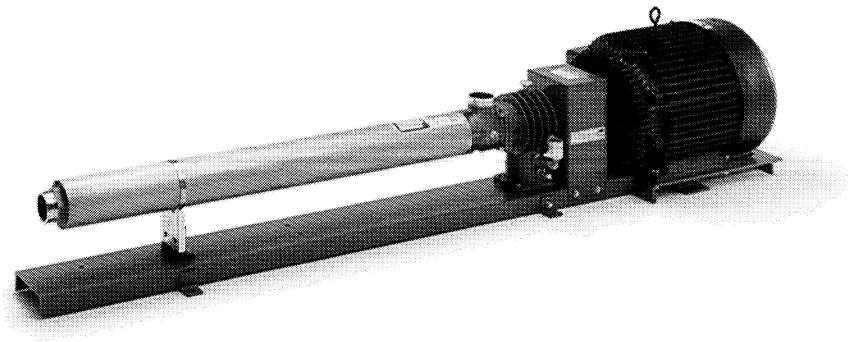
Tonkaflo® Pumps

SS Series

Installation, Operation and Maintenance Manual



For SS5500, SS8500, SS12500, SS23000, and SS24000 High Pressure Tonkaflo Centrifugal Pumps with Type E-Bearing Frame

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

FOR SS5500, SS8500, SS12500, SS23000, AND SS24000 SERIES HIGH PRESSURE TONKAFLO CENTRIFUGAL PUMPS WITH TYPE E-BEARING FRAME

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1.0 INTRODUCTION

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

The Tonkaflo Multi-Stage Centrifugal Pump

Your new Tonkaflo multi-stage centrifugal pump is designed for quiet, smooth running, highly efficient operation. The seven series of Tonkaflo pumps range in capacities from 2 to 300 gpm (0.45 to 68 m3/h) with single-unit pressures up to 650 psig (44.8 bar). The materials of construction make Tonkaflo pumps suitable for many chemical, corrosive and pure water applications.

The 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, Osmonics will produce pumps to fit your particular applications should a standard model pump not suit your requirements.

2.0 TONKAFLO SPECIFICATIONS

The Tonkaflo pumps covered in this instruction manual are the higher capacity SS5500, SS8500, SS12500, SS23000, SS24000 Series pumps. These five series of pumps cover a flow range of 20 to 300 gpm (4.5 to 68 m3/h) with single-unit pressures up to 650 psig (44.8 bar). The capacity and discharge pressure can be increased by operating 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 (69.0 bar) may be achieved with optional high pressure construction on the downstream pump. With inlet pressures greater than 200 psig (13.8 bar) and less than 400 psig (27.6 bar), optional high pressure mechanical seals should be used.

Capacities:

Series	3500 rpm 60 Hz Min - Max	Max No. of Stages (60 Hz)	2900 rpm 50 Hz Min - Max	Max No. of Stages (50 Hz)	Max Efficiency
SS5500	20 - 75 gpm (4.5-17 m3/h)	24	15 - 65 gpm (3.4-14.8 m3/h)	33	60%
SS8500	30 -100 gpm (6.8-22.7 m3/h)	27	20 - 90 gpm (4.5-20.4 m3/h)	33	64%
SS12500	40-190 gpm (9.1-43.1 m3/h)	22	35 -160 gpm (7.9-36.3 m3/h)	27	62%
SS23000	80-300 gpm (18.2-68.1 m3/h)	11	65-250 gpm (14.8-56.8 m3/h)	16	61%
SS24000	80-300 gpm (18.2-68.1 m3/h)	16	65 -250 gpm (14.8-56.8 m3/h)	18	61%

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

Maximum Developed Boost Pressure for Standard Model Pumps (3500 rpm):

Series	Centrifugal Stages	Standard
SS5500	24	Up to 650 psig (44.8 bar)
SS8500	27	Up to 640 psig (44.1 bar)
SS12500	22	Up to 640 psig (44.1 bar)
SS23000	11	Up to 380 psig (26.2 bar)
SS24000	16	Up to 530 psig (36.6 bar)

Maximum Recommended Operating Temperature:

The maximum recommended operating temperature range is 125°F (52°C) for standard stages and 160°F (71°C) for high temperature GFN stages. The maximum operating temperature is dependent upon the operating pressure. For high temperature applications, consult your local Tonkaflo distributor or the factory for the available special materials of construction.

Pumps have the maximum recommended temperature stated on the label on the pump case. The temperature stated is for the design flow and pressure.

Standard Materials of Construction:

SS: Wetted castings and pump shaft are 316 stainless steel. The pump casing is 316 stainless steel. Impellers and diffusers are Noryl* except SS24000 Series diffusers which are 316SS. The 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, 1-inch diameter with a material code of BF50-1C1-316. The O-rings and discharge bearings are Buna-N.

Special Materials of Construction

Special rubbers, plastics and metals are available. Contact the factory.

Pump Nomenclature Example

Model SS5518E		Model SS5527E-50Hz	
SS	= Materials of Construction	SS	= Materials of Construction
55	= Series 5500	55	= Series 5500
18	= Number of Stages	27	= Number of Stages
E	= Bearing Frame	E	= Bearing Frame
		50 Hz	= 50 Hz Operation Only

Special Liquids

For liquids other than water, aqueous solutions at elevated temperatures or corrosive solutes, consult the factory for compatibility.

* Noryl is a trademark of General Electric Company.

3.0 PUMP INSTALLATION

3.1 Check Upon Arrival

Your pump was inspected and tested at the factory prior to shipment to assure meeting the requirements of your order. It is suggested the pump be checked upon receipt for possible damage due to shipping. Any damage should be reported immediately to the carrier.

3.2 Location

Install the pump as close as possible to the source of the liquid to be pumped. High pressure process pumps may need to be located several feet away or remote from the liquid source in which case a transfer pump would be used near the liquid source to transfer liquid to the high pressure pump. It is ideal for the pump to be fed from a reservoir above the pump or from a supply line under positive pressure.

3.3 Foundation

The foundation for the bedplate, motor and pump must be sufficiently rigid and substantial to prevent any significant vibration of the pump or deflection of the motor and pump shafts when operating the pump.

The recommended foundation is of reinforced concrete or a heavy steel skid. When using concrete, it should support the bedplate at all points. When using a steel skid, the motor and coupling must be re-aligned after any movement whatsoever of the skid.

The pump mounting is to be horizontal and the pump leveled within 1/16 inch/foot, so the oil level at both bearing frame bearings is the same. The pump case is the best reference for leveling.

3.4 Bedplate Installation

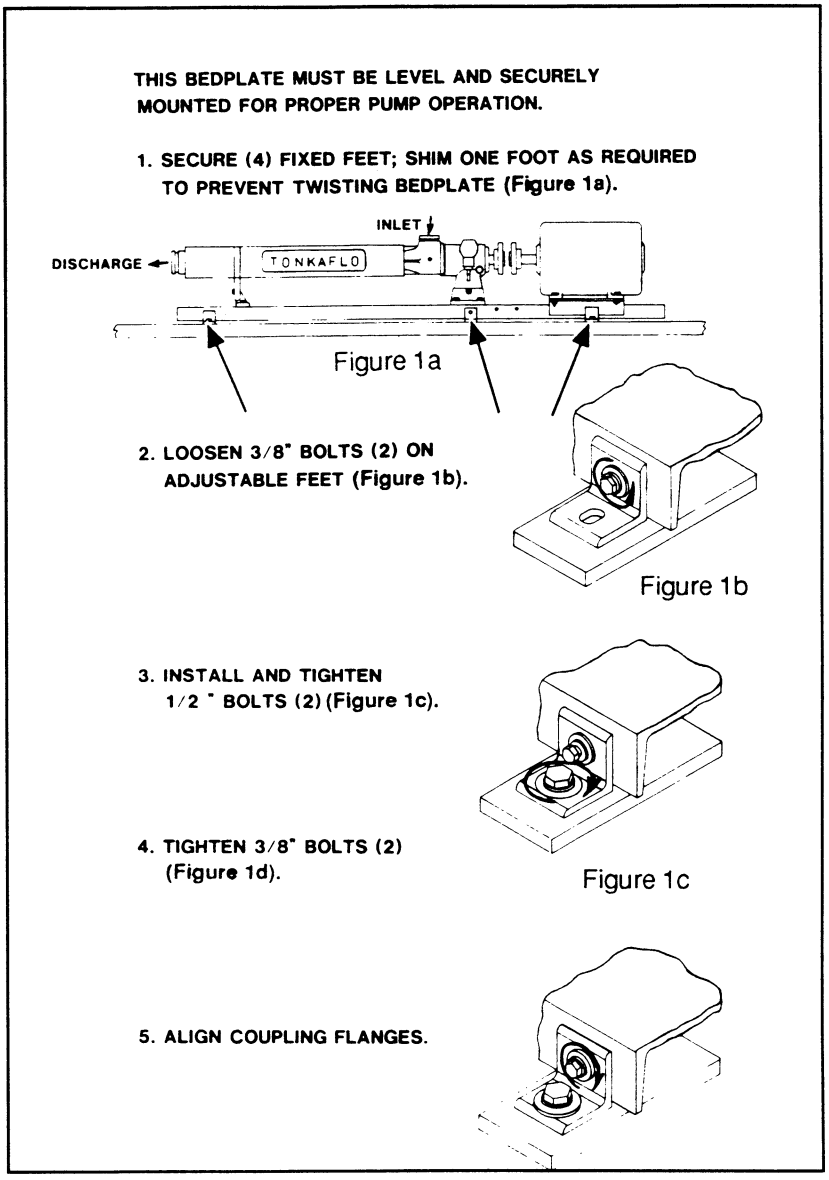


FIGURE 1 - BEDPLATE INSTALLATION

3.5 Motor, Pump and Coupling Alignment (Applicable for Direct Drive)

Accurate alignment of the motor, pump and coupling is a "MUST."

