjusted to achieve approximately 0.3-inch (7.6 mm) deflection with 5.5 lb. (2.5 kg) force applied midway between the pulleys.

A support bracket and clamp is provided to support the discharge end of the pump housing. The pump casing support and the bearing frame base should be in-line and on the same plane so that no stress results.

4.0 PUMP OPERATION

Review Section 2.0 on specifications and Section 3.0 on pump installation before operating your pump.

4.1 Priming

Prime the pump as noted in Section 3.4. After initial priming, any remaining air in the pump may frequently be expelled by opening and closing a discharge valve two or three times.

4.2 Operation

Operate the pump within its specified flow range. Refer to Section 2.0 specifications or to the performance curve provided with your pump.

4.3 Bearing Frame Lubrication

The bearings were lubricated at the factory. Do not add grease when you have a new or factory rebuilt pump.

Your pump operates at approximately 3450 rpm on 60 Hz power and 2875 rpm on 50 Hz power using standard 2-pole motors. Be sure to add the specified grease type, the correct quantity (Section 6.4), and at the specified intervals noted on the label on the bearing frame to ensure reliable pump operation.

On D-Bearing frame pumps operating on 60 Hz power, use only lubricant EMB grease. Do not substitute.

5.0 GENERAL TROUBLESHOOTING

5.1 Troubleshooting Chart

LOW FLOW	**MOTOR RUNS HOT OR STOPS**
1. Restrictions in inlet or discharge 2. Foot valve operating improperly 3. Air leak in inlet piping 4. Air leak in mechanical seal 5. Wrong installation of belt drive 6. Suction lift too high 7. Reverse rotation of pump shaft 8. Pump not primed adequately 9. Inlet strainer/filter plugged 10. Pump throttling valve on discharge closed (pump deadheaded)	1. Motor surface temperature up to 80°F (45°C) over ambient can occur. The motor will feel hot to the touch. 2. Bad connection 3. Motor exceeding rated amp draw 4. Excessive ambient temperature 5. Heater size too small in motor starter 6. Binding rotation in the pump shaft 7. Bearings not lubricated adequately 8. Specific gravity or viscosity of liquid higher than design conditions 9. Motor wired improperly
MOTOR DOES NOT RUN	**LOW PRESSURE**
1. Blown fuse, tripped circuit breaker, or overload heater 2. Motor too hot - allow to cool 3. Motor voltage connection and line voltage different 4. Bad connection 5. Motor wired improperly	1. Pump not primed adequately 2. Air leak in inlet piping 3. Excessive flow 4. Clogged suction line filter or screen 5. Reverse rotation of pump shaft 6. Foot valve operating improperly 7. Wrong ratio for belt drive
PUMP VIBRATION	**PUMP LEAKING**
1. Misalignment of flexible coupling 2. Bent pump shaft 3. Improper mounting 4. Starved suction 5. Worn bearings 6. Motor out of balance 7. Operating beyond specified capacity range of the pump	1. Mechanical seal needs replacing 2. O-rings in pump casing damaged 3. Oil seals need replacing 4. Piping not properly sealed

5.2 Bearing Frame Temperature

The operating temperature of the grease lubricated bearing frames utilized on Tonkaflo pumps will vary depending on the boost pressure of the pump. As a general rule, the G- and H-Bearing frames will operate within a temperature range of 150 - 200°F (65 - 93°C). The D-Bearing frame will operate within a temperature range of 160 - 220°F (71 - 104°C). During operation, the bearing frame will feel hot to the touch. A new bearing frame will run cooler after 24 hours of operation. Bearing frame temperatures will typically decrease further after a few weeks as the bearings break in. Pumps operating on 50 Hz power (2875 rpm) will operate cooler.

5.3 Mechanical Seal Leakage

If liquid is leaking from the holes on either side or underside of the bearing frame near the inlet, the mechanical seal may need to be replaced. With new pumps, pumps with new mechanical seals, or pumps which have been dormant for long periods, the seal faces may not be completely seated and a slight leakage will occur. If this leakage continues for more than 60 seconds, remove the discharge piping and tap the pump shaft using a wooden dowel to seat the seal. Be careful not to damage the pump shaft. If leakage continues, remove the liquid end from the bearing frame and add a small amount of oil to the ceramic seal. See Section 6.1, Steps 1 and 4 only.

6.0 TONKAFLO PUMP FIELD MAINTENANCE

6.1 Mechanical Seal Replacement - 400, 1600, 2500, and 4000 Series

STEPS:

1. Remove the set screw which holds the pump shaft in the bearing frame. This is done by inserting a 3/16-inch Allen wrench in one of the access holes on either side of the bearing frame toward the liquid end (Figure 6.3). Rotate the pump shaft until the Allen wrench may be inserted into the set screw. Remove the set screw.

2. Remove the four (4) 5/16-inch bolts and lockwashers that fasten the inlet housing to the bearing frame. Separate the liquid end from the bearing frame.

   CAUTION: DO NOT BEND THE PUMP SHAFT.

