Owner's/Operator's Manual

Submersible Turbine

INSTALLATION / OPERATION MAINTENANCE

Table of Contents:

BE215 (Rev. 6/17/98)

READ AND FOLLOW SAFETY INSTRUCTIONS!

⚠ This is the safety alert symbol. When you see this symbol on your pump or in this manual, be alert to the potential for personal injury.

⚠ DANGER warns about hazards that **will** cause serious personal injury, death or major property damage if ignored.

⚠ WARNING warns about hazards that **can** cause serious personal injury, death or major property damage if ignored.

⚠ CAUTION warns about hazards that **will** or **can** cause minor personal injury or property damage if ignored.

The label **NOTICE** indicates special instructions which are important but not related to hazards.

Carefully read and follow all safety instructions in this manual and on pump.

Keep safety labels in good condition.

Replace missing or damaged safety labels.

GENERAL CONSIDERATIONS

Before installing your submersible turbine pump, review the following checklist.

Be sure the well is clear of sand and abrasive material before installing pump. Abrasive materials in the water cause component wear and reduce pump capacity and discharge pressure. Never use the pump to develop or clean the well. Permanent pump damage can result within the first few hours of operation.

If the well casing is suspected of being crooked, check it with a gauge of identical length and diameter as the pump and motor with two lengths of pipe attached. Serious damage can result if the pump becomes lodged in a crooked casing.

Be sure the well can supply a high-capacity turbine pump. The well should be deep enough to cover the pump unit with water, even at extreme pumping rates. Typically, the pump should be submerged 10 to 20 feet below the lowest water level and at least 5 feet above the bottom of the well.

Air entrained in the water reduces performance and will damage the pump.

Your pump is designed to provide maximum efficiency under specific capacity and head conditions. Do not operate it beyond specified limits.

System controls and pump must match. Do not interchange controls with other models. Serious damage can result to the unit if pump and controls do not match.

Motor control systems and pump units are repairable in the field. To avoid serious damage to the unit, use only parts obtained from authorized dealers/suppliers.

Average number of starts per day will influence motor and control component life (starters, relays, capacitors, etc). Select pump size, tank size and control components for lowest practical number of starts per day. Excessive cycling accelerates bearing, spline, and pump wear and control contact erosion.

SPECIFICATIONS

Table I: Frequency of Starts

Avg. No. of Starts per 24 Hr. Day		
HP Rating	**Single Phase**	**Three Phase**
1 to 5	50	150
7-1/2 to 30	25	50
40 and over	–	50

Table II: Weight of Pipe (Column)

Weight per Foot (Lbs)		
Pipe Size (In)	**Full**	**Empty**
2-1/2	7.9	5.8
3	10.8	7.6
4	16.3	10.8
5	23.3	14.62
6	31.5	18.97

Table III: Weight of Cable per 1000 Ft. (lbs.)

AWG Size	3-Phase		1-phase	
	Nom. Dia.	Weight	Nom. Dia.	Weight
12-3	.500	140	.487	130
10-3	.545	186	.517	161
8-3	.771	328	.750	293
6-3	.965	525	.826	400
4-3	1.071	717		
2-3	1.243	1066		

Table IV: Cable Wire Resistance

AWG Wire Size	Resist (Ohms/Ft)
14	.0050
12	.0032
10	.0020
8	.0013
6	.0008
4	.0005
2	.0003

PREINSTALLATION PROCEDURES AND CHECKS

Electrical Splices and Connections

Splices must be waterproof. Make a strong mechanical bond between the motor leads and the cable to avoid high resistance at the connection. A poor mechanical connection, or a poorly wrapped splice, can cause motor problems and motor failure.

Before connecting the motor to the cable, perform a ground check to assure that the motor has not been damaged. Attach one end of an ohmmeter lead to any of the three motor leads and the other ohmmeter lead to the pump intake bracket. A new motor must have a resistance of 2 megohms or greater. If not, contact your dealer. Repeat for all three leads.

Prepare the cable and make the mechanical connections (Figure 1A) and splices as follows:

1. Cut motor leads and corresponding cable ends at 3-inch spacings to stagger connections for a smooth splice.
2. Cut connecting cable to match the motor leads. **NOTICE:** Match color coded wires, red to red, black to black, and white to white.
3. When using a butt connector, expose bare wire for about 1/2". When using stranded wire, expose about 1" of wire.