The final alignment of the motor, pump and coupling is to be done after the bedplate is rigidly mounted (see Section 3.3 Foundation) with the unit in its final operating position. Shipment, as well as handling in the field, may have operating the changed the alignment, and it is essential that the alignment be checked before operating the pump.

Shims are placed under the motor mounting pads to facilitate adjustment. Use a straight edge, feeler gauges, and a 1/2- to 1-inch taper gauge (or telescope gauge and micrometer) to perform the steps shown in Figures 2a, 2b, 2c and 2d.

If the pump has been supplied complete with motor, pump, coupling and coupling guard, remove the coupling guard. Loosen the coupling flange on the motor shaft and remove the coupling sleeve.

If the pump is not supplied as a complete unit, slide one coupling flange onto the pump shaft with a snug-fitting key. With the flange and key flush with the shaft end, tighten the set screws.

Slide the coupling flange onto the motor shaft with shaft key and position the motor on the bedplate.

Measure horizontal and vertical alignment (reference Figures 2a and 2b) using a straight edge and feeler gauges. Align the coupling to the accuracy noted in Figures 2a and 2b using the shims provided and placing them under the motor mounting feet as needed. Measure angular alignment of the flanges using a 1/2- to 1-inch taper gauge or telescope gauge and micrometer. (Taper gauge shown on Figures 2c and 2d.) Align the coupling to the accuracy noted in Figures 2c and 2d.

For best coupling life, keep the misalignment values as near to zero as possible.

Insert the wire ring and two-piece coupling sleeve between the two coupling flanges. Slide the wire ring into the groove on the sleeve halves and slide the flange along the motor shaft to fully seat the sleeve between the two flanges. Adjust the gap between the flanges to the values shown in Figure 3 within + /-0 inch (+1.5 mm/-0 mm).

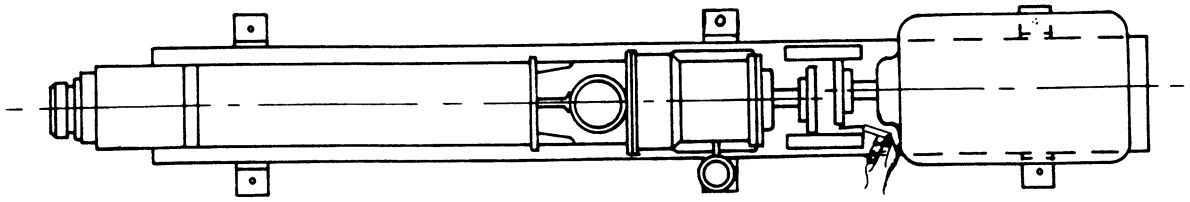


Figure 2a - Measuring horizontal parallel alignment. Coupling must be aligned within 0.010 in. (0.25 mm).

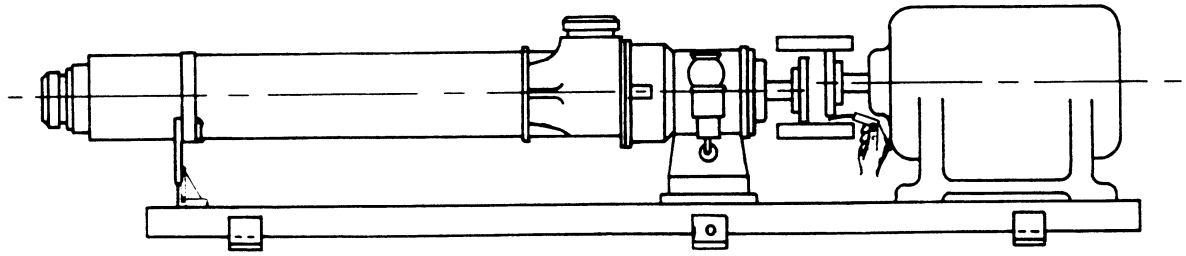


Figure 2b - Measuring vertical parallel alignment. Coupling must be aligned within 0.010 in. (0.25 mm).

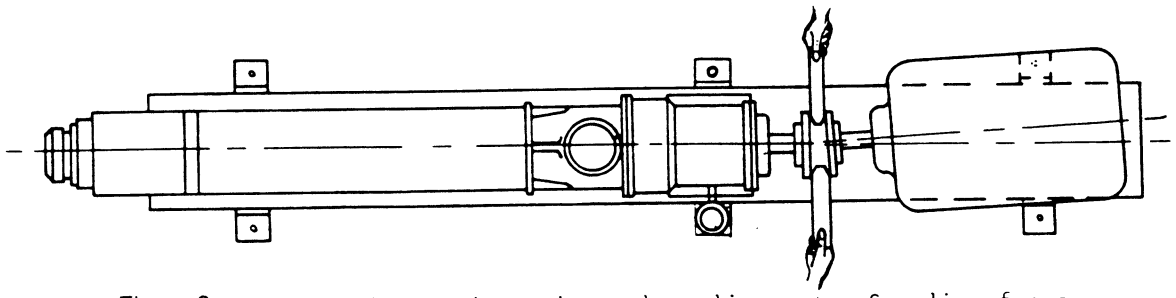


Figure 2c - Measuring horizontal angular alignment. Coupling faces must be parallel within 0.020 in. (0.5 mm).

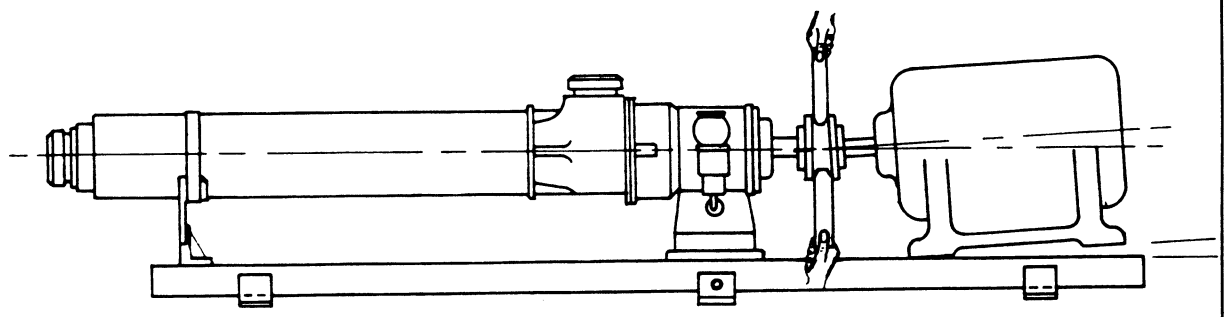
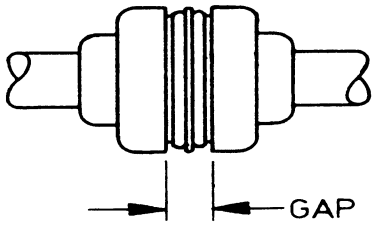


Figure 2d - Measuring vertical angular alignment. Coupling faces

FIGURE 2 - COUPLING ALIGNMENT



Coupling Size	Gap	
	inch	(mm)
6	7/8	(22.2)
7	1	(25.4)
8	1-1/8	(28.6)
9	1-7/16	(36.5)

Figure 3 - GAP BETWEEN FLANGES

3.6 Coupling Guard

Coupling guards are available as an option from Tonkaflo pumps. A coupling guard is highly recommended. Check your plant safety requirements.

3.7 Piping

The pump inlet housing has been designed for either upright, or left or right horizontal positioning. For left or right position, remove bolts (4) holding the suction (inlet) housing to the bearing frame. Rotate the suction housing 90° and replace the bolts (4). For left or right position, a pipe plug can be removed to vent off any air in the top of the pump inlet housing should "venting" be required for pump priming and start-up for your installation.

Suction (pump inlet) piping should be of ample size, installed in direct runs, and have a minimum of bends to minimize pressure loss and to help ensure sufficient suction pressure. When possible, keep the suction pipe short.

The suction (inlet) pipe size immediately ahead of the pump inlet should be sufficiently sized so that the pressure available at the pump suction (inlet) exceeds the Net Positive Suction Head (NPSH) required by the pump. Generally, the suction (inlet) piping should be 4 inches (102 mm) for flows greater than 170 gpm (38.6 m3/h), 3 inches (76 mm) for 100 gpm - 170 gpm (22.7 - 38.6 m3/h), 2-1/2 inches (63.5 mm) for 60 gpm - 100 gpm (13.6 - 22.7 m3/h), and 2 inches (51 mm) or greater for 60 gpm (13.6 m3/h) or less (see frictional loss and pressure loss discussion below).

The recommended pipe size for most applications should result in frictional line loss of 3 psig per 100 feet (0.7 bar per 100 m) or less for suction lines and 10 psig per 100 feet (2.3 bar per 100 m) or less for discharge lines. A larger pipe size will reduce the frictional line loss.

The pump inlet piping should be designed to avoid areas where air may be trapped and accumulated. Keep the suction pipe free of high points and thus air pockets, which tend to disrupt pump priming and start-up. Suction pipe size changes just ahead of the pump should be tapered. Reducers should be eccentric to avoid air pockets.

The discharge piping should be sized to properly handle the maximum flow and pressure developed by the pump.

When the pump operates with a suction lift, the suction pipe should slope upward to the pump from the source of supply (see Figure 4). Provision 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. An alternate method would be to use a shutoff valve on the discharge line and a vacuum pump to draw air out of the pump and suction line.