3. Remove the pump shaft key.

4. Remove the mechanical seal holder by sliding the holder off the pump shaft.

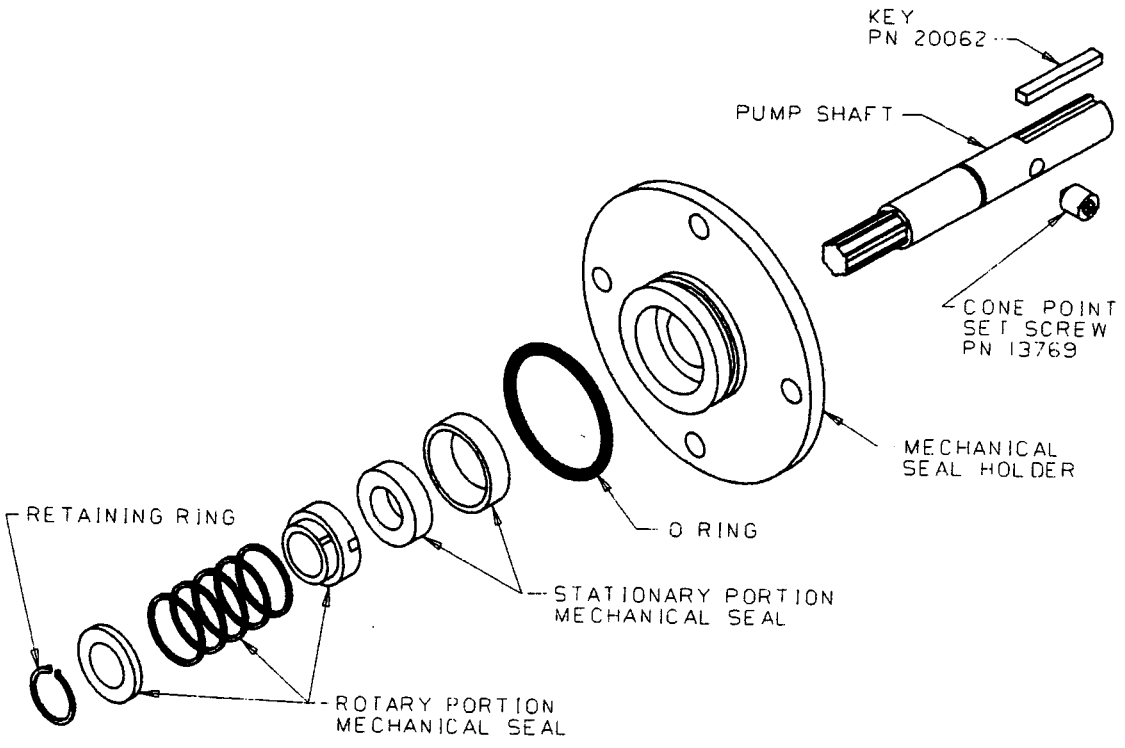

Figure 6.3
Removal of Mechanical Seal

5. Remove the rotary portion (spring, washer, and face assembly) of the seal assembly from the pump shaft by rotating and pulling the rotary portion until it slides off the pump shaft (Figure 6.3).

6. Lubricate the round surface of the pump shaft with a light film of oil, petroleum grease or silicone grease, or soap and water. After lubrication, install the rotary portion of the new seal by placing it onto the pump shaft and carefully rotating and pushing the rotary portion down the pump shaft until it is seated against the spring.

   NOTE: Be careful when sliding the rotary portion over the keyway in the shaft not to damage the rubber on rotary portion.

7. Remove the stationary portion of the mechanical seal from the cavity in the seal holder.

8. Install the new stationary portion into the seal holder cavity. Lubricate the rubber on the outside before replacement. Lubricate with petroleum or silicone grease, or with soap and water. Make sure the stationary portion is fully seated. Also, lightly lubricate the ground surface of the stationary seat with a light film of oil or grease.

9. Examine the rubber O-ring on the mechanical seal holder and, if the O-ring is damaged, replace it with a new one. A new O-ring is included with the factory supplied, mechanical seal replacement kit. Be sure to lubricate the O-ring with grease or water and a soap solution before installing.

10. Place the mechanical seal holder containing the new stationary portion onto the pump shaft and slide it over the shaft until fully engaged with the inlet casting. Care must be taken not to damage the seal when sliding it over the pump shaft.

11. Replace the key in the keyway, making sure the key is fully seated in the pump shaft keyway.

12. Apply an anti-seize compound (which helps to prevent corrosion, rust, and seizure) on the exposed pump shaft where it engages with the bearing frame shaft. These compounds are available from the factory or local industrial supply house.

13. Align the keyed pump shaft with the bore of the bearing frame shaft and insert the pump shaft such that the key on the pump shaft fits into the keyway on the bearing frame shaft. Then push until the castings come together.

14. Fasten the inlet housing, mechanical seal holder, and the bearing frame assembly together with the four (4) 5/16-inch bolts and lockwashers.

15. After fastening the inlet housing to the bearing frame assembly, line up the set screw hole in the bearing frame shaft with the access hole in the bearing frame. Place the set screw in the bearing frame shaft. Through the opening in the discharge housing, push on the end of the pump shaft with a wooden dowel to seat the shaft in the bearing frame. Tap until the pump shaft is finally seated. The shaft will bottom out when seated. Tighten the set screw to secure the pump shaft.

6.2 High-Pressure Mechanical Seal Replacement - 400, 1600, 2500, and 4000 Series

High pressure Type-1 mechanical seals have the same basic design as standard Type-21 mechanical seals, except the Type-1 seal is longer when installed. Replace them using the same procedure as denoted in Section 6.1. Since the Type-1 seal is longer, place the retaining ring in the second retaining ring groove.

6.3 Motor Lubrication

Lubrication for motors 10 Hp or below is generally not required. For larger motors, lubrication intervals vary between manufacturers, but lubrication is generally required every 2000 hours. CONSULT YOUR LOCAL MOTOR DISTRIBUTOR FOR LUBRICATION ADVICE.

6.4 Bearing Frame Lubrication

6.4.1 Relubrication Interval

The bearings were lubricated at the factory. Do not add grease when first putting your new pump into service. The bearing frame should be regreased every relubrication interval or once a year, whichever occurs first. Note the relubrication interval information on the label on the pump bearing frame.

6.4.2 Grease Type for HT-, HU-, HW-, HY-, HZ-, and G-Bearing Frames

Use a No. 2 lithium grease with molybdenum disulfide additive. This lubricant is a premium grade automotive chassis type grease available from a number of manufacturers. Two are listed below, but other brands may be used provided it is a No. 2 lithium grease with molybdenum disulfide.

Tonkaflo P/N	Manufacturer	Description
	Valvoline	Special Moly EP #630, 14-oz Tube
1113767	Pennzoil	TTM Lubricant 302, 14-oz Tube

Alternate: Lubriplate EMB grease (Tonkaflo P/N 1121576). This grease has a lithium/polymer base to provide exceptional stability and effectively reduces the operating temperature.

6.4.3 Grease Type D-Bearing Frames

Use Lubriplate EMB grease (Tonkaflo P/N 1121576). DO NOT SUBSTITUTE ON PUMPS OPERATING ON 60 Hz POWER (3450 rpm).

6.4.4 Quantity of Grease for Lubrication

Add approximately 2/3 ounce (20 grams). This is typically 15 shots from a hand-operated cartridge grease gun.