   NOTICE: Butt connectors may be used with solid wires through 8 AWG, or stranded wires through 10 AWG.
4. Clean exposed ends of wire thoroughly with emery cloth or sandpaper to assure good electrical connections.

5A. BUTT CONNECTORS (Figure 1A): Insert wires into connector until insulation butts up against connector. Crimp connector to wires with a pair of crimping pliers. Pull on cable to make sure the connection is solid and tight.

Table V: Cooling Flow Rates Past Submersible Motors In Feet Per Second (FPS)
6" Nominal Motor (5.38" OD)

Casing Size	GPM												
	20	40	60	80	100	120	140	160	180	200	220	240	
6" ID	1.2	2.3	3.5	4.6	5.8	7.0	8.1	9.3	10.4	11.6	12.7	13.9	} FPS
8" ID	–	0.5	0.7	0.9	1.2	1.4	1.6	1.9	2.1	2.3	2.6	2.8	
10" ID	–	–	0.3	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.4	

Formula to find flow rate:

$$FPS = \frac{GPM \times .409}{D1^2 - D2^2}$$

D1 = Casing inside diameter
D2 = Motor outside diameter

NOTICE: If flow rate past motor is expected to be less than rate shown in table, install a shroud around motor to force cooling flow past shell. To minimize erosion to shell if flow rate is expected to be more than 10 FPS (especially if sand is present), reduce flow through pump to reduce flow past shell.

5B. SOLDERED CONNECTIONS (Figure 1A):

NOTICE: Do not use acid core solder or corrosive solder paste.

I. Straighten individual cable strands and spread apart slightly.

II. Clean each strand and push strands of cable into matching (color-coded) open strands of the motor leads.

III. Wrap entire length of joint with fine copper wire until strands are compressed.

IV. Apply heat and solder. Solder will follow the heat; make sure solder flows throughout the joint. Pull firmly on cable to test joint.

6. Repeat Step 5 for each lead.

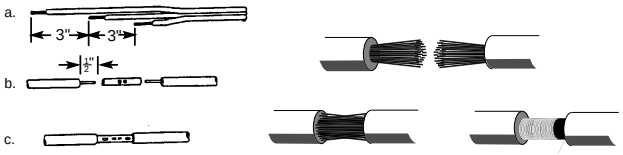


Figure 1A: Cable Splicing: Solid Wire, Stranded Wire

7. Taping splice (Figure 1B):

⚠ CAUTION **Because friction tape is not water resistant, never use friction tape on a water-tight splice. Use Scotch Number 33, or equivalent.**

7A. Clean joints and adjoining cable/wire insulation of all grease and dirt, and build up joint area with tape until it matches diameter of cable.

7B. Starting 1-1/2" back from the joint, firmly apply one layer of tape, overlapping about half the previous lap and continuing approximately 1-1/2" beyond joint. Cut tape evenly and press both ends firmly against cable.

7C. Apply two additional layers of tape, as described in Step 7B, beginning and ending 1-1/2" beyond the previous starting/ending points.

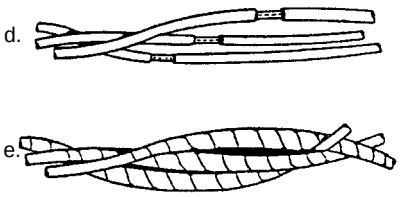


Figure 1B: Stagger splices and tape

Splice and Cable Continuity Test

Before installing pump check cable and splices as follows (see Figure 1C):

1. Submerge cable and splice in steel barrel filled with water. Make sure both ends of cable are out of water.
2. Clip one ohmmeter lead to barrel. Test each lead in cable successively by connecting the other ohmmeter lead to the three cable leads, one after the other.
3. If resistance reading goes to zero on any cable lead, a leak to ground is present. Pull splice out of water. If meter reading changes to "infinity" (no reading) the leak is in the splice.
4. If leak is not in splice, slowly pull cable out of water until reading changes to "infinity". Reading will change to "infinity" when leak comes out of water.
5. Repair cable by splicing as explained under "Electrical Splices and Connections".