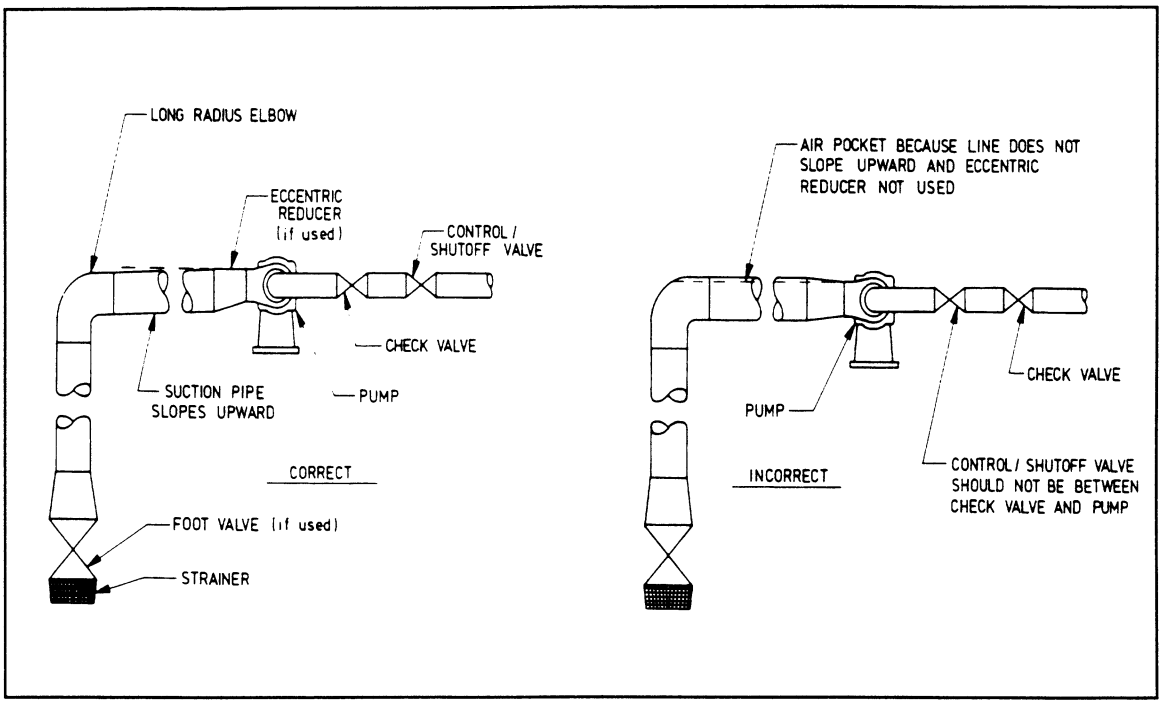


FIGURE 4 - SUCTION LIFT PIPING

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 for 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 at 30 psig (2.1 bar) pressure to detect leaks.

3.8 By-Pass Piping for Multi-Stage Pumps

Sufficient flow must be maintained through a multi-stage pump so the pump does not overheat. Low flow rates result in excessive energy accumulation and heat buildup in the pump. Minimum recommended flows are shown in Section 2.

A by-pass pipe, that is, a pipe from the discharge piping back to the source of liquid supply or suction line, may be needed for your installation to ensure that the pump operation is within the specified flow range. It is recommended that the connection of a by-pass pipe to the suction line be at least 24 inches (610 mm) away from the pump inlet.

3.9 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 30 mesh or finer screen (available as an accessory) or a cartridge filter in the suction line to collect any foreign objects or large particles.

The pump must not be operated with restricted suction line (inlet) flow.

Positive gauge pressure must be maintained at the pump inlet (downstream from the filter or screen). A clogged screen or filter will result in a greater pressure drop. A low pressure alarm or shutoff switch located between the screen or filter and the pump should always be used in conjunction with a suction line screen or filter.

3.10 Discharge Screen (Strainer)

A 30 mesh screen (available as an accessory) 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 discharge screen is shown in Figure 5 below.

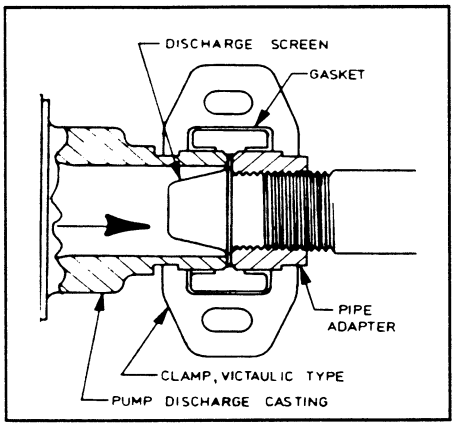


FIGURE 5 - INSTALLATION OF DISCHARGE SCREEN, P/N 1120501

3.11 Pump Piping Connections

The standard model Tonkaflo SS5500, SS8500, SS12500, SS23000 and SS24000 Series pumps have grooved ends as shown in Figure 5 to accept Victaulic-type couplings. The couplings with 1000 psi (69.0 bar) working pressure rating are available as an accessory and include a Buna-N gasket (standard). Other gasket materials such as Viton* or ethylene propylene are available. Consult the factory.

The coupling gasket should be thoroughly lubricated before installation. Silicone grease is recommended. Petroleum grease is suitable for most gasket materials, but is not suitable with ethylene propylene (EPDM).

3.12 Lubrication of Pump Bearings

The pump bearings are not lubricated at the factory.

The bearings are lubricated by maintaining a static oil level within the bearing frame.

One quart (0.9 L) of oil is provided with each new Tonkaflo oil lubricated pump. Additional oil can be purchased (see Section 10.2) from Osmonics.

A heavy-duty premium hydraulic and lubricating oil (antiwear, non-detergent, rust, oxidation, and foam inhibited) should be used, such as those listed in Table 1.

TABLE 1 - TYPICAL HEAVY-DUTY HYDRAULIC AND LUBRICATING OIL TYPES

Manufacturer or Supplier	Description
Tonkaflo Pumps	Anti-wear Hydraulic Oil 1 qt, P/N 1120693 1 case (12 qt), P/N 1120682
Shell	Tellus Antiwear Hydraulic Oil, Code 65214
The oil will run between 130°F and 220°F (54-104°C). Normally, operating conditions would require a heavy-duty hydraulic oil with a viscosity of 465 SSU at 100°F (38°C) (ISO-Vg grade 100).	

A #5 TRICO OILER is provided (not installed when shipped) and is used to maintain the static oil level. The removable crossbar bottle support for the oiler was adjusted at the factory to maintain proper oil level. If adjustment is lost, reset according to Figure 7. The crossbar support must be used. Do not discard.

An oil sight gauge is provided on the bearing frame so the oil level may be viewed before start-up as a check on proper installation of the oiler.

* Viton is a trademark of E.I. DuPont de Nemours and Company, Inc.

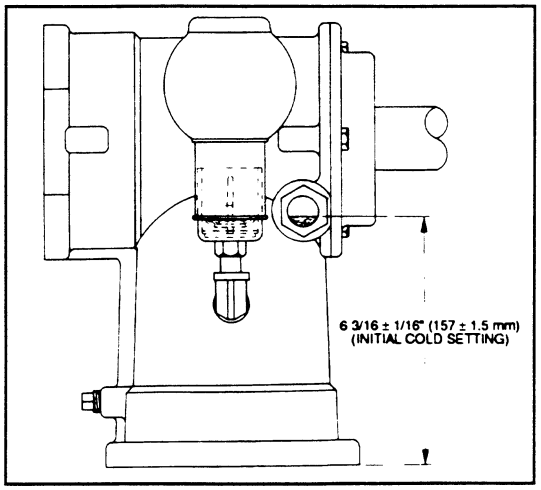


FIGURE 6
INITIAL COLD SETTING FOR CONSTANT LEVEL OILER

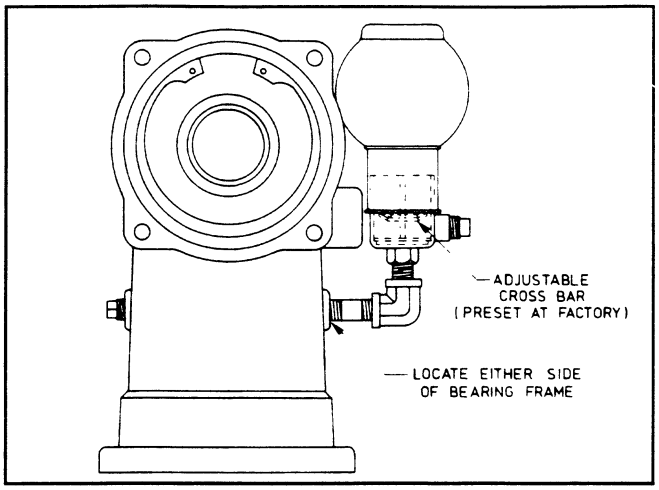


FIGURE 7
INSTALLATION OF OILER

To install the oiler, remove the 1/4-inch pipe plug in either side of the bearing frame. Using a pipe sealing compound compatible with oil, install the nipple and elbow assembly as shown in Figure 7. Install the lower reservoir using the thread sealing compound.

The bearing frame oil reservoir capacity is approximately one quart (one liter). Fill the oiler bottle and place onto the lower reservoir. Several fillings should be required. DO NOT try to fill the bearing frame reservoir by pouring directly into the lower reservoir. On the final bottle fill, allow 15 minutes or more to elapse before measuring the oil level. On the final fill, the bottle should be approximately 2/3 to
3/4 full, and not completely full, for best operation of the Trico Oiler.

Check the oil level according to Figure 6 cold setting. Adjust as necessary, draining excess oil.

Replenish oil in bottle only when oil is no longer visible in the globe.

ON PUMP START-UP, VIEW THE SIGHT GAUGE TO SEE THAT OIL DROPLETS FORM ON THE SIGHT GAUGE, indicating sufficient oil level. The oil level will rise gradually in the sight gauge in a few minutes to the center of the eye, or just above the center.

The bearings are lubricated by a mist. Setting the initial cold oil level higher than specified will result in higher oil operating temperatures and reduced oil life.

4.0 START-UP OF THE TONKAFLO PUMP

4.1 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 overheating and possible damage to the internals of the liquid end.

The pump should not run with a closed discharge for more than one minute as the liquid can heat up very quickly and exceed the maximum operating temperatures causing irreversible damage to the wetted internal parts of the liquid end.

