OPERATING AND MAINTENANCE INSTRUCTIONS FOR BASE MOUNTED END SUCTION CENTRIFUGAL PUMPS

The THRUSH End Suction Centrifugal Pump has been carefully assembled and factory tested to provide years of trouble free service. In order to insure the service intended, the following information is provided to enable proper installation, operation and maintenance of this product.

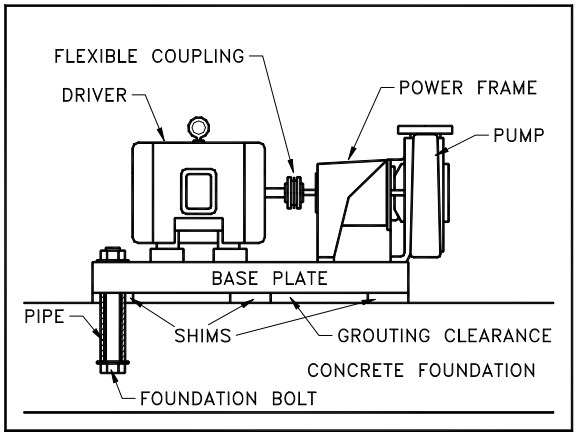

Figure 1

INSTALLATION

LOCATION

The pump should be located as close to the liquid source as possible so that the suction line can be short and direct. It should be located in a clean, open area, where it is easily accessible for inspection, lubrication and repair. Pumps installed in dark, dirty areas or cramped locations are often neglected which can result in premature failure of both the pump and the driver.

Adequate provisions should be made for electrical wiring to the pump motor. A switch and overload protection should be installed near the pump unless it is impractical. The electrical conduit should be positioned in such a way as to preclude the possibility of moisture entering the conduit or the motor and causing short circuit.

FOUNDATION

The foundation must be sufficiently rigid to absorb any vibration and stress encountered during pump operation. A raised foundation of concrete is preferable for most floor-mounted pumps. The raised foundation assures a satisfactory base, protects against flooding, simplifies moisture drainage and facilitates keeping the area clean.

The pump should be firmly bolted to the foundation, whether it is a raised concrete base, steelwork wall, or structural member. The mounting bolts or studs should be accurately located per the applicable THRUSH dimension sheet. Foundation bolts should be enclosed by a sleeve 2 to 4 diameter larger than the bolt to allow movement for proper alignment with the pump mounting holes. Refer to Figure 1. If the pump is to be mounted on steelwork or other structure, adequate support should be provided to prevent distortion of the base plate or the structure, which could produce excessive strain on the pump casing and piping and seriously affect alignment of the pump and driver.

MOUNTING

The pump unit should be set on the foundation, being careful not to damage the threads on the foundation bolts. The flexible coupling halves should be disconnected. Shims could be inserted and the pump leveled. A spirit level should be used on the faces of the flexible coupling halves and on the suction and discharge flanges. If the pump has threaded nozzles, a short piece of pipe inserted in the nozzles will serve as a smooth surface for a leveling reference point. The shims should be adjusted until the pump is leveled horizontally and vertically. Tighten the foundation bolts finger tight.

GROUTING

Grouting the base plate prevents lateral movement of the base plate and improves the vibration absorbing characteristics of the foundation by increasing its mass. A wooden dam should be constructed around the base plate to contain the grout while it is being poured. The entire base plate should be filled with grout, allow 48 to 72 hours for grout to dry. After grout is thoroughly dried, firmly tighten foundation bolts.

PIPING

The piping practices followed will directly affect the efficiency and power consumption of the pump. Pay particular attention to the seemingly insignificant details involved in piping for they make the difference between a good and bad installation. BOTH THE SUCTION AND THE DISCHARGE PIPING SHOULD BE INDEPENDENTLY SUPPORTED NEAR THE PUMP. LIBERAL USE OF PIPE HANGERS AND SUPPORT BLOCKS WILL PREVENT EXCESSIVE STRAIN ON THE PUMP CASING AND ON THE PIPE JOINTS. The suction diameter should be at least the same diameter as the suction nozzle on the pump and preferably larger. Use of a smaller diameter pipe will result in loss of head due to friction. All joints must be tight to maintain prime on the pump.