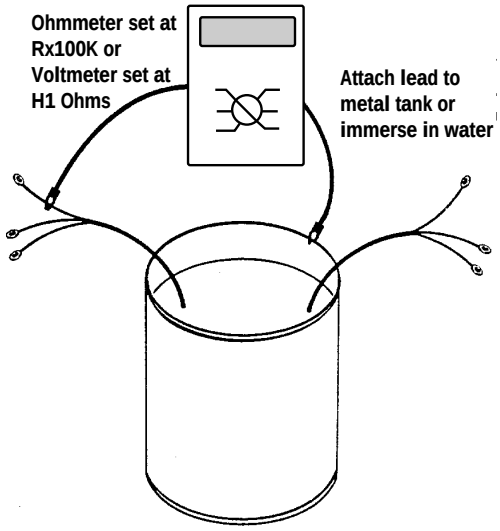


Figure 1C: Splice and Cable continuity

Rotation Check (3-Phase Only)

After satisfactorily completing continuity test, connect cable to pump controller. Check 3-phase motors for correct rotation. If necessary, reverse any two cable leads at the controller and recheck rotation. Permanently mark and match to control box terminals for future reference. Connect cable to motor controller and then wire controller to disconnect switch. Connect temporary jumper wire between proper terminals in controller to temporarily energize magnetic coil.

Momentarily engage disconnect switch and note direction of rotation. The shaft should rotate counterclockwise when viewed from the top or shaft end of the motor. If rotation is incorrect, reverse any two wires; mark wires to correspond with the controller terminal numbers.

NOTICE: Pump is water lubricated. Do not operate the pump for more than 5 seconds while it is out of water.

INSTALLATION

General

After completing all connections and tests so far, connect a 5-foot length of pipe to pump.

Lower pump into well with pipe clamps attached to the 5-foot pipe. Attach a standard length of pipe to 5-foot length and lower pump CAREFULLY into well.

NOTICE: Do not use a pipe longer than 5 feet for the first connection. Hoisting pump upright with a long length of pipe can cause pump misalignment from excessive leverage.

⚠ CAUTION **Use extreme care when lowering pump and cable to avoid damage to cable insulation.**

Anchor power cable to pump every 20 feet with adjustable steel band clamps. Protect insulation from clamps with pieces of split rubber hose inserted between clamps and cable. Attach cable to pipe halfway between clamps with waterproof tape (Scotch No. 33 or equivalent).

Submergence

Be sure the pump is always submerged, even at extreme pumping rates. Install pump at least 10 to 20 feet below the lowest "drawdown" water level and at least 5 feet above bottom of well.

Check Valves

Pump back spin and hydraulic shock can cause severe damage to pump and motor. Install at least one check valve to help prevent this.

Install check valve in discharge pipe, not more than 25 feet above pump. For 6" and larger submersible pumps installed more than 600 feet deep, install a second check valve at the pipe joint nearest to the half-way point between pump and ground level.

NOTICE: To avoid water hammer and pipe breakage, distance from first check valve to second check valve should not equal distance from second check valve to ground level.

Well and Pump Test

Check and record static water level of well before starting tests. Before making final piping connections, test flow rate, capacity, and condition of well.

NOTICE: Do not operate pump with discharge valve closed. Operate pump only within pressure and flow limits of operating range established by performance curve.

NOTICE: If sand is present in discharge, allow pump to run with discharge completely open until water is clear. If loud rattling noises develop, pump is probably cavitating. Gradually close discharge valve until rattling stops.

INSTALLATION - ELECTRICAL TESTS

⚠WARNING Risk of high voltage electrical shock when testing. Can stun, burn, or kill.

Only qualified electricians should perform these tests. When testing, use all normal precautions for the voltages involved.

Electrical test of motor, cable, connections

The cable and splices can be damaged as the pump is lowered into the well. To electrically test them, attach one lead of ohmmeter to pipe. Attach other lead to each cable lead in turn. See motor owner's manual for required resistance in a good motor. A low reading indicates that cable or splice has developed a leak to ground. Remove pump from well and correct problem before proceeding with installation.

Measure electrical resistance between motor leads and well casing when motor is cold.