⚠ CAUTION NEVER RUN PUMP DRY.

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

4.2 Pump Rotation

When initially connecting to the power source, be certain that the motor wiring and available line voltage are the same. Connect the wires as shown on the motor wiring diagram located on the inside of the motor junction box cover or on the nameplate label.

⚠ CAUTION If a 3-phase motor is wired incorrectly, it will cause the pump shaft to rotate in the wrong direction. This will result in low pressure (about 1/4 to 1/2 of normal) and flow (about 1/2 of normal).

A motor starter is required for all 3-phase motors.

BEFORE STARTING 3-PHASE MOTORS:

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

2. Apply power for ONE SECOND 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.

4.3 Initial Operation

With the oiler installed and filled, oil level set, pump primed and pump rotation checked, your pump is ready to operate.

Upon start-up, check to see that the correct boost pressure level is obtained at design flow and that oil droplets form in the oil eye (see Section 3.12).

If prime was not achieved, reprime as necessary

5.0 GENERAL TROUBLESHOOTING FOR TONKAFLO PUMPS

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	1. Motor wired improperly 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
MOTOR DOES NOT RUN	**LOW PRESSURE**
1. Blown fuse or 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	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 oil lubricated E-bearing frame utilized on high pressure Tonkaflo pumps will vary depending on the boost pressure of the pump. As a general rule, type E-bearing frame will operate within a temperature range of 130°F to 230°F (54°C to 110°C). During operation, the bearing frame will feel hot to the touch.

6.0 TONKAFLO FIELD MAINTENANCE

6.1 Mechanical Seal Leakage

If liquid is leaking from the hole on the bottom or the holes on either side 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 discharge piping and tap pump shaft using a wooden dowel to seat the seal. Be careful not to damage the pump shaft.

⚠WARNING POWER MUST BE DISCONNECTED BEFORE MAINTENANCE

6.2 Removal and Installation of Liquid End Assembly

6.2.1 Removal of Liquid End Assembly

Removal of the liquid end assembly is required for replacement of the mechanical seal or for maintenance work on the pump bearing frame as described in Sections 6.3 - 6.6. The liquid end may be removed from the bearing frame without removing the bearing frame from the bedplate or other mounting.

STEPS:

1. Remove four 3/8-inch bolts and lock washers connecting the liquid end assembly to the bearing frame as shown in Figure 8.

2. Insert a 3/16-inch Allen (hex) wrench in one of the access holes on either side of the bearing frame toward the liquid end. Refer to Figure 8 for more detail. Rotate the pump shaft until the Allen wrench slips into the set screw. Rotate the shaft by rotating the flexible coupling.

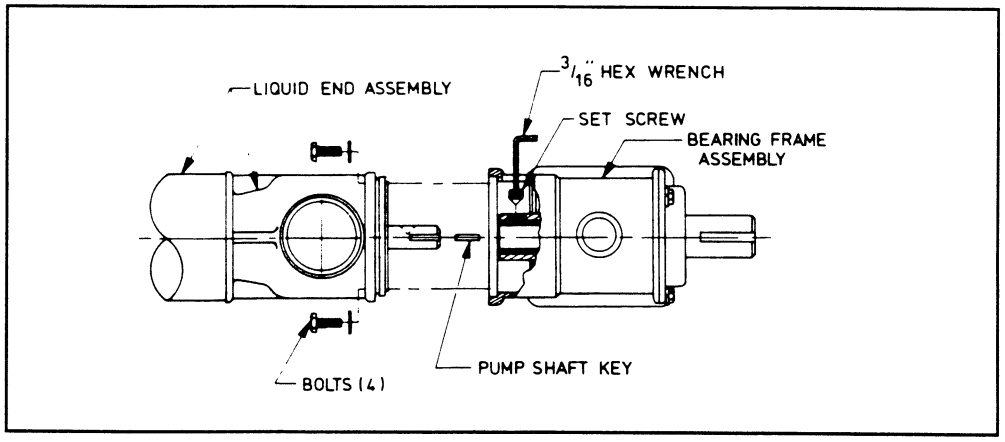


FIGURE 8 - SEPARATION OF LIQUID END FROM BEARING FRAME

3. Loosen the clamp on the discharge end of the pump case.

4. Remove the liquid end assembly (i.e., liquid end and pump shaft) by pulling the liquid end away from the bearing frame. Be sure the discharge end of the liquid end assembly is supported so that the pump shaft is not bent upon removal.

6.2.2 Installation of Liquid End Assembly

STEPS:

1. Place the shaft key in the pump shaft keyway and be sure it is fully seated.

2. Check to see that anti-seize compound is on the exposed pump shaft where it engages with the bearing frame shaft. If not, coat the pump shaft with a small amount of an anti-seize compound (i.e., Never-Seez or Anti-Seize). The anti-seize compound is used to prevent corrosion, galvanic pitting, rust, and seizure. These compounds are available from the factory or local industrial supply house.

3. 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 castings come together.

4. Fasten together the inlet casting, mechanical seal holder, and bearing frame assembly with the four 3/8-inch bolts and lock washers. Reference Figure 8 (liquid end) and Figure 9 (mechanical seal) for correct placement of parts.

5. After fastening the inlet casting to the bearing frame assembly, line up the set screw hole in the bearing frame shaft with the access hole in the bearing frame by rotating the flexible coupling. Place the set screw in the bearing frame shaft. Through the opening in the discharge casting, push on the end of the pump shaft with a wooden dowel to seat the shaft in the bearing frame and then tighten the set screw.

6.3 Mechanical Seal Replacement - SS5500, SS8500, SS12500, SS23000, and SS24000 Series Pumps

STEPS:

1. Remove the liquid end assembly (see Section 6.2.1).

2. Remove the pump shaft key and slide the mechanical seal holder off the pump shaft (see Figure 9).

3. 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. If prying is required, do not damage the pump shaft or inlet housing where the seal holder seals (see Figure 9).

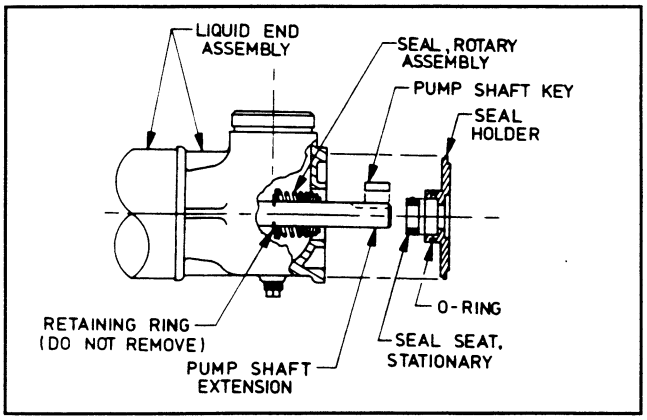


FIGURE 9 - REMOVAL OF MECHANICAL SEAL

4. When installing a new mechanical seal, do not cut the rubber bellows when sliding the seal over the shaft keyway. One method is to wrap thin plastic tape over the shaft keyway to protect the rubber bellows from damage. Wrap 1-1/4 turns to cover the end of the keyway opposite the shaft end. With some overlap, wrap a second 1-1/4 turns, etc., until complete keyway is covered.

5. Lubricate the round surface of the pump shaft with oil, petroleum grease or silicone grease. 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 lightly seated against the spring. Remove the tape.

6. Remove the stationary portion of the old mechanical seal from the cavity in the seal holder (see Figure 9).

7. Lubricate the O-ring on the outside of the new stationary seat. Lubricate with petroleum or silicone grease. Install the stationary portion into the seal holder cavity. Make sure the stationary portion is fully seated. Lightly lubricate the ground surface of the stationary seat with grease or oil.

8. 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 with grease before installing.

9. Place the mechanical seal holder containing the new stationary seat onto the pump shaft and slide it down the shaft until fully engaged with the inlet casting.

⚠CAUTION Care must be taken not to damage the new stationary seat when sliding the assembly over the pump shaft.

10. Install the liquid end assembly onto the bearing frame (see Section 6.2.2).

6.4 High Pressure Mechanical Seal Replacement

High pressure mechanical seals have the same basic design as standard mechanical seals. Replace them using the same procedure as denoted in Section 6.3.

6.5 Bearing Frame Maintenance on E Frame Tonkaflo Pumps

6.5.1 Disassembly of Pumps with Type E-Bearing Frame

6.5.1.1 Remove the liquid end assembly (see Section 6.2.1).

6.5.1.2 Drain the oil from the bearing frame by removing the oil drain plug on the lower portion of the bearing frame and then remove the bearing frame from the bedplate or other mounting.