SUCTION PIPING

Long radius elbows should be used in place of standard elbows wherever possible, because of their superior flow characteristics. Elbows should not be used at suction nozzle, but if it is unavoidable, long radius elbows should be used. Elbows installed in any position at the suction nozzle have a tendency to distribute the liquid unevenly in the impeller eye and may cause a reduction in capacity, create an undesirable thrust condition, or create noisy operation. Eccentric reducers should be installed directly at the suction nozzle, with the taper at the bottom to prevent air pockets from forming. Straight taper reducers should never be used in a horizontal suction line because of the air pocket that is formed at the leg of the reducer and the pipe.

DISCHARGE PIPING

The discharge pipe diameter should be the same as or larger than the discharge nozzle diameter. The size of the discharge pipe to be used is dependent upon its application.

Long radius elbows should be used in the discharge piping as well as in the suction piping to prevent excessive head loss due to friction. Whenever possible, elbows should not be installed directly at the discharge nozzle as the turbulence created by the elbow will affect pressure gauge readings.

An increaser should be installed at the discharge nozzle if larger diameter discharge piping is used. Straight taper increasers and/or reducers are satisfactory in discharge applications.

Expansion joints are used primarily to prevent the transmission of piping strain, caused by thermal expansion and contraction, piping misalignment, pressure changes, or other causes, to the pump casing. They are also used to suppress any noise that may be transmitted through the piping.

PROPER PIPING ALIGNMENT IS ESSENTIAL BEFORE CONNECTION IS MADE. PIPING ALIGNMENT SHOULD NEVER BE ACHIEVED BY FORCE. THIS COULD PRODUCE STRAIN ON THE PIPING AND THE PUMP CASING. PROPER SUPPORTS SHOULD BE INSTALLED FOR THE PIPING TO KEEP ITS WEIGHT OFF THE PUMP CASING.

ALIGNMENT

The pump and driver were accurately aligned at the factory. However, it is impossible to maintain this alignment during shipping and handling. Therefore, it will be necessary to realign the pump and driver. Flexible couplings are not universal joints and should not be used to compensate for misalignment of the pump and motor shafts. Their function is to transmit power from the driver to the pump while compensating for thermal expansion and shaft end movement. The coupling faces should be far enough apart so that they do not make contact when the motor shaft is forced to the limit of the bearing clearance toward the pump.

There are two types of misalignment encountered with flexible couplings: ANGULAR MISALIGNMENT in which the shafts are not parallel and PARALLEL MISALIGNMENT where the shafts are parallel but not on the same axis.

STRAIGHT EDGE ALIGNMENT

All THRUSH base mounted end suction pumps are furnished with flexible couplings. To check alignment, simply place the alignment gauge furnished with the pump across the coupling flanges, making sure the edge is firmly against the coupling halves. If parallel misalignment exists, there will be a gap under the gauge. To correct this, loosen the motor, hold down bolts and realign or shim motor until the alignment gauge rests firmly on both coupling halves as in Figure 2. Check alignment at 90° increments around the circumference of the coupling. (Do not rotate shaft for this check.) If alignment is correct, retighten motor bolts. After the bolts have been tightened, recheck alignment. Angular misalignment can be checked with a caliper by checking the spacing between coupling halves at 90° intervals. If misalignment exists, realign as previously described.

DIAL INDICATOR ALIGNMENT

To check angular alignment with a dial indicator, remove coupling insert, clamp the dial indicator to the pump coupling half so that the ball on the indicator just rests on the face of the motor coupling half. A chalk mark should be made at the point where the ball contacts the coupling half. Both the pump shaft and the motor shaft should be rotated an equal amount so that the reading is taken at all check points with the ball on the chalk mark. Insert shims as required. To check parallel alignment with the dial indicator, the ball should rest on periphery of the motor coupling half. A chalk mark should be made at the point of contact, and the shafts rotated equally so that the reading is taken with the ball on the chalk mark at all check points. Insert shims as required.