On a vertically-mounted pump having two grease fittings on the bearing frame, add 8 ounce (8 grams) of grease to the upper grease fitting, and 1/2 ounce (12 grams) to the lower fitting. This typically is 6 and 9 shots, respectively from a hand-operated cartridge grease gun.

6.4.5 Procedure

The pump may be operating or not operating when greased.

For horizontally-mounted pumps, remove the two threaded plugs from the top of the bearing frame. Add grease through the grease fitting located between the two plugs.

Add 2/3 ounce (20 grams) as specified in Section 6.4.4. For vertically-mounted pumps, remove the pressure plug and add 2/3 ounce (20 grams) of grease dividing the grease as noted in Section 6.4.4.

Insert the threaded plug(s) in the vent hole(s).

CAUTION: DO NOT OVERGREASE.

Should the bearing frame become so full of grease that the grease exits from the vent holes WHILE BEING ADDED, disassemble and clean the bearing frame.

6.5 Disassembly of Pumps with Bearing Frame Types D, G, HT, HU, HW, HY and HZ

6.5.1 Pump Removal From its Installation

STEPS:

1. Disconnect the motor from the power source.
2. Remove inlet and discharge plumbing.
3. If you want to service the mechanical seal only, go to Section 6.1. Otherwise, remove pump from its installation.

6.5.2 Disassembly of the Liquid End from the Bearing Frame.

Remove the liquid end from the bearing frame by following Section 6.1, Steps 1 and 2 (Figure 6.3).

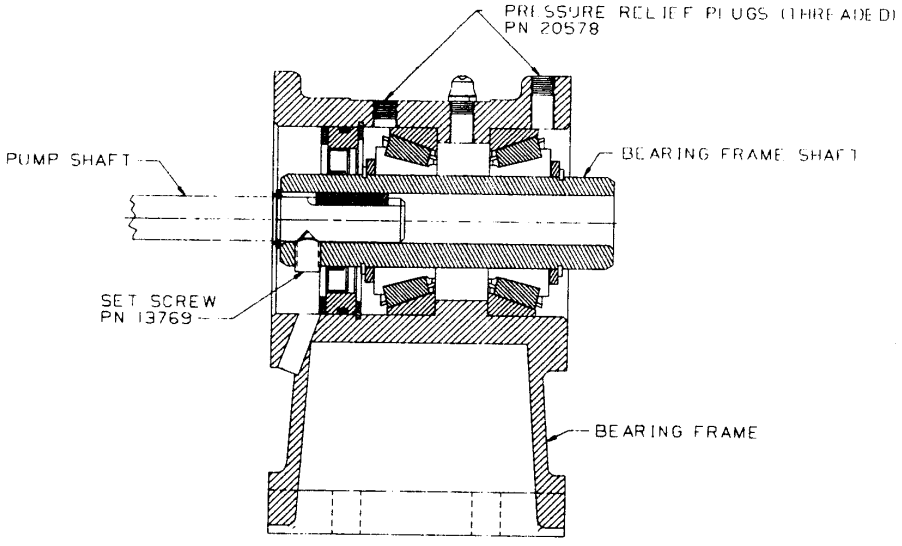

Figure 6.4
Disassembly of Liquid End From the Bearing Frame

6.5.3 Disassembly of Motor and Motor Adapter from Bearing Frame.

Unfasten the four bolts and lockwashers that secure the motor adapter to the motor and remove the motor (Figure 8.8). Remove the four (4) 5/16-inch bolts from the motor adapter and separate motor adapter from bearing frame. The D-Bearing frame has six (6) 3/8-inch bolts to remove.

6.6 Bearing Frame Overhaul-Types HT, HU, HW, HY, HZ, and G

Refer to Figure 6.5, for the construction of bearing frames HT, HU, HW, HY, HZ, and G. These bearing frames utilize a shim pack to adjust the bearings.

STEPS:

1. Remove the grease seal holder from the liquid end side of the bearing frame. This is done by removing retaining ring #4 and then by inserting two (2) 6-32 bolts into the threaded holes, gripping the bolts with a pair of pliers and working the seal holder out.

   As an alternative the seal and seal holder assembly may be removed simultaneously with bearing cone #3, (proceed to Step 4). The bearing frame can be disassembled without removing retaining ring #1.

2. Remove retaining ring #2, the shims, and the back-up washer.

3. Place the bearing frame in a press. Press on the motor end of the shaft to remove the shaft assembly from the bearing frame. Bearing cone #2, which is a press fit bearing, will slide off the shaft when it is pressed out of the bearing frame. Bearing cone #1 will remain on the shaft. Removal of bearing cone #1 from the shaft should be done only when replacement is necessary.

4. Clean the bearings and bearing frame of all grease.

5. Inspect the bearing cup and cone for any rough surface conditions and replace both cup and cone when necessary.

6. Inspect both grease seals (i.e., motor adapter and bearing frame grease seals) and replace if the seals are no longer pliable or if they were leaking.

7. Pack grease into both bearings using #2 lithium grease with molybdenum-disulfide additive referred to in Section 6.4.2.

8. If removed, press bearing cone #1 onto the shaft, making sure the back-up washer behind retaining ring #3 is replaced if the pump had one installed initially. Do not apply excess force. The bearing cone should be held squarely on the shaft when starting to insure it is pressed on straight. The correct set-up may be checked by placing the shaft into the frame and measuring the 5/32-inch (4 mm) recess (Figure 6.5).

9. With the shaft placed in the bearing frame, press on the second bearing cone, holding it square while starting. Press the bearing cone on until it contacts the bearing cup. Do not use excess force.

10. Install the back-up washer #1, the shim pack, and the retaining ring, making sure the flat side of the retaining ring is away from the shims. Press the shaft to force bearing #2 back against the shim pack. Again, apply just enough force to set the bearing against the washer, shim, and retaining ring. Do not apply excess force or damage may result.