6.5.1.3 Bearing frame overhaul. Refer to Figure 10 for the construction of type E-bearing frame.

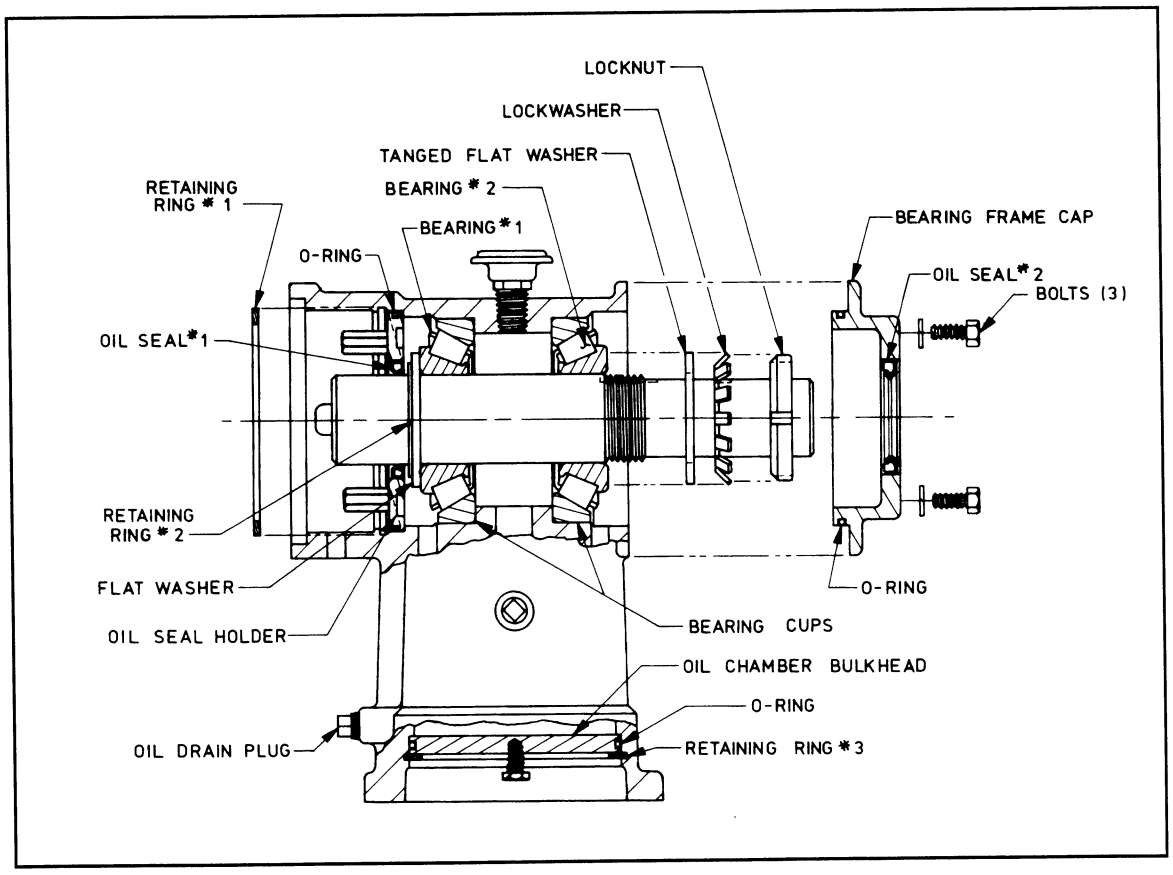


FIGURE 10 - BEARING FRAME OVERHAUL

STEPS:

1. Remove the three bolts and lock washers that fasten the bearing frame cap to the motor side of the bearing frame. Separate the cap from the bearing frame.

2. Remove retaining ring #1 from the bearing frame as shown on Figure 10.

3. Remove the lock nut, lock washer and flat washer from the bearing frame shaft.

4. Place the bearing frame in a press. Simultaneously press out the oil seal holder and remove bearing cone #2 from the shaft by pressing on the motor end of the bearing frame shaft. After the oil seal holder 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.

5. Inspect the bearing cups and cones for any rough surface conditions and replace both cup and cone when necessary. Pitted and galled rollers and/or bearing cap indicate replacement is necessary. Very light marks around each roller may occur during "break-in period" from the bearing cage. This is not a problem and bearing replacement is not necessary.

6. To remove the bearing cup(s) from the bearing frame, use a brass or soft steel rod and hammer to knock them out.

7. Inspect both oil seals and replace if the seals are no longer pliable or if they were leaking.

6.5.2 Assembly of Pumps with Type E-Bearing Frame

6.5.2.1 Assembly of Type E-Bearing Frame

STEPS:

1. If removed, press new bearing cup(s) into the bearing frame, making sure they are fully seated.

2. If removed, press a new bearing cone (#1, Figure 10) onto the shaft, holding the bearing square with the shaft while starting. Make sure the washer behind bearing cone #1 has been replaced. The correct setup may be checked by placing the shaft into the bearing frame and measuring the 2.772 inches ± 0.010 inch (70.41 ± 0.25 mm) recess (refer to Figure 11).

3. With the shaft placed in the bearing frame, press on the second bearing cone, holding it square with the shaft while starting. Press until the bearing cone is fully seated against the bearing cup and there is no end play.

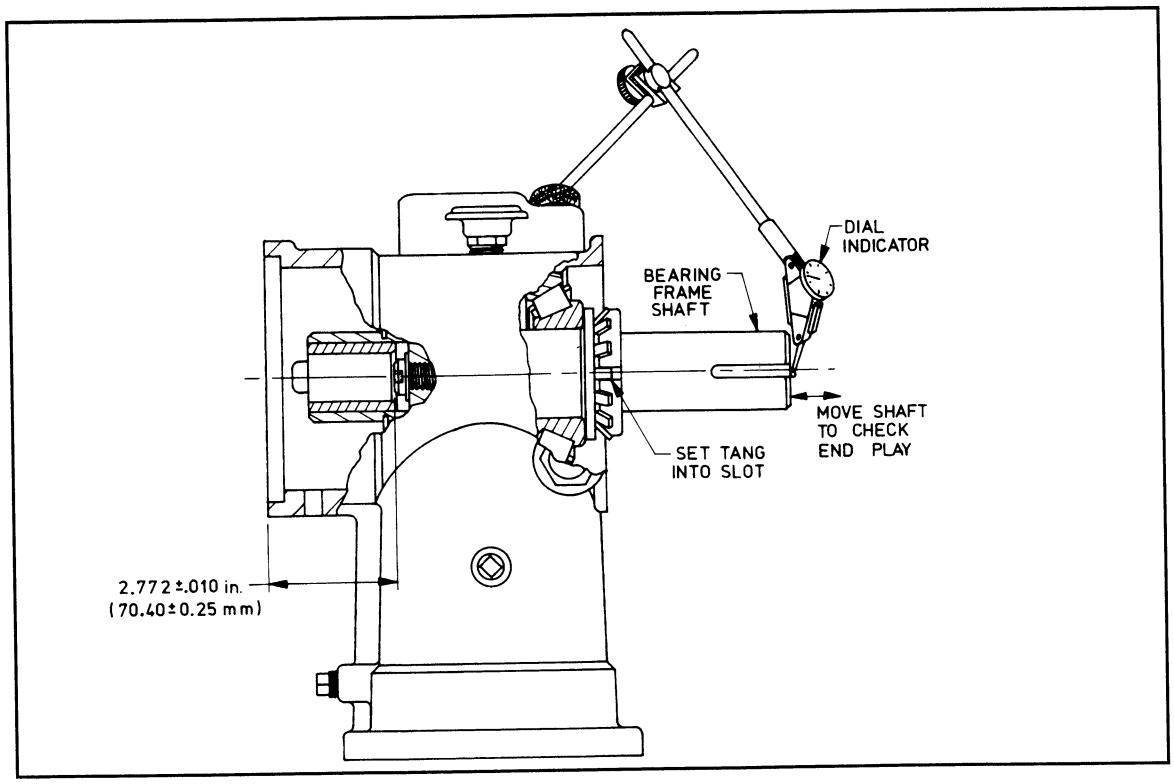


FIGURE 11 - SETTING BEARING FRAME SHAFT END PLAY

4. Reinstall the tanged flat washer, lock washer and nut. Hand tighten the lock nut and lightly set a tang on the lock washer into a slot on the lock nut. If desired, a 3/8-16 NC x 3 bolt may be inserted through a side port in the bearing frame and into the set screw hole in the end of the bearing frame shaft (see Figure 8) when tightening the lock nut.

5. Using a press, force bearing cone #2 back against the tanged flat washer by pressing on the motor end of the shaft. This sets the bearing so the shaft end play may be checked.

6. Check the end play of the shaft by pulling and pushing on the shaft. The end play should be 0.003-0.006 inch (0.08-0.15 mm) for direct-driven pumps, using a dial indicator (see Figure 11). For belt-driven pumps, the end play should be 0.003-0.005 inch (0.08-0.13 mm). End play of 0.006 inch (0.15 mm) or less is difficult to feel by hand. Readily noticeable play means further adjustment is necessary.

7. If further adjustment is necessary, press bearing cone #2 to reseat it against the bearing cup.

8. Tighten or loosen the lock nut as required. Advancement of the nut until the next lock washer tang is aligned results in 0.0008 inch (0.02 mm) less end play. Advancing the lock nut until the same notch lines up with the next lock washer tang results in 0.003 inch (0.08 mm) less end play.

9. Repeat Steps 5 and 6.

10. When the end play setting is correct, set one tang of the lock washer into a slot in the lock nut.

11. Inspect and replace the O-ring on the oil seal holder and on the end cap if damaged. Replace the oil seals.

12. Reinstall the oil seal holder, oil seal, and retaining ring (Figure 10) making sure the seal and O-ring are lubricated with grease or oil.

13. Install the bearing frame cap and oil seal on the motor end of the bearing frame.

⚠ CAUTION IT IS IMPORTANT NOT TO DAMAGE THE SEAL LIP TO PREVENT OIL LEAKAGE.

The oil seal rubber must be lubricated with grease or oil and the shaft keyway must be covered to protect the oil seal from damage.

A thin metal sleeve placed over the end of the shaft will suffice. The sleeve should be tapered on the end so the seal can be easily slipped on the end. As an alternate, thin plastic tape, applied 1-1/4 wrap at a time, can be used to cover the keyway.

14. Install the three 5/16-inch bolts and lock washers to secure the bearing frame cap.

6.5.2.2 Install the liquid end and remount the pump.

STEPS:

1. Install the liquid end on the bearing frame (see Section 6.2.2, Steps 1-5).

2. Mount the pump on the bedplate or other mounting, and position and tighten the clamp on the discharge support.

3. Align the coupling (see Section 3.5).

4. Lubricate as indicated in Section 3.12.

6.6 Oil Seal Replacement

Oil leaking around the bearing frame shaft means oil seal #2 (Figure 10) is leaking.

Oil leaking from the ports in the bearing frame near the liquid end indicates oil seal #1 (Figure 10) is leaking.