NOTE: ANY ADJUSTMENT TO CORRECT ONE DIRECTION OF ALIGNMENT MAY AFFECT THE OTHER DIRECTION. THEREFORE, IT IS NECESSARY TO RECHECK BOTH ANGUALR AND PARALLEL ALIGNMENT AFTER EACH ADJUSTMENT.

THRUSH STANDARD COUPLINGS (TB WOODS) WILL OPERATE SATISFACTORILY WITH 1/16” PARALLEL MISALIGNMENT OR 1 Deg. ANGULAR MISALIGNMENT MAXIMUM. ON OTHER COUPLINGS CONSULT MANUFACTURE’S DATA.

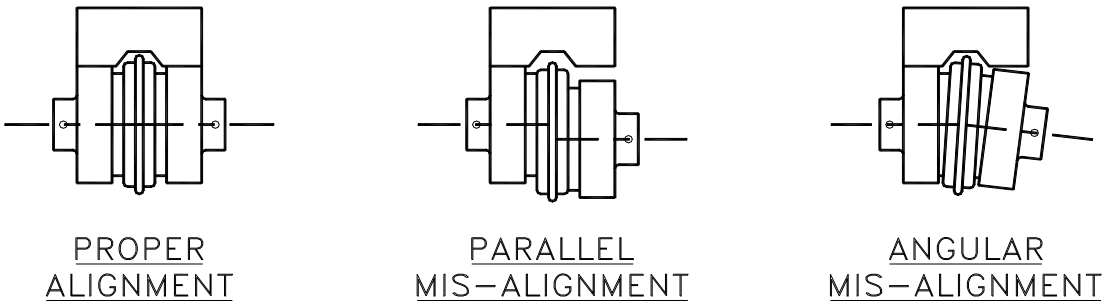

Figure 2

OPERATION

CAUTION: CENTRIFUGAL PUMPS SHOULD NEVER BE STARTED OR RUN DRY. OPERATING A PUMP DRY WILL CAUSE SCORING OF THE MECHANICAL SEAL, RESULTING IN PREMATURE SEAL FAILURE. TO PREVENT THE PUMP FROM BEING RUN DRY, IT SHOULD BE PRIMED BEFORE STARTING.

PRIMING THE PUMP

The pump will not operate satisfactorily until it is primed. All air must be expelled from the suction piping and pump casing and replaced by the liquid to be pumped. There are several methods of priming pumps. The one selected will depend on the specific requirements.

FLOODED SUCTION PRIMING

This method of priming a pump is relatively simple. (See Figure 3) The liquid source is located above the pump and all that is necessary to prime the pump is to open the air vent valve or plug in the pump casing and to crack open the gate valve in the suction line. The suction line and pump should be filled slowly until a steady stream of liquid is observed flowing from the air vent. After the pump is operating, it is recommended that the air vent valve or plug be opened again to insure that all air has been expelled from the pump casing.

SUCTION LIFT

A foot valve should be used for priming on suction lift applications (See figure 3). The foot valve located at the bottom or end of the suction piping functions as a check valve, which allows flow in one direction only – toward the pump. Otherwise, all the liquid may drain from the pump and suction piping back into the sump after shutdown. Initial priming is accomplished by completely filling the suction piping and pump casing with the liquid to be pumped. This can be done by removing the air vent valve or plug at the top of the pump casing and inserting a pipe nipple in the orifice with an appropriate increaser to accommodate a hose connection. A priming line can also be inserted in the discharge piping between the check valve and the pump, or the priming can be done with a bucket and funnel. **IMPORTANT: FILL THE SUCTION PIPE AND PUMP CASING WITH LIQUID.**

When the pump is started, the vacuum created by pumping the priming fluid, combined with atmospheric pressure in the liquid well, forces liquid into the suction piping, thus opening the valve and keeping it open until the pump is shut down. When the pump is shut down, the liquid being pumped reverses its flow causing the valve to close. The liquid is trapped in the suction piping and pump casing, thus maintaining a prime on the pump.