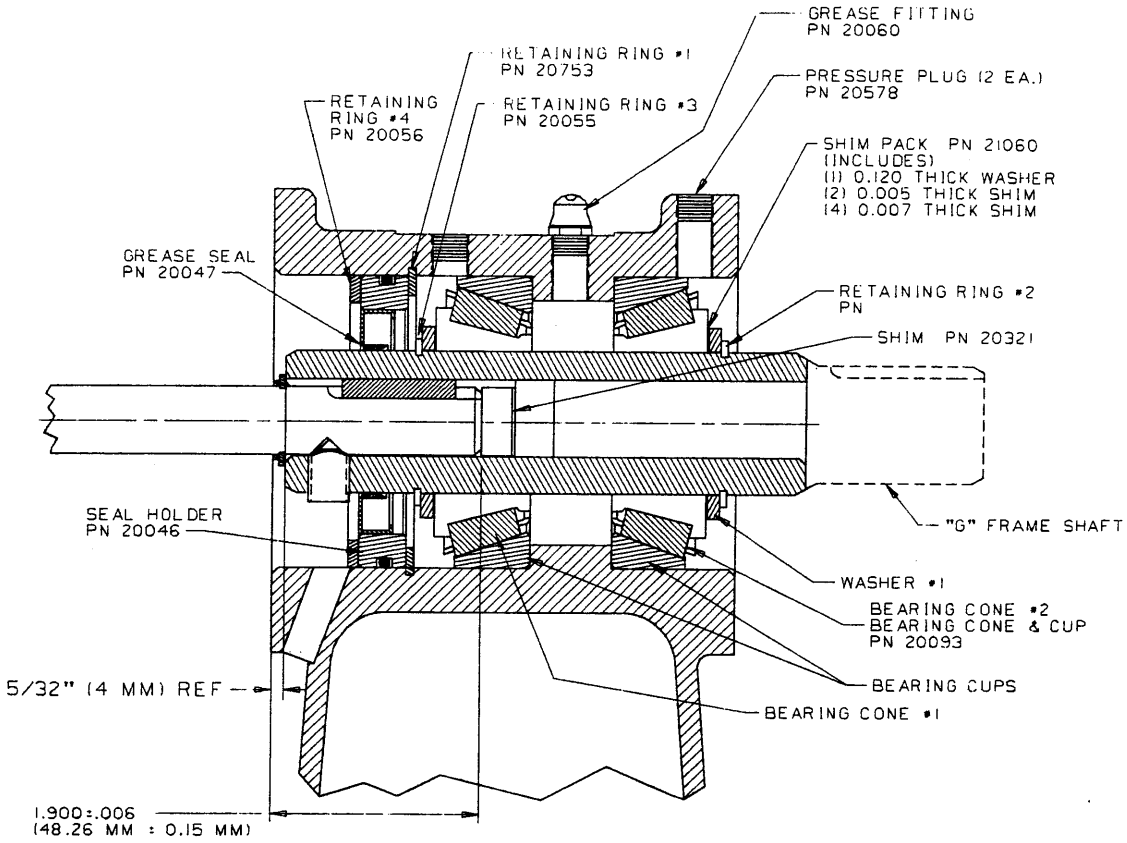

Figure 6.5
Pump Bearing Frame Types HT, HU, HW, HY, HZ, and G

11. Check the end play of the shaft.

    Steps:

    1. Grasp the shaft on the motor side of the bearing frame while turning the shaft as far as it will go.

       This ensures that the bearing cone is completely seated in the bearing race.

    2. Hold the shaft in place to prevent axial movement.

    3. Zero out and place the dial indicator on the motor.

    4. Push the shaft back toward the motor side of the bearing frame, and observe the movement on the dial indicator. The end play should read 0.003 - 0.006-inch (0.07 - 0.15mm) on the dial indicator.

    5. Repeat Step 4 two to three times to verify end play accuracy.

       NOTE: End play of 0.006-inch (0.15 mm) or less is difficult to read by hand. Osmonics recommends using a dial indicator to measure end play.

       NOTE: Readily noticeable end play means additional shimming is required. Reshim as necessary, making sure the bearing #2 is pressed back against the shim pack before making the measurement.

12. Examine the rubber O-ring on the outside of the grease seal holder and if it is damaged, replace it with a new one. Be sure the O-ring is well lubricated with grease.

13. Lubricate the lip of the grease seal with grease.

14. Re-install the grease seal back-up retaining ring #1.

15. Press the grease seal assembly into the bearing frame until seated on the retaining ring.

    CAUTION: Be sure the face of the grease seal holder with the threaded holes is exposed and is not facing the bearings.

16. The 1.900-inch ± 0.006-inch (48.26 mm ± 0.15 mm) dimension shown on Figure 6.5 applies to the HT-, HU-, HW-, HY-, HZ-, and G-Bearing frames.

    Reshim the low profile socket head cap screw as needed.

6.7 Type D-Bearing Frame Overhaul

Refer to Figure 6.6 for the construction of bearing frame type D. The D-Bearing frame utilizes a threaded nut to control the bearing running clearance.

STEPS:

1. Remove the lock nut and lockwasher from the bearing frame shaft. Removal of the nut can be facilitated by placing a 3/8-inch bolt into the set screw hole in the shaft to hold the shaft while unthreading the bolt.

2. Place the bearing frame in a press. Simultaneously press out the grease seal and remove bearing cone #2 by pressing on the motor end of the bearing frame shaft. After the grease seal is removed, continue pressing to remove the shaft assembly from the bearing frame. Bearing cone #1 will remain on the shaft. Removal of bearing cone #1 from the shaft should be done only when replacement is necessary. The back-up retaining ring behind the grease seal does not have to be removed to remove the shaft assembly.

3. See Section 6.6, Steps 4, 5, and 6.

4. On D-Bearing frames, pack grease into both bearings using lubricant EMB grease. Do not substitute on 60 Hz pump bearing frames.

5. If removed, press bearing cone #1 onto the shaft, holding the bearing square while starting. Make sure the washer behind retaining ring #2 has been replaced. The correct set-up may be checked by placing the shaft into the frame and measuring the 0.05-inch (1.3 mm) recess (Figure 6.6). Press the bearing on until it is seated against the washer and retaining ring. Do not apply excess force when seating the bearing or damage will result.

6. With the shaft placed in the bearing frame, press on the second bearing cone, holding it square while starting.

7. Re-install the lockwasher and nut. Using a press, force bearing #2 back against the lockwasher by pressing on the shaft. Do not use excess force or damage will result.