6.6.1 Replacement of Oil Seal #2, Figure 10

STEPS:

1. Remove the flexible coupling guard.
2. Either remove the pump or motor from the bedplate or other mounting, or swing the motor shaft away from the bearing frame shaft.
3. Remove the flexible coupling flange and key from the bearing frame shaft.
4. Remove the constant level oiler bottle and drain about 1/2 cup or 120 cc of oil from the bearing frame.
5. Remove the three bolts and lock washers that fasten the bearing frame cap to the bearing frame. Separate the bearing frame cap from the bearing frame.
6. Remove the oil seal from the bearing frame cap. Replace with a new oil seal.
7. Replace the O-ring on the end cap if damaged.
8. To prevent damage to the oil seal from the shaft keyway, cover the keyway in the shaft as described in Section 6.5.2.1, Step 13. Apply grease or oil to the bearing frame shaft and the O-ring on the end cap.
9. Place the bearing frame cap and new oil seal onto the bearing frame. Care must be taken to not damage the oil seal lip.
10. Reinstall the three bolts and lock washers to fasten the bearing frame cap to the bearing frame.
11. Reinstall the coupling flange so it is flush with the end of the shaft and remount the pump or motor as required.
12. Install and align the flexible coupling (see Section 3.5).
13. Install the coupling guard.

14. Replace the oiler bottle, refilling it with oil as needed. Recheck the oil level per Figure 7.

6.6.2 Replacement of Oil Seal #1, Figure 10

STEPS:

1. Remove the liquid end assembly from the bearing frame as described in Section 6.2.1.

2. Remove retaining ring #1 shown in Figure 10.

3. Remove the oil seal holder (shown in Figure 10), which can be done as described in Section 6.5.1.3, Step 4, or as described here by making a simple fixture. Use two 5/16-18NC bolts and a flat plate (not provided) to bridge across the end of the bearing frame to pull out the seal holder. Drill two holes, 3/8-inch or 10-mm diameter, through the flat plate, spacing the holes 3.25 inch (82 mm) apart. Insert two 5/16-18NC bolts through the plate and turn them into the seal holder's two coupling nuts provided. (Select bolt length as needed to engage coupling nuts). Tighten the two bolts uniformly to pull the seal holder out straight.

4. Remove the oil seal from the seal holder and install a new oil seal. The seal should be flush with the exterior side of the seal holder.

5. Reinstall the oil seal holder and retaining ring in the bearing frame. Make sure the O-ring on the outside of the oil seal holder and the oil seal lip are lubricated before installing. Replace the O-ring if damaged.

6. Install the liquid end and remount the pump (see Section 6.2.2, Steps 1-4).

6.6.3 Replacement of Oil Chamber O-Ring Seal

Should the O-ring seal for the oil chamber bulkhead (refer to Figure 10) need replacement, remove the bulkhead.

STEPS:

1. Remove the retaining ring using a retaining ring pliers.
2. Using a pliers or other gripping tool, pull on the bolt in the center of the bulkhead to remove the bulkhead and O-ring.
3. Lubricate the new O-ring with grease.
4. Place the O-ring in the groove in the bulkhead.
5. Insert the bulkhead into the bearing frame with the bolt outward.
6. Install the retaining ring.
7. Install the liquid end and remount the pump (see Section 6.2.2, Steps 1-4).

6.7 Lubrication

6.7.1 Adding Oil

Add oil to the oiler bottle; do not fill directly into the oiler reservoir. After filling, allow at least 15 minutes to elapse before measuring the oil level (see Figure 6). Fill the oiler bottle approximately 2/3 to 3/4 full, and not completely full, for best operation of the Trico oiler. The oiler bottle is designed to maintain a constant oil level in the bearing frame. Refer to Section 3.12 for oil type.

6.7.2 Oil Change

THE RECOMMENDED OIL CHANGE INTERVAL IS 2000 HOURS OF PUMP OPERATION OR SIX MONTHS, WHICHEVER OCCURS FIRST. Refer to Section 3.12 on oil filling. The crossbar support for the oiler must be installed; do not discard.

Always add oil into the oiler bottle; do not fill directly into the oiler reservoir.

Before starting, check the static oil level on the oil sight gauge (see Figure 7). After starting the pump, check for formation of oil drops on the oil eye. Do not set oil level too high. Lubrication of the bearings is with an oil mist and not immersion.

7.0 TONKAFLO SERVICE POLICY - LIQUID END

Section 6.0 in the Tonkaflo Operating and Maintenance Manual was written to assist our customers in performing minor maintenance in the field on Tonkaflo pumps. Proper maintenance will ensure 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 and send the complete pump, with or without motor, to the factory. 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, contact a Tonkaflo distributor certified for service or return it with or without motor to the factory for repair. For fast replacement of standard model pumps, a rebuilt pump may be ordered with or without motor as described below.

8.0 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 authorization 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.

8.1 Out-of-Warranty Pump Failure

8.1.1 Return the pump on an RGA for repair. The pump will be repaired and repair charges invoiced to the customer. The customer will receive full warranty as described in Section 11.0.

8.1.2 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.

8.2 In-Warranty Pump Failure

8.2.1 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 the customer receives full warranty as described in Section 11.0.

8.2.2 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.

*Applies to standard stock model pumps only.

8.2.3 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 (see Section 11.0) is 12 months from installation or 15 months from receipt, whichever occurs first.

8.3 Shipping Charges

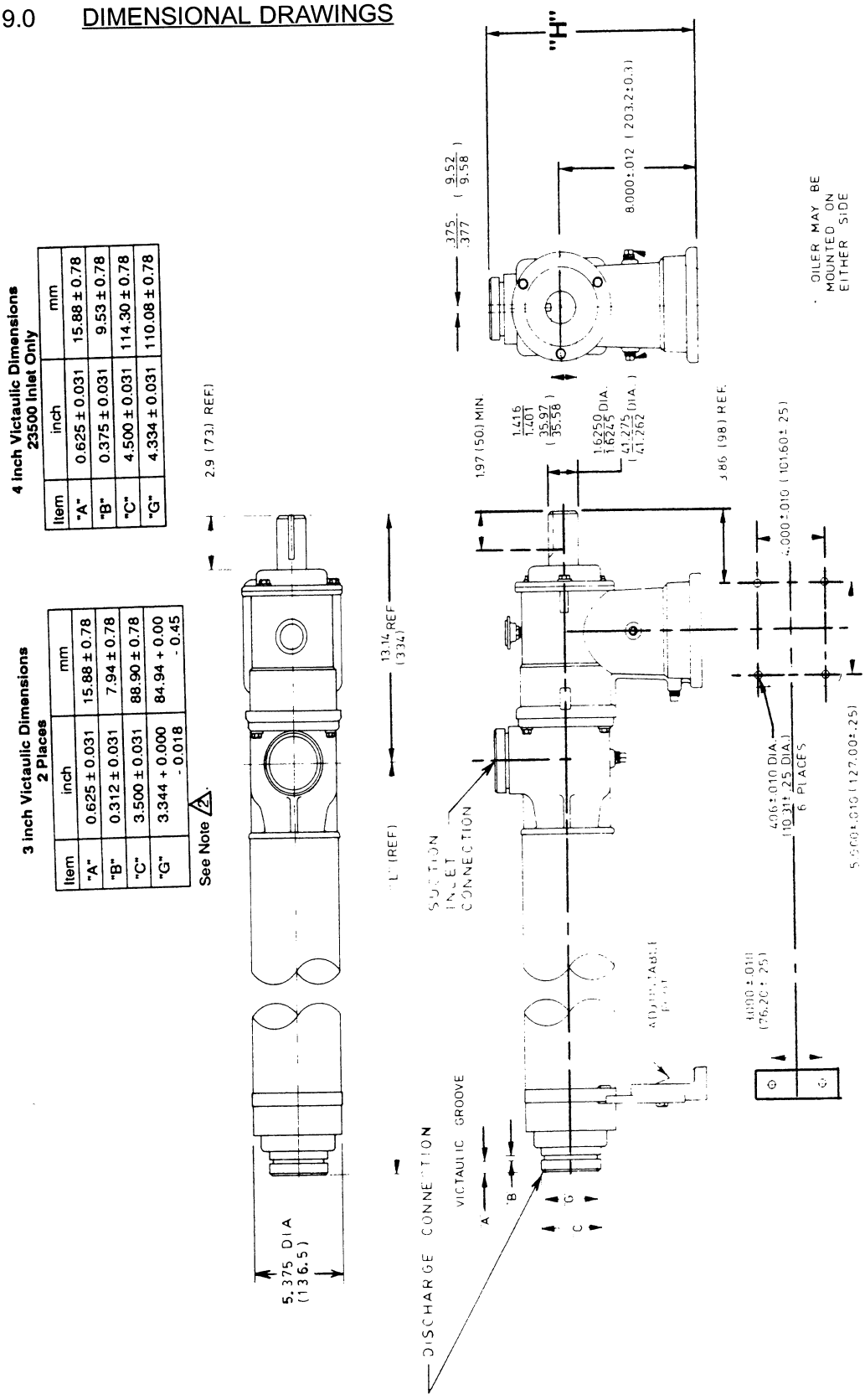
8.3.1 In-Warranty

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

8.3.2 Out-of-Warranty When New Pump Is Purchased

Customer pays all shipping charges.

9.0 DIMENSIONAL DRAWINGS



4 inch Victaulic Dimensions 23500 Inlet Only

Item	inch	mm
"A"	0.625 ± 0.031	15.88 ± 0.78
"B"	0.375 ± 0.031	9.53 ± 0.78
"C"	4.500 ± 0.031	114.30 ± 0.78
"G"	4.334 ± 0.031	110.08 ± 0.78

3 inch Victaulic Dimensions 2 Places

Item	inch	mm
"A"	0.625 ± 0.031	15.88 ± 0.78
"B"	0.312 ± 0.031	7.94 ± 0.78
"C"	3.500 ± 0.031	88.90 ± 0.78
"G"	3.344 + 0.000 - 0.018	84.94 + 0.00 - 0.45

"H" Dimensions

Series	inch	mm
8000	12.3	312.4
13500	12.3	312.4
22500	12.5	317.5

Notes:

1. Pump must be mounted on a rigid bedplate, and direct drive coupling or belt drive must be aligned for vibration free operation.
2. Pump discharge connection mate with 3 inch Victaulic-type clamped union. Pump inlet connection mate with 3 inch clamped union for 550, 8500, 12500 and 23000 Series of 4 inch clamped union for 23500 Series.
3. See pump instructions (P/N 15092) for additional information on installation, start-up and maintenance.