VACUUM PRIMING

Vacuum priming consists of removing air from the pump casing and suction piping and drawing liquid into them by means of a vacuum-creating device. The types of vacuum equipment range from a simple hand pump to a complex central priming system. The specific priming requirements will govern what type of vacuum primer is used.

STARTING THE PUMP

The discharge gate valve should be partially closed when the pump is started in order to avoid possible water hammer and initial power draw. As soon as the pump is up to operating speed, the discharge gate valve should be opened to the desired position. The motor should turn clockwise when viewed from the motor end and counter-clockwise when viewed from the casing end.

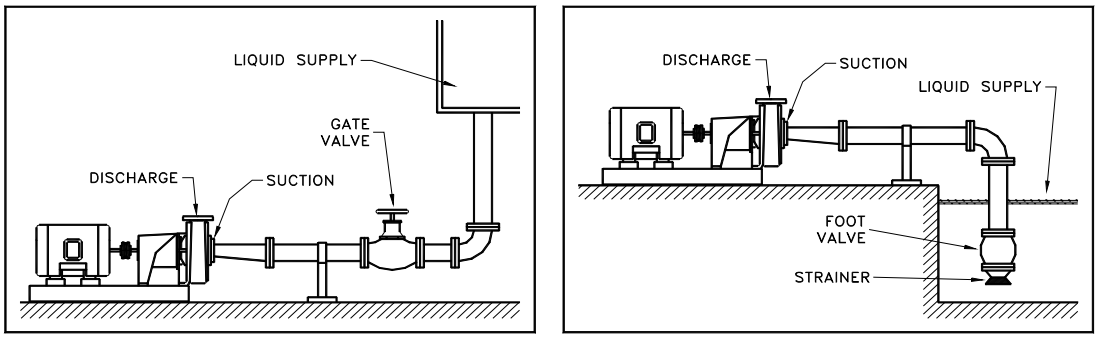

Figure 3: Suction Piping

MAINTENANCE

It is doubtful that the THRUSH pump will ever require complete disassembly; generally only certain components need to be disassembled to accomplish inspection or repair.

DISASSEMBLY

Since the THRUSH base mounted end suction pumps are a back pull out design, it is unnecessary to disconnect the piping or casing for service. All service and maintenance can be performed by disconnecting the coupling and removing the power frame assembly from the casing.

1. Close suction and discharge valves.

2. Break electrical connections to prevent drive unit from being energized during disassembly.

3. Unscrew two of the pipe plugs (29) from top and bottom of the casing (28). (See Parts List)

4. Remove all relief, cooling, flushing or drain lines, if present, from the pump.

5. Disconnect the flexible coupling from between the pump and motor. Unscrew the hold down bolts that hold support foot (24) and bearing frame (10) to base.

6. Remove capscrews (30) from bracket (15) and pull bearing frame bracket assembly from casing (28). Remove casing gasket (27).

7. Unscrew impeller bolt (35) and remove impeller washer (34), taking care not to damage gaskets (33 & 36).

8. Slide impeller (37) and impeller key (14) from the shaft, again taking care not to damage sleeve gasket (23) located behind impeller. Remove sleeve gasket (23).

9. Casing wear ring (39) is pressed into casing (28) with an interference fit and must be removed with a puller if replacement is necessary.

10. If replacing seal cartridge assembly (19, 20, 21 & 22) slide seal assembly off the shaft.

11. If replacing mechanical seal only (21 & 22) slide assembly off the shaft. Remove snap ring (20) at spring end. Remove spring and seal head (22). The rubber in seal head may be partially adhered to shaft sleeve (19). Remove seat and O-ring (21). The sleeve should be carefully cleaned to remove any residue in seal area, and checked for abrasion or corrosion. The sleeve under the seal may be polished lightly to 32 RMS finish before replacing seal assembly (21 & 22). DO NOT REUSE A PITTED SLEEVE.