Voltage test (Figure 2)

Low or high voltages can cause motor failure. While pump is operating, check voltage across each pair of leads at motor controller. Readings more than 10% above or below rated nameplate voltage can damage pump; correct before placing pump in service. Test as follows:

1. Disconnect main power supply and open controller.
2. Connect power and start pump. For 3-phase motors, read voltage across three pairs of leads (L1 – L3, L3 – L2, L2 – L1) while pump is operating. For single phase motors, read voltage across L1 and L2 while pump is operating. Voltage should be within ±10% of motor nameplate rated voltage. If not, consult power company.

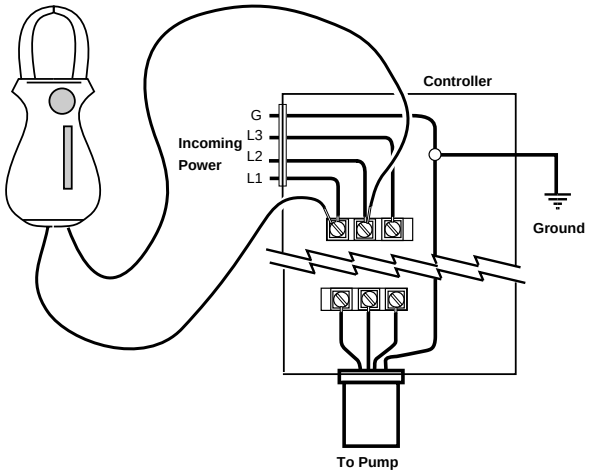


Figure 2: Voltage Test

Load current test (Figure 3)

Load current should be obtained on each motor lead at the controller. Partially close pump discharge valve (keep pressure and flow within specified operating range) until maximum amp reading has been obtained. Compare reading with motor nameplate rating. If reading is 15% or more over rated load, check for incorrect voltage in supply line or overload due to abrasives in pump. Find and correct problem before putting pump in service.

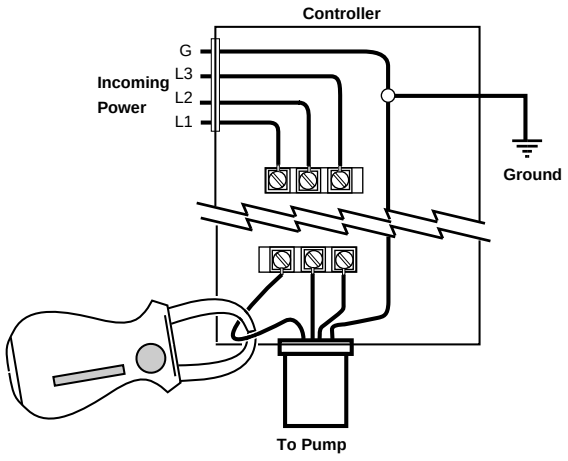


Figure 3: Load Current Test

Current unbalance test (3 Phase only)

Determine current unbalance by measuring current in each power lead. Measure current for all three possible hookups. Use example and worksheet (Page 5) to calculate current unbalance on a three phase supply system and retain for future reference.

NOTICE: Current unbalance should not exceed 5%. If unbalance cannot be corrected by rolling leads, locate and correct source of unbalance.

If, on all three possible hookups, the reading furthest from average stays on the same power lead, most of the unbalance is coming from the power source.

However, if the reading furthest from average changes leads as the hookup changes (that is, stays with a particular motor lead), most of the unbalance is on the "motor side" of the starter. In this case, consider a damaged cable, leaking splice, poor connection, or faulty motor winding.

Current Unbalance Example and Worksheet

3-Phase Current Unbalance - Example

Here is an example of current readings at maximum pump loads on each leg of a three wire hookup. Make calculations for all three possible hookups.

A. For each hookup, add the readings for the three legs:

Ex.: Hookup #1	Hookup #2:	Hookup #3
L1 = 51Amps	L1 = 50 Amps	L1 = 50 Amps
L2 = 46 Amps	L2 = 48 Amps	L2 = 49 Amps
L3 = 53 Amps	L3 = 52 Amps	L3 = 51 Amps
Total 150 Amps	Total 150 Amps	Total 150 Amps

B. Divide each total by three to get average amps:

Example: 150/3 = 50
Example: 150/3 = 50
Example: 150/3 = 50

C. For each hookup, find current value farthest from average (Calculate the greatest current difference from the average).