FIGURE 12 - DIMENSIONS, PUMP ONLY

10.0 REPLACEMENT PARTS

10.1 Cutaway Drawing

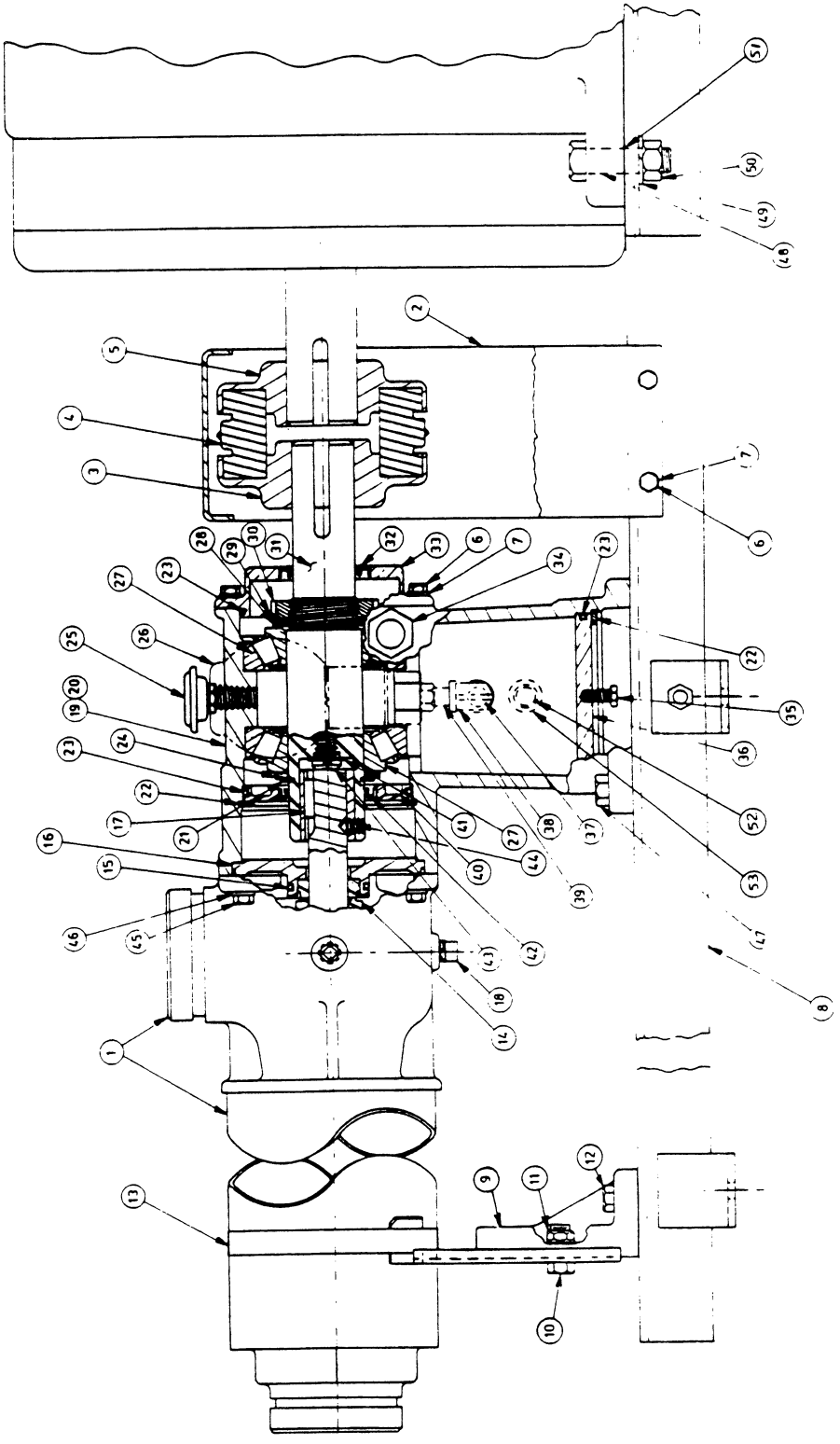


FIGURE 13 - PUMP CUTAWAY DRAWING

10.2 Parts List, Standard Models

Item No.	Part Description	Part No.
1.	Liquid End Assembly	Specify Model No.
2.	Coupling Guard-7 inch channel	1120601
	Coupling Guard-8 inch channel	1120544
3.	Coupling Flange, Pump	
	Size 6 1-5/8 inch bore	1114333
	Size 7 1-5/8 inch bore	1114334
	Size 8 1-5/8 inch bore	1114335
	Size 9 1-5/8 inch bore	1115177
	Size 10 1-5/8 inch bore	1123102
4.	Coupling Sleeve	
	Size 6	1114454
	Size 7	1114337
	Size 8	1114338
	Size 9	1115179
	Size 10	1118896
5.	Coupling Flange, Motor	
	Size 6 1-5/8 inch bore	1114333
	Size 7 1-5/8 inch bore	1114334
	Size 8 1-5/8 inch bore	1114335
	Size 8 1-7/8 inch bore	1114336
	Size 9 1-7/8 inch bore	1115178
	Size 10 2-1/8 inch bore	1123103
	Size 6 38 mm	1121439
	Size 7 42 mm	1121349
	Size 7 48 mm	1122328
	Size 8 48 mm	1121346
	Size 8 55 mm	1122237
	Size 9 55 mm	1122338
6.	Screw, Cap, 5/16-18NC x 3/4	1110490
7.	Lock Washer, 5/16	1112256
8.	Bedplate, for NEMA frame motors	
	60 Hz	
	213T & 215T Size A	1120599
	254T & 256T Size B	1120380
	284TS & 286TS Size D	1120381
	324TS & 326TS Size F	1120382
	364TS & 365TS Size I	1120383
	404TS/405TS	1123058
	Bedplate, for NEMA frame motors	
	50 Hz	
	254T & 256T Size C	1120859
	284TS & 286TS Size E	1120858
	324TS & 326TS Size G 110 in	1120857
	324TS & 326TS Size H 120 in	1120758
	364TS & 365TS Size J	1120856
	160L & 160M Size N	1122335
	180M & 180L Size K	1121278
	200M & 200L Size L	1121279
	225S & 225M Size M	1121280

Item No.	Part Description	Part No.
9.	Discharge Support Assembly (includes Items 10 & 11)	1120600
10.	Screw, Cap, 5/16-18NC x 1/2 in	1110471
11.	Nut, Lock	1113768
12.	Screw, Cap, 3/8-16NC x 1.00	1112048
13.	Clamp, HD	1114375
14.	Mechanical Seal	
	Standard - Type 21 (200 psi, ceramic seat)	1121167
	High Pressure - Type 1 (300 psi, ceramic seat)	1116127
	High Pressure - Type 1 (300 psi, Ni resist seat)	1114326
	High Pressure - Type 1 (400 psi, tungsten carbide seat)	1115090
15.	O-Ring, 1-7/8 ID	1114284
16.	Seal Holder	1120341
17.	Shaft Key, 1/4 x 1-1/2	1120445
18.	Plug, 1/4 NPT	
	Stainless steel, 316	1115055
19.	Bearing Frame Assembly	1120412
20.	Bearing Frame, Painted	1120604
21.	Retaining Ring 5100-187	1113999
22.	Retaining Ring N5000-433	1114280
23.	O-Ring, 4-1/4 ID	1113998
24.	Washer, Bearing Frame	1120379
25.	Oil Breather	1114851
26.	Oiler, 30005	1114476
27.	Roller Bearing, Cup & Cone	1120603
28.	Tanged Washer	1114283
29.	Lock Washer	1114282
30.	Lock Nut, Right Hand Thread	1114281
	Lock Nut, Left Hand Thread	1115975
31.	Bearing Frame Shaft	1120348
32.	Oil Seal N473231	1121049
33.	Oil Seal Cap	1120356
34.	Oil Sight Gauge	1114455
35.	Screw, Cap, 1/4-28NC x 3/4	1115091
36.	Oil Chamber Bulkhead	1120354
37.	Nipple, 3/8 NPT x 3-1/2	1122025
38.	Elbow, 3/8 NPT x 1/4 NPT	1121976
39.	Nipple, Close, 1/4 NPT	1110202
40.	Oil Seal Holder Assembly	1120723
41.	Shim, Bearing Frame	1120361
42.	Oil Seal N2692	1113996
43.	Screw, Cap, 1/2-13C x 1.00	1114379
44.	Set Screw	1113769
45.	Screw, Cap, 3/8-16NC x 1/4	1110984
46.	Lock Washer, 3/8	1110012
47.	Screw, Cap, 3/8-16NC x 1-1/2	1112250

Item No.	Part Description	Part No.
48.	Screw, Cap	
	3/8-16NC x 1-1/2	1112250
	1/2-13NC x 2	1112986
	5/8-11NC x 2	1111648
49.	Lock Washer	
	1/2	1113104
	5/8	1111650

Item No.	Part Description	Part No.
50.	Nut	
	1/2-13	1113462
	5/8-11	1111649
51.	Shim, 5/8 inch	1120665
	Shim, Square	1122204
52.	Nipple, 1/4 NPT x 2	1111754
53.	Cap, 1/4 NPT	1121978