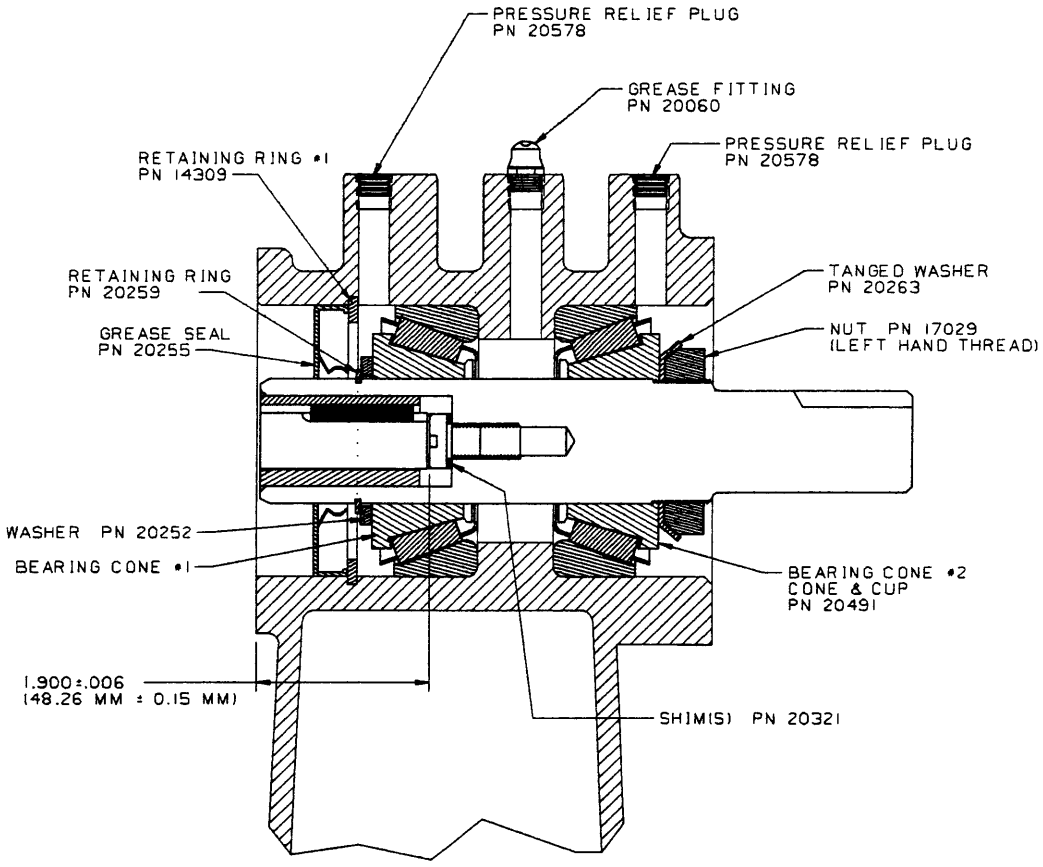

Figure 6.6
Pump Bearing Frame Type D

8. Check the end play of the shaft.

   STEPS:

   1. Grasp the shaft on the motor side of the bearing frame while turning the shaft as far as it will go.

      This ensures that the bearing cone is completely seated in the bearing race.

   2. Hold the shaft in place to prevent axial movement.

   3. Zero out and place the dial indicator on the motor.

   4. Push the shaft back toward the motor side of the bearing frame, and observe the movement on the dial indicator. The end play should read 0.003 - 0.006-inch (0.07 - 0.15mm) on the dial indicator.

5. Repeat Step 4 two to three times to verify end play accuracy.

NOTE: End play of 0.006-inch or less is difficult to read by hand. Osmonics recommends using a dial indicator to measure end play.

NOTE: Readily noticeable end play means tightening the lock nut is required. When the end play setting is correct, set one tang on the lockwasher into the nut slot.

Re-install the grease seal making sure it is well lubricated with grease.

9. Check the 1.900-inch ± 0.006-inch (48.26 mm ± 0.15 mm) dimension shown in Figure 6.6. Reshim the low profile socket head cap screw as needed.

6.8 Assembly of Motor Adapter and Motor to Type HY- and HZ-Bearing Frame

STEPS:

1. Attach the motor adapter to the bearing frame using four (4) 5/16-inch bolts and lockwashers.

2. Check to see that key is fully seated in the keyway of the motor shaft. With a chisel, put two small indentions along the shaft key slot near the shaft end. Tighten the bolts.

3. Lubricate motor shaft with anti-seize compound.

4. Align the keyed motor shaft with the bore of the bearing frame shaft and insert until the motor adapter mates with the motor frame.

5. Fasten the motor to the adapter with four (4) 3/8-inch bolts and lockwashers.

6.9 Assembly of Motor Adapter to Type D- and G-Bearing Frames

STEPS:

1. Attach the motor adapter to the bearing frame using four (4) 5/16-inch bolts and lockwashers for the G-Frame and six 3/8-inch bolts and lockwashers for the D-Frame. When first positioning the motor adapter, check to see that the grease seal clears the keyway. Reposition the seal in the motor adapter as needed.

2. Position the flexible coupling flange so it is flush with the end of the bearing frame shaft, and tighten the set screws.

3. Slip the rubber coupling in place and engage with the flange.

4. Place the second flexible coupling flange on the motor shaft. Be sure the set screws are positioned so that they may be tightened through the opening in the adapter when the motor is installed. Do not tighten the set screws at this time.

5. Install the motor and bolt it to the adapter with four (4) 1/2-inch bolts and lockwashers.

6. Adjust the motor flange for 7/8-inch (22.2 mm) space between the flange.

7. Tighten the set screws on the motor shaft flange.

6.10 Liquid End - Tonkaflo Service Policy

Sections 5.0 and 6.0 in the Tonkaflo Installation, Operation, and Maintenance Manual were written to assist our customers in performing minor maintenance in the field on Tonkaflo pumps. Proper maintenance will insure longer pump life and minimize downtime. Tonkaflo pumps are manufactured to make field repairs on the mechanical seal a quick and easy process. Bearing frame overhauls may be done by the customer, a local maintenance shop, or the factory. If repair at the factory is desired, call the factory for a Return Goods Authorization (RGA) number. Send the complete pump, with or without motor, to the attention of the Pump Service Department, Tonkaflo Pumps. For motor problems, such as worn out motor bearings, it is recommended that maintenance be done at a local motor repair shop.