Ex. #1	Ex. #2	Ex. #3
50 Amps	50 Amps	50 Amps
–46 Amps	–48 Amps	–49 Amps
= 4 Amps	= 2 Amps	= 1 Amps

D. Divide this difference by the average and multiply by 100 to obtain the percentage of unbalance. Example:

Ex. 1: 4/50 = .08 x 100 = 8%
Ex. 2: 2/50 = .04 x 100 = 4%
Ex. 3: 1/50 = .02 x 100 = 2%

Use smallest percentage unbalance, in this case Ex. 3.

3-Phase Current Unbalance - Worksheet

Use this worksheet to calculate curent unbalance for your installation.

A. Add the readings for the three legs:

Ex.: Hookup #1	Hookup #2:	Hookup #3
L1 = Amps	L1 = Amps	L1 = Amps
L2 = Amps	L2 = Amps	L2 = Amps
L3 = Amps	L3 = Amps	L3 = Amps
Total Amps	Total Amps	Total Amps

B. Divide each total by three to get average amps:

Hookup #1: /3 =
Hookup #2: /3 =
Hookup #3: /3 =

C. For each hookup, find current value farthest from average (Calculate the greatest current difference from the average).

Hookup #1	Hookup #2	Hookup #3
Amps	Amps	Amps
Amps	Amps	Amps
Amps	Amps	Amps

D. Divide this difference by the average to obtain the percentage of unbalance:

Hookup #1: / = x100 = %
Hookup #2: / = x100 = %
Hookup #3: / = x100 = %

Use hookup with smallest percentage unbalance.

SERVICE

General

When installed in a clear well and operated under normal conditions, the submersible turbine pump requires no special maintenance. The hermetically sealed motor is pre-filled and self-lubricating. Completely tested at the factory, it should provide many years of dependable service. The motor is a continuous duty type and can operate continuously for long periods.

Removing Pump From Well

Most pump problems are caused by above-ground electrical problems. Minor control box components or outside electrical difficulties (such as low voltage) can cause a malfunction. Before removing pump from well, check motor windings for damage (check winding resistance with an ohmmeter – see Page 6). Eliminate all above-ground trouble causes before pulling pump. Pull the pump only as a last resort.

Sandlocked Pump:

NOTICE: Before pulling pump, make all possible above ground electrical tests. Most submersible pump problems are above ground, not in the pump itself.

NOTICE: Motor failure can result from starting a sandlocked pump. Do not bypass overload circuit or exceed

electrical rating when trying to start a siezed pump.

Remove a sandlocked pump from well for cleaning. To prevent pump from locking again when reinstalled, clean the well thoroughly before reinstalling the pump.

Cleaning Sandlocked Pump:

1. Insert a reducing bushing in discharge adapter cap to receive a hose coupling.
2. Use a hose to flush pump backwards (discharge to suction). Oscillate shaft backwards and forwards with a pump pliers and backwash pump for several minutes.
3. If pump cannot be freed, disconnect pump from motor, disassemble liquid end (see Page 7) and backwash sand from each part.

Checking Pump Performance:

Water containing abrasives can cause impeller wear and reduce impeller efficiency, resulting in overload conditions. In such cases, it is necessary to remove the pump from the well and replace the impellers to maintain capacity and pressure. To assure quality and integrity of the unit, replace with genuine parts available from your dealer.

ELECTRICAL TEST

The following electrical checks can be made with pump installed.

⚠WARNING Risk of high voltage electrical shock when testing. Can stun, burn, or kill. 0nly qualified electricians should perform these tests.When testing, use all normal precautions for the voltages involved.

Circuit (Winding) Resistance Test (Figure 4)

1. Shut off main power supply and disconnect motor wires.
2. Attach two ohmmeter leads to pairs of cable wires in turn (black and red wires on three wire single phase units). Compare readings with data provided in motor manual.
3. If reading is considerably higher than chart, an open circuit (broken wire) is indicated; if reading is considerably lower, a short circuit is indicated. In either case, remove pump from well and repair unit.

NOTICE: Be sure to include cable and winding resistance. Multiply cable length by the per-foot cable resistance (see Table IV, Page 2) and add winding resistance from motor chart to get total.