ACCESSORIES FOR SS5500, SS8500, SS12500, SS23000 AND SS24000 SERIES TONKAFLO PUMPS

Part Description	Part Number
Retaining ring pliers for mechanical seal retaining ring	1120717
Set screw pump shaft D-, E-, G- and H-bearing frame	1113769
Allen wrench 3/16 inch for set screw P/N 1113679	1113770
Pump discharge screen	1120501
Standard Trico oiler	1114476
316SS Trico oiler - (2) Cap screws, 5/16 x 18NC x 2-1/2-inch-long U.S. thread (for oil seal holder removal, pump side)	-
Heavy-duty hydraulic oil	
1 qt	1120693
1 case (12 qt)	1120682
ISO-Vg, Grade 100, 1 qt	1120693
Anti-seize thread compound	1120110
Thrust washers	1120424
Stage bearing	1120349
Carbon bearing	1120386
Center housing tool, E frame pumps	1120780
Discharge housing tool, E frame pumps	1120781
SS5500-SS12500 Series stage parts	Contact factory for technical assistance.
Mechanical seal kit	
200 psi, Type 21 ceramic	1121177
300 psi, Type 1 ceramic	1120606
300 psi, Type 1 Ni-Resist	1120607
400 psi, Type 1 tungsten carbide	1120608
Allen wrench, 3/16 inch	1113770

Part Description	Part Number
Victaulic adapters	
3-inch Victaulic x 3-inch MNPT 304SS	1120589
3-inch Victaulic x 3-inch MNPT 316SS	1120590
3-inch Victaulic x 2-inch FNPT 304SS	1120586
3-inch Victaulic x 2-inch FNPT 316SS	1120587
3-inch Victaulic x 1-1/2 inch FNPT 316SS	1120588
4-inch Victaulic x 4-inch MNPT 304SS	1122066
4-inch Victaulic x 4-inch MNPT 316SS	1122067
Victaulic coupling, 3 inch, Style 77 Buna-N	1114373
Victaulic coupling, 4 inch, Style 77 Buna-N	1115161

10.3 Recommended Spares for Standard Tonkaflo Pumps with E-Bearing Frames

SPARE PARTS FOR MECHANICAL SEAL REPLACEMENT AND GENERAL BEARING FRAME MAINTENANCE

Part Description	Part Number	Qty
Operating and Maintenance Manual for SS5500, SS8500, SS12500, SS23000, and SS24000 Series High Pressure Pumps [up to 1000 psig (69.0 bar)] with Type E-Bearing Frames	1115092	1
1-inch, Type 21, BF501C1-316SS mechanical seal kit. Inlet pressure < 200 psig (13.8 bar).	1121177	1
Heavy-duty, antiwear hydraulic oil, ISO-VG 100 (1 qt)	1120693	1
Bearing cup and cone	1120603	2

10.4 Complete Set of Bearing Frame Replacement Parts

Part Description	Part Number	Qty
Bearing frame oil seal, motor side (replaces P/N 1113997)	1121049	1
Bearing frame oil seal, pump side	1113996	1
O-ring for bearing frame	1113998	3
Bearing cup and cone	1120603	2
Retaining ring for bearing frame housing	1114280	2
Retaining ring for bearing frame shaft	1113999	1
Lock nut - left hand thread	1115975	1
Lock nut - right hand thread	1114281	1
Lock washer, flat with tang	1114282	1
Multi-tanged washer	1114283	1
Bearing frame shaft - left-hand thread	1120348	1
Bearing frame shaft bolt shims	1120361	3
Painted bearing frame housing	1120604	1
Oiler cup and globe	1114476	1
Oiler nipple, 3/8 NPT x 3-1/2	1122025	1
Oiler elbow, 3/8 NPT x 1/4	1121976	1
Oiler nipple, close 1/4 NPT	1110202	1
Bearing frame shaft washer	1120379	1
Bearing frame shaft bolt	1114379	1
Oil breather	1114851	1
Bearing frame shaft set screw cone point	1113769	1
Oil sight gauge	1114455	1
Oil drain nipple, 1/4 NPT x 2	1111754	1
Oil drain cap, 1/4 NPT	1121978	1
Oil seal holder assembly (without oil seal, P/N 1113996)	1120723	1
Coupling flanges (2) and sleeve (1); refer to Coupling Size Section	1120444	1
Coupling key bearing frame		
Pump shaft key	1120445	1
Machine bolts, 5/16 x 18NC x 2-inch-long	1116595	2
U.S. thread (for oil seal holder removal)	1120356	1
Holder oil seal cap E		

10.5 Bearing Frame Overhaul Tools

1. Two 5/16-inch x 18 UNC x 2-1/2-inch-long bolts for removal of grease seal holder (E frame pumps)
2. One 3/8-inch bolt for E frame pumps to hold bearing frame shaft when removing lock nut
3. One 3/16-inch Allen (hex) wrench for removal of bearing frame shaft set screw
4. Bearing press (arbor press)
5. Dial indicator for setting bearing frame shaft endplay
6. Retaining ring pliers for removal of retaining ring from E-bearing frame shaft (Truarc L1520 or equivalent)

10.6 Mechanical Seal Change-Out Tools

1. One 3/16-inch Allen (hex) wrench for removal of bearing frame shaft set screw
2. 9/16-inch wrench

10.7 Ordering Parts

Order parts through your local distributor or directly from:

Osmonics, Inc.
5951 Clearwater Drive
Minnetonka, MN 55343-8995 USA
Phone (952) 933-2277
Fax (952) 933-0141
Toll Free (800) 848-1750

To order parts, the following information is necessary:

1. Pump model number
2. Pump serial number (from nameplate)
3. Other nameplate information such as operating temperature 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. Special materials of construction, if any

11.0 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 temperatures, 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 _____

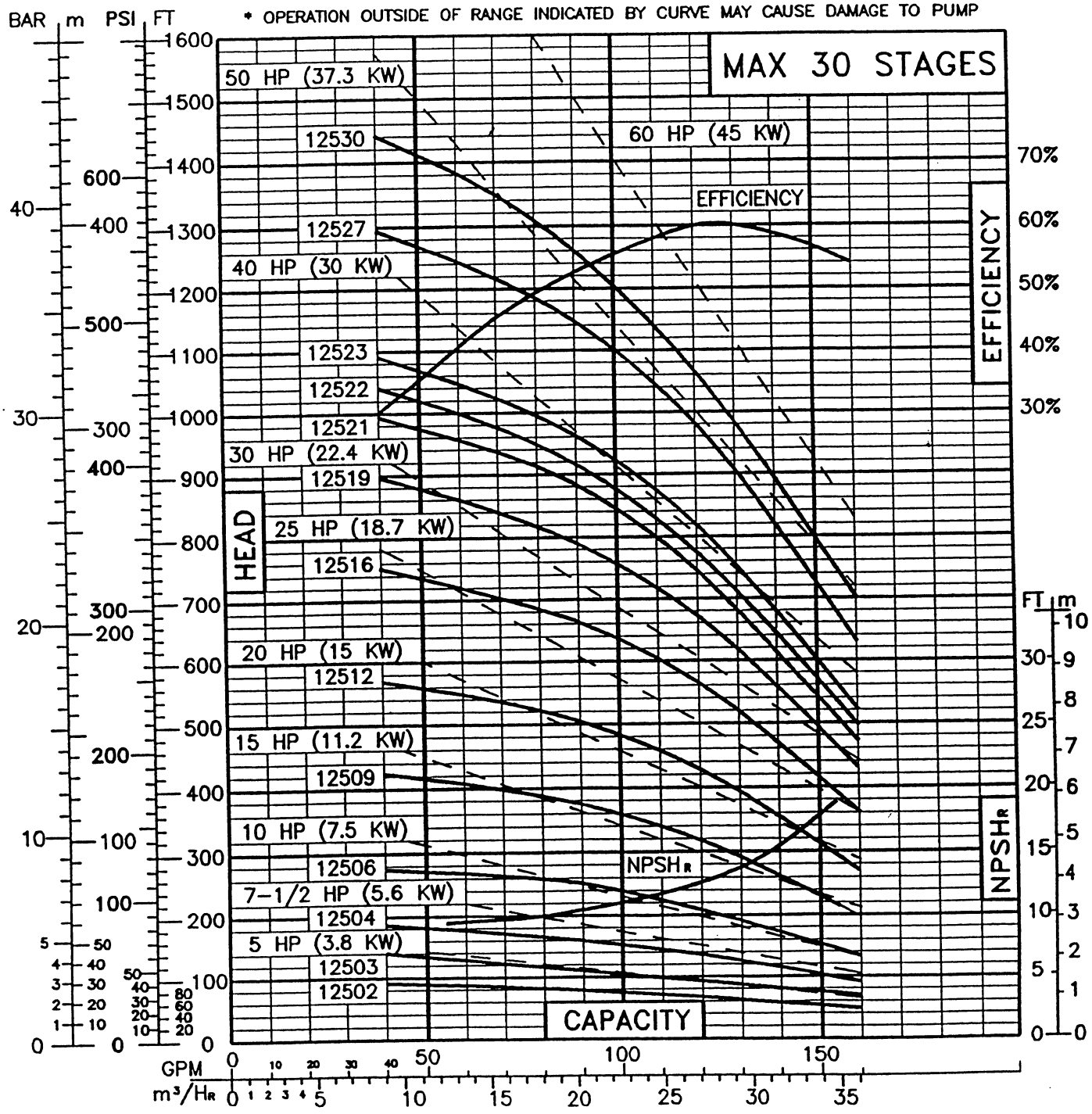
PUMP SERIAL NUMBER _____

TONKAFLO® Pumps SERIES 12500

NORYL STAGED PUMP PERFORMANCE CURVES – 2900 RPM

CUSTOMER _____ 50 Hz

MODEL _____



OSMONICS

HP CURVES INCLUDE BEARING FRAME

5951 Clearwater Drive Minnetonka, MN 55343-8995 USA • Phone 800-848-1750 (612) 933-2277 • Fax (612) 933-0141

• www.osmonics.com

P/N 1115415 Rev E

For more information call toll free in the USA (800) 848-1750

Manufactured in the USA

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