Field service of the liquid end, with the exception of mechanical seal replacement, is not recommended. If a liquid end is damaged by running the pump dry, inadequate flow, excessive deadheading, cavitation, or other reasons, return it with or without motor to the factory for repair or order a rebuilt pump with or without motor as described in Section 7.0.

7.0 TONKAFLO PUMP RETURN GOODS AUTHORIZATION (RGA) PROCEDURE

If you wish to return goods for repair, warranty evaluation and/or credit, please have your original sales order or invoice available when you call Osmonics. Call (800) 848-1750 and press #6 to speak with Customer Service. An Osmonics Customer Service representative will provide instructions and a Return Goods Authorization (RGA) number which needs to be clearly written on the outside of the box used to ship your materials. All equipment must be shipped to Osmonics with the freight prepaid by the customer. Call our Customer Service Center with any questions or issues concerning freight claims and a representative will discuss your situation.

All materials to be returned must be rendered into a non-hazardous condition prior to shipping.

There are three ways to handle a return: (1) send in the pump for repair and return; (2) purchase a rebuilt pump (standard stock models only) and return the original pump for credit; or (3) purchase a new pump and when desired, send the defective pump to the factory for repair and return.

7.1 Out-of-Warranty Pump Failure

7.1.1 Return the pump on an RGA for repair. The pump will be repaired and repair charges invoiced to the customer. The warranty on repairs is three months.

7.1.2 Purchase a rebuilt pump from stock at list price with full one-year warranty. Return the damaged pump on an RGA for full credit less repair charges.

7.2 In-Warranty Pump Failure

7.2.1 Return the defective pump to the factory for repair on an RGA within 15 days. Osmonics absorbs the cost of repair. The repaired pump will be returned and remains under warranty for the remainder of the original warranty period or three months, whichever is longer.

7.2.2 Order a rebuilt pump from stock at list price and full year warranty. Return the defective pump on an RGA within 15 days. Credit will be issued based on warranty determination.

7.2.3 Osmonics will not restock or issue return credit against a new, non-stock, pump purchase regardless of the warranty status of the failed pump. An exception will be considered if failure occurs at start-up and there is no time on failed unit. The warranty (Section 10.0) is 12 months from installation or 15 months from receipt, whichever occurs first.

7.3 Shipping Charges

7.3.1 In-Warranty

Customer pays for shipment to Osmonics, Inc. Osmonics pays one way surface freight return to customer.

7.3.2 Out-of-Warranty When New Pump is Purchased

Customer pays all shipping charges.