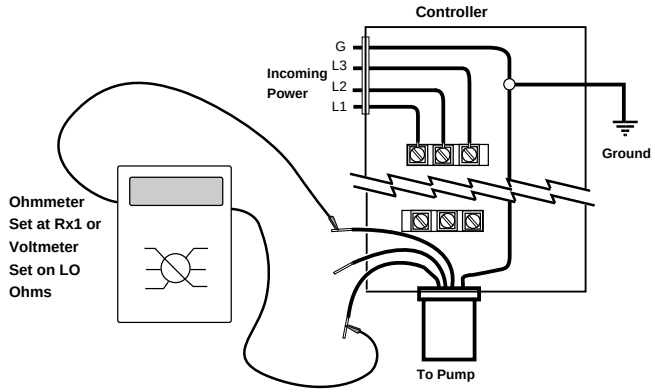


Figure 4: Circuit (Winding) Resistance Test

Ground Check (Figure 5)

1. Shut off main power supply and disconnect motor wires.

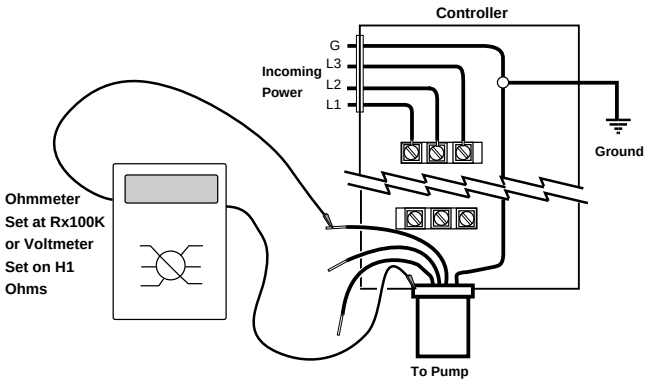


Figure 5: Ground Check

2. Attach one ohmmeter lead to pipe or METAL well casing and the other lead, in turn, to each individual motor wire.
3. If resistance reading goes to zero after touching any of the wires, the pump should be raised to determine location of ground fault (cable, motor, or splice).
4. Raise pump, watching resistance reading. When resistance goes to infinity, fault has come out of the water. If ground fault is located in cable or splice, repair it.
5. If ground fault appears to be located in motor, remove pump from well. Cut cable at motor side of splice and determine whether or not motor is grounded. If motor indicates complete ground (resistance reading goes to zero) replace unit.

If motor is not grounded, re-check splice and cable.

PUMP/MOTOR SEPARATION; PUMP DISASSEMBLY

NOTICE (Please read before starting):

- To avoid damage to the upthrust bearing, never stand the pump on the discharge adapter.
- Use an assembly fixture for disassembly/assembly; purchase it from Berkeley Pumps. When ordering, please specify pump model number, motor size, and horsepower.
- All threaded-bowl units have left-hand bowl threads.
- The stub shaft stick-up is 2-7/8" for 6" motors; the stick-up is 4" for 8" motors.

Removing Pump From Motor

1. Remove the cable guard from the pump; cut the cable off of the motor leads just above the splice.
2. Remove the suction screen; remove the nuts holding the pump to the motor. Using suitable lifting apparatus, hoist pump off of motor.
3. If you are returning the motor to the factory, cut motor lead above cable splice, leaving motor lead installed in motor. Don't work on the motor before returning it. To prevent damage in transit, crate the motor as it was when shipped new.

Pump Disassembly

1. Remove coupling from shaft.
2. Fasten pump in chain vise.
3. Remove the discharge.
4. Remove the last stage bowl.
5. Mount the fixture to the pump suction bracket with a 1/4" spacer inserted between the fixture and the end of the pump shaft. Bolt the fixture to the pump bracket.
6. Slip the collet driver , large end first, over the shaft and tap on the impeller to loosen the collet. **Do not** use a pipe wrench or any other tool that could damage or scar the impeller or the pump shaft.
7. Remove the impeller and the collet. Mark the impeller and the bowl as they come off so that they can be reassembled as a pair.
8. Repeat steps 4 and 5 for all stages.
9. If the unit has a lower sand collar, mark the collar location on the shaft and remove the collar.
10. Remove the shaft from the suction bracket (be careful not to damage the suction bracket bearing).
11. Clean each part. Dress down any burrs raised during diassembly. Make sure all flanges and mating fits are free of burrs, rust, and dirt.