12. NOTE: THE MECHANICAL SEAL IS A PRECISION PRODUCT AND MUST BE TREATED AS SUCH. DURING REMOVAL GREAT CARE MUST BE TAKEN TO AVOID DROPPING ANY PART OF THE SEAL. TAKE PARTICULAR CARE NOT TO SCRATCH THE LAPPED FACES ON THE WASHER OF THE SEALING SEAT. DO NOT PUT A SEAL BACK INTO SERVICE UNTIL THE SEALING FACES OF THE WASHER AND SEAT HAVE BEEN LAPPED OR REPLACED.

13. The seal cavity of the bracket (15) should be cleaned of all residues. Make sure the 1/32-inch radius in the seal seat cavity is not damaged during disassembly since a sharp edge can easily cut the O-ring during reassembly.

14. Remove capscrews (26) and washers (25) to take off support foot (24).

15. Unscrew capscrews (17) and washers (18) to remove bracket (15) from bearing frame (10).

16. Remove impeller key (14) from the shaft and remove water slinger (66).

17. Unscrew capscrews (3) and remove bearing cap (2). Remove O-ring and retainer ring (6).

18. Slide out shaft (12) with bearing (7 & 11). Since bearings are press fitted on the shaft, they will have to be pulled or pressed off the shaft. Remove lip closure seal (5) from frame and bearing cap if damaged.

REASSEMBLY

1. Press lip closure seal (5) into frame and bearing cap.

2. Press bearings (7 & 11) onto shaft (12). Snap retainer ting (6) into place.

3. Slide shaft (12) with bearings (7 & 11) into frame (10) and place O-ring into place.

4. Fasten bearing cap (2) in position with capscrews (3) and position water slinger (66) on the shaft.

5. Mount bracket (15) by screwing capscrews (17) and washers (18) into bearing frame (10) to assure proper alignment. Turn all capscrews in an even amount. Fasten the bracket support foot (24) by placing washers (25) over capscrews (26) and screwing them into position.

6. Thoroughly inspect the seal cavity in the bracket for burrs or nicks which could damage the seat of the seal. APPLY A FILM OF SOAP PASTE OR FLAX SOAP (*DO NOT USE OIL OR GREASE*) TO THE SEAT AND O-RING (21).

7. If replacing seal cartridge assembly, remove cardboard spacer and slide assembly (19, 20, 21 & 22) onto shaft (12).

8. If it is not possible to insert seal assembly with fingers, press into place with a piece of tubing that has the end cut square and matches the sleeve diameter. Tubing should be slightly larger than the diameter of the shaft. Spring tension will probably prevent the sleeve from remaining in position axially until the impeller is locked against it.

9. When replacing mechanical seal only (21 & 22) wipe the sealing faces of the seat and seal washer clean. Lubricate theses surfaces and shaft sleeve (19) with a clean soap solution. Put seat and O-ring (21) on shaft sleeve (19), smooth side to pump end. Slide the entire rotating assembly onto the sleeve. Carbon in seal head must mate with seal seat. Replace snap ring (20). The shaft sleeve with the seal rotating assembly on it may now be replaced onto the pump shaft. Spring tension will probably prevent the sleeve from remaining in position axially until the impeller is locked against it.

10. Press casing wear ring (39) in casing if change is necessary. Rings should not be hammered into place. Use a press or clamp the parts in a bench vise using wooden blocks to protect the rings. It may be necessary to pin or dowel the rings after assembly if the insert or casing had rings replaced before since each re-assembly can stretch or tear metal and thereby loosens the fit. If the facility is available it is good practice to take a very light finish out or to ream the inside diameter of the casing rings after pressing to restore roundness. When rings are pressed they may get squeezed out of shape.

11. Replace bracket wear ring (16) in bracket (15), if applicable.

12. Carefully place sleeve gasket (23) on motor end of impeller. Assemble impeller key (14) and impeller (37) to shaft. Secure impeller with impeller washer gasket (33), washer (34 & 36) and impeller bolt (35).