8.0 CUTAWAY DRAWINGS

8.1 HT-, HU-, HW-, HY- and HZ-Frames

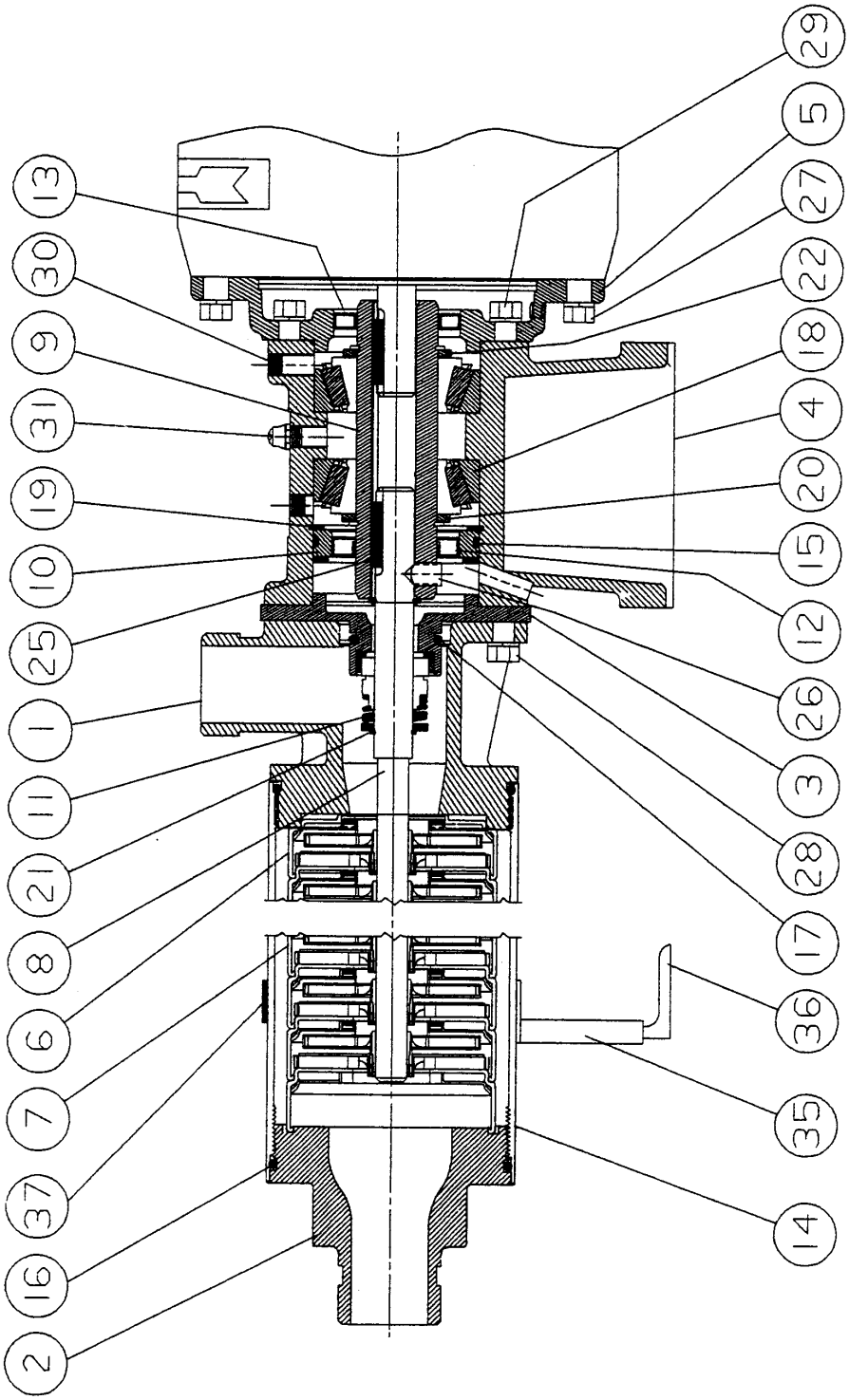

Figure 8.7
HT-, HU-, HW-, HY-, and HZ-Frames

8.2 D- and G-Frames

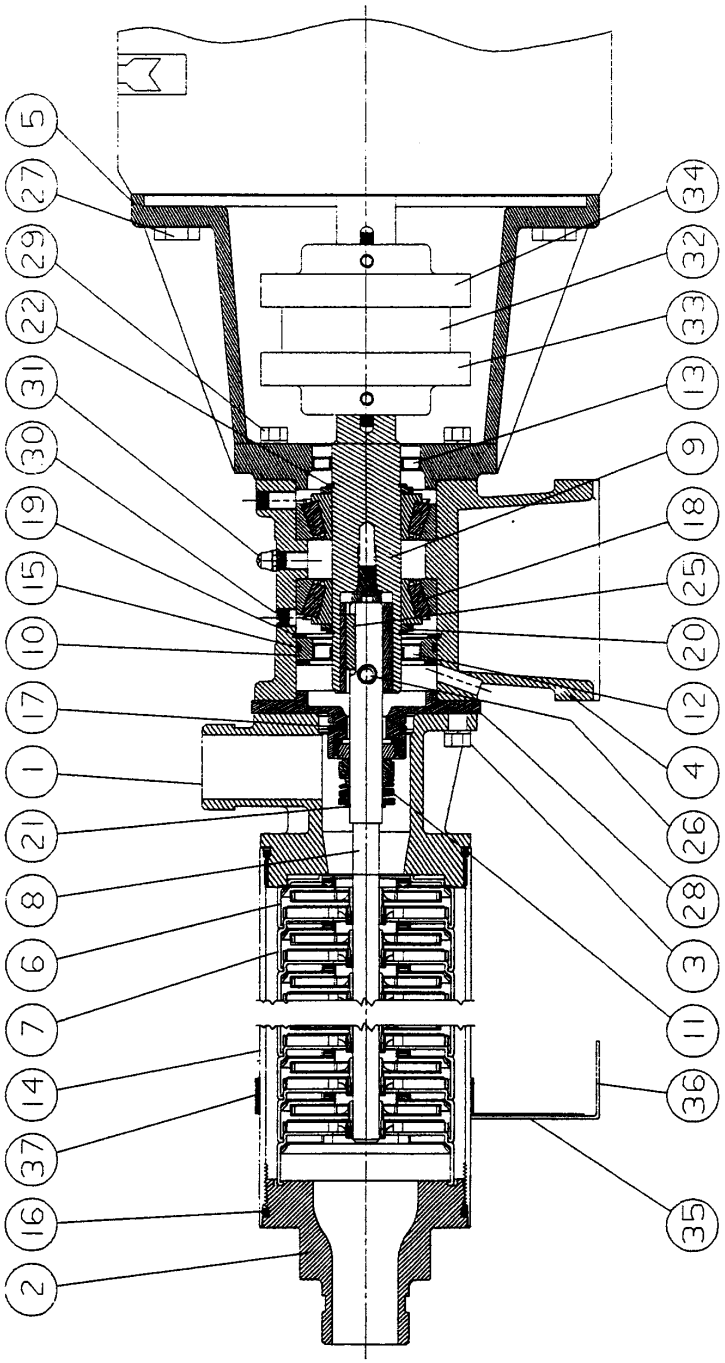

Figure 8.8
D- and G-Frames

9.0 REPLACEMENT PARTS

9.1 Parts List

PARTS LIST - STANDARD MODELS

ITEM NUMBER	PART DESCRIPTION	PART NUMBER				
		All HT, HU, HW	ALL HY	ALL HZ	ALL G	ALL D
1	Inlet Housing	*	*	*	*	*
2	Discharge Housing	*	*	*	*	*
3	Mechanical Seal Holder	1122731	1122731	1122731	1122731	1122733
4	Bearing Frame Housing	1120800	1120800	1120800	1120800	1120358
5	Motor Adapter	*	1120025	1120025	1120026[1]	1120359[2]
6	Initial Stage	*	*	*	*	*
7	Stage Assembly	*	*	*	*	*
8	Pump Shaft Assembly	*	*	*	*	*
9	Bearing Frame Shaft Assembly	*	*	*	1120688	1120325
10	Grease Seal Holder	1120046	1120046	1120046	1120046	-
11a	Mechanical Seal, Standard - 200 psig (13.8 bar)	1113575	1113515	1113515	1113515	1113515
11b	Mechanical Seal, High Pressure - 300 psig (20.7)	1113497	1113497	1113497	1113497	1113497
11c	Mechanical Seal, High Pressure - 400 psig (27.6 bar)	1113516	1113516	1113516	113516	1113516
12	Grease Seal, Inlet Side	1120047	1120047	1120047	1120047	1120055
13	Grease Seal, Motor Adapter or Belt Drive Cap	1120047	1120047	1120047	1120047	1120256
14	Pump Casing	*	*	*	*	*
15	O-ring, Grease Seal Holder	1120285	1120285	1120285	1120285	*
16	O-ring, Pump Casing	1122793	1122793	1122793	1122793	1122793
17	O-ring, Seal Holder	1122786	1122786	1122786	1122786	1122786
18	Bearing Cone and Cup	1120093	1120093	1120093	1120093	1120491
19	Retaining Rings, Bearing Frame Housing	1120753	1120753	1120753	1120753	1114309
20	Retaining Rings, Bearing Frame Shaft	1120055	1120055	1120055	1120055	1120059
21	Retaining Ring, Mech Seal	1120054	1120054	1120054	1120054	1120054
22	Shim Pack	1121060	1121060	1121060	1121060	-
23	Lock Nut	-	-	-	-	1117029
24	Washer, Lock, Multi-Tanged	-	-	-	-	1120263
25	Pump Shaft Key	1120062		1120062	1120062	1120062
26	Set Screw	1113769		1113769	1113769	1113769
27	Cap Screws, Adapter to Motor	1110984		1110984	1113793	1113793
28	Cap Screws, Liquid End	13102		1113102	1113102	1113102
29	Cap Screws, Adapter to Bearing Frame	1110985		1110985	1113102	1113102
30	Pressure Relief Plug, Metal	1120578	1120578	1120578	1120578	1120578
31	Grease Fitting	1120060	1120060	1120060	1120060	1120060

ITEM NUMBER	PART DESCRIPTION	PART NUMBER				
		All HT, HU, HW	ALL HY	ALL HZ	ALL G	ALL D
32	Flexible Coupling Sleeve[3]	-	-	-	1120306	1120306
33	Flexible Coupling Flange 1.125 Bore, Pump	-	-	-	1120094	1120094
34a	Flexible Coupling Flange 182/184 TC Motors	-	-	-	1120094	-
34b	Flexible Coupling Flange 1.375 Bore, 213/215 TC Motors	-	-	-	-	1120095
34c	Flexible Coupling Flange 1.625 Bore, 254/256 TC Motors	-	-	-	-	1114333
34d	Flexible Coupling Flange 28 mm Bore, 100/112 Motors	-	-	-	1121438	-
35	Discharge Support, Upper	1122865	1122865	1122865	1122865	1122865
36	Shell Support, Lower	1122862	1122862	1122862	1122862	1122862
37	Discharge Support Clamp	1122861	1122861	1122861	1122861	1122861
38	O-ring - Bearing Frame to Motor Adapter	-	-	-	-	1114471

ACCESSORIES - STANDARD MODELS

PART DESCRIPTION	PART NUMBER				
	All HT, HU, HW	ALL HY	ALL HZ	ALL G	ALL D
Loctite 242, 0.5 cc Bottle	1120109	1120109	1120109	1120109	1120109
Never-Seez	1120110	1120110	1120110	1120110	1120110
Liquid End Assembly	*	*	*	*	*
Bearing Frame Assembly	*	1120743	1120742	1120740	1120327
Mechanical Seal Kit:	*	*	*	*	*
- Standard (< 200 psig)	*	*	*	*	*
- High Pressure (< 300 psig)	*	*	*	*	*
- High Pressure (< 400 psig)	*	*	*	*	*
Victaulic Adapters					
- 1.25 Vict. x 1.25 MPT, 316SS[4]	1113653	1113653	1113653	1113653	1113653
- 1.25 Vict. x 1 FPT, 316SS[4]	1120797	1120797	1120797	1120797	1120797
- 1.25 Vict. x 0.75 FPT, 316SS[4]	1120229	1120229	1120229	1120229	-
Victaulic Coupling 1.25 inch[4]	1110597	1110597	1110597	1110597	1110597
Pump Discharge Screen, 1.25[4]	1120264	1120264	1120264	1120264	1120264

Notes:

1 Model GM Metric Motor Adapter - P/N 1121315
2 Model DM Metric Motor Adapter - P/N 1121316
3 Flexible Coupling not applicable for Belt Drive
4 1.1/4-inch Victaulic Adapter not applicable for 4000 Series
* Specify Pump Model

9.2 Bearing Frame Overhaul Tools

1. Two (2) 6-32 bolts for removal of grease seal holder (HT-, HU-, HW-, HY-, HZ- and G-Frame pumps).

2. One (1) 3/8-16 bolt for D-Frame pumps to hold bearing frame shaft when removing lock nut.

3. 3/16-inch Allen (hex) wrench for removal of bearing frame shaft set screw.

4. Bearing press.

5. Dial indicator for setting bearing frame shaft endplay.

6. No. 2 lithium grease with molybdenum disulfide additive; use lubriplate EMB grease on D-Bearing frames.

7. Hand-held cartridge grease gun.

8. Retaining ring pliers for removal of retaining ring from HT-, HU-, HW-, HY-HZ-, G-Bearing frame shafts. (Milbar 245R or equivalent).

9. Retaining ring pliers for bearing frame shaft ring (Milbar 445R or equivalent).

10. Retaining ring pliers for bearing frame housing ring (Milbar 5R or equivalent).

9.3 Mechanical Seal Change-Out Tools

1. One (1) 3/16-inch Allen (hex) wrench for removal of bearing frame shaft set screw (G- and D-Frame pumps).

2. 1/2-inch wrench.

3. Retaining ring pliers (Milbar 245R or equivalent).

9.4 Ordering Parts

Order parts through your local distributor or directly from:

OSMONICS, INC.
5951 Clearwater Drive
Minnetonka, MN 55343-8995 USA
Telephone: (952) 933-2277
Fax: (952) 933-0141
Toll Free: (800) 848-1750

To order parts, the following information is necessary:

1. Pump model number (see pump label).

2. Pump serial number (see pump label).

3. Other nameplate information such as operating temperature, materials of construction, or material code and type of mechanical seal.

4. Motor horsepower, motor frame size and enclosure specification.

5. Part name.

6. Part number.

7. Quantity desired.

8. Specific materials of construction, if any.

10.0 WARRANTY

TONKAFLO PUMP WARRANTY

Osmonics, Inc. warrants its pumps to be free from defects in design, material or workmanship for a period of 15 months from receipt or 12 months from installation of the product, whichever occurs first, when said products are operated in accordance with written instructions and are installed properly. If Tonkaflo pumps are altered or repaired without prior approval of Osmonics, all warranties are void. If any defects or malperformance occur during the warranty period, Osmonics' sole obligation shall be limited to alteration, repair or replacement at Osmonics' expense, F.O.B. factory, of parts or equipment, which upon return to Osmonics and upon Osmonics' examination prove to be defective. Equipment and accessories not manufactured by Osmonics are warranted only to the extent of and by the original manufacturer's warranty. Osmonics shall not be liable for damage or wear to equipment caused by abnormal conditions, excessive temperature, vibration, failure to properly prime or to operate equipment without flow, or caused by corrosives, abrasives or foreign objects. The foregoing warranty is exclusive and in lieu of all other warranties, whether expressed or implied, including any warranty of merchantability or fitness for any particular purpose. In no event shall Osmonics, Inc. be liable for consequential or incidental damages.

PUMP MODEL NUMBER _____

PUMP SERIAL NUMBER _____