13. Replace casing gasket (27) on bracket (15). Slide entire bearing frame-bracket assembly into casing (28) being careful not to damage casing gasket (27). With assembly properly positioned in casing (28) replace capscrews (30). Turn all capscrews in and tighten evenly. Replace all hold down bolts securing pump assembly to base.

14. Install the two pipe plugs (29) in the pump casing. Position the casing gasket (27) and casing (28) against the pump bracket and secure with capscrews (30).

15. Replace all relief cooling, flushing or drain lines.

16. Read carefully the selection of the manual titled – INSTALLATION, especially those paragraphs referring to pump and coupling alignment.

17. Connect electricity to the motor.

18. Lubricate bearings.

19. Open suction and discharge valves.

SERVICE

The THRUSH pump requires no maintenance other than periodic inspection, occasional cleaning and lubrication of bearings. The intent of inspection is to prevent breakdown, thus obtaining optimum service life. The liquid end of the pump is lubricated by the fluid being pumped and therefore does not require periodic lubrication. The motor, however, may require lubrication, in which case, the motor manufacturer's recommendation should be followed.

LUBRICATION OF IMPELLER SHAFT BEARINGS

The base mounted end suction pump is available with two options for lubricating the shaft bearings. They are:

1. Re-greasable (standard)
2. Oil Lubrication

REGREASABLE bearings will require periodic lubrication. This can be accomplished by using the lubrication fittings in the cartridge cap and power frame. Lubricate the bearings at regular intervals using a grease of high quality. Lime, lithium, lithium soda or calcium base grease is recommended as lubricants for pumps operating in both wet and dry locations. Mixing of different brands of grease should be avoided due to possible chemical reaction between the brands, which could damage the bearings. Accordingly, avoid grease of vegetable or animal base (which can develop acids) as well as, grease containing rosin, graphite, talc and other impurities. Under no circumstance should used grease be reused.

THRUSH STANDARD GREASE IS AMERICAN OIL CO, RYCON NO. 2 NLG 1 – 2 OR EQUAL

The THRUSH base mounted end suction pumps are quite large and require a considerable amount of grease to purge the bearing. It is recommended that the following quantities be used:

No. 1 Power Frame – 2 oz. per bearing on initial startup

No. 2 Power Frame – 4 oz. per bearing on initial startup

The frequency of lubrication is dependent upon the location and environment. In clean, dry location 1 oz. of grease every 3 months is sufficient. In wet or humid locations the frequency of lubrication should be doubled.

OIL LUBRICATED bearings are optional on THRUSH base mounted end suction pumps. A fixed oil level is maintained with the proper frame by an oiler, which allows visual indications of reserve oil.

On initial installation and before starting a unit that has been shut down for repairs or for any extended length of time, run enough 10/20 weight motor oil through the oiler to maintain a constant oil level to insure that the bearing will never be without an oil supply. Oil will have to be added at intervals to maintain a constant level in the oil cup.

Under working conditions, oil will break down and need to be replaced at regular intervals. The length of these intervals will depend on many factors. Under normal operation, in clean and dry locations, the oil should be changed about once a year. However, when the pump is exposed to dirt contamination, high temperatures (200 Degree F or above) or a wet location, the oil may have to be changed every 2 or 3 months.

At times it may be necessary to clean the bearings due to accumulated dirt or deteriorated lubricants. This can be accomplished by flushing the bearing with light oil heated to 180 – 200 Degrees F while rotating it on a spindle. Wipe the bearing housing with a clean rag soaked in kerosene and flush all surfaces. Dry the bearings completely before re-lubricating. Compressed air can be used to speed drying, but care should be taken not to let bearings rotate while being dried.

CAUTION: USE NORMAL FIRE CAUTION PROCEDURES WHEN USING ANY PETROLEUM CLEANER.

The motor, which drives the THRUSH pump, may or may not require lubrication. Consult the motor manufacturer's recommendations for proper maintenance instructions.