PUMP INSPECTION/ MAINTENANCE

Wear: While pump is disassembled, visually check the following for wear:

- Bearings
- Bowl Skirts
- Upthrust Screw
- Impellers
- Pump Shaft

Shaft Runout (TIR): Pump shaft must be straight to within .002" TIR, measured every 6" along pump shaft.

Impeller Wear Ring Clearance: Measure bowl bore-to-impeller wear ring radial clearance with a micrometer. Maximum design clearance is .007" per side. Replace assembly if clearance is more than .011" per side.

NOTICE: Axial wear may indicate improper upthrust adjustment. See Step 10, Page 10, or Steps 11 and 12, Pages 12 and 13.

Bearing Clearance (Bronze only): Measure shaft/bearing cearance. Maximum design clearance is .009" per side. Replace bearing if clearance is more than .013" per side.

Shaft Diameter:

6", 7" – 1.00" Diameter
8" – 1.18" Diameter
10" – 1.50" Diameter

Rubber Bearing Replacement:

A. Use a wooden or plastic tool to push rubber bearing out of bowl. Push from discharge side of bowl toward suction side.
B. Remove all fragments from bowl bearing bore and clean up the bore .
C. Lubricate the new bearing with water (oil or glycerin do not give sufficient flow to adequately lubricate the bearing) and push it into the bearing bore. All 6T75 and 90 series pump bearings must be fastened in place with rubber cement.

Bronze Intermediate bearing Replacement:

1. Press old bearing out with an arbor press or tap it out with a hammer and dowel. Do not score the bearing bore.
2. Wipe the bearing bore clean.
3. Press the new bearing into the bore; use light oil if necessary to aid the pressing. If a press is not available, protect the bearing with a wood block and tap it into place. Make sure the bearing is aligned with the bearing bore.

NOTICE: The bronze bearing is a press fit; do not bond it in place. If the bearing is loose in the bearing bore, replace the bowl. See Table VI, below, for installation location of bronze intermediate bearings. Pumps with less than six stages do not require an intermediate bearing.

Bronze Suction Bracket Bearing Replacement: See "Assembling Pump", Page 8, Step 2, for this procedure.

Table VI: Intermediate Bronze Bearing Locations (Notice: 6T- Series pumps use all rubber bearings [no bronze]; 7T-, 8T-, and 10T- use a combination of rubber and bronze bearings).

No. of Stages	No. of Bearings	Install at Stages
6	1	3
7,8	1	4
9,10	1	5
11,12	2	4,8
13,14	2	5,9
15	2	5,10
16,17	3	4,9,13
18,19	3	4,9,14
20	3	5,10,15
21,22	4	4,9,13,17
23,24	4	4,9,14,19
25	4	5,10,15,20
26,27	5	4,9,14,18,22
28,29	5	4,9,14,19,24
30	5	5,10,15,20,25
31,32	6	4,9,14,19,23,27
33,34	6	4,9,14,19,24,29
35	6	5,10,15,20,25,30
36,37	7	4,9,14,19,24,28,32
38	7	4,9,14,19,24,29,34

PREVENTIVE MAINTENANCE

To avoid major repairs, make the checks listed below every 4 to 6 months.

TEST	RESULT SHOULD BE	POSSIBLE INDICATIONS
1. Measure and record the standing water level (from top of well casing).	1. Reference number.	1. To aid in monitoring pump performance.
2. Measure electrical resistance between motor leads and well casing with motor cold.	2. See motor manual.	2. See motor manual.
3. Check pump flow capacity (gallons per minute).	3. At least 90% of readings at installation.	3. Lower readings may indicate pump needs repair.
4. Check pump discharge pressure (PSI) at operating conditions.	4. At least 90% of readings at installation.	4. Lower reading indicates pump wear, increased friction losses, or change in standing water level in well.
5. Check drawdown level (in feet) from standing water level.	5. High enough so that pump does not break suction.	5. Cavitation can damage pump; increased drawdown may indicate reduced well flow.
6. Measure voltage across motor leads while pump is operating.	6. Within ±10% of rated voltage.	6. If voltage is more than 110% or less than 90% of rated voltage, consult power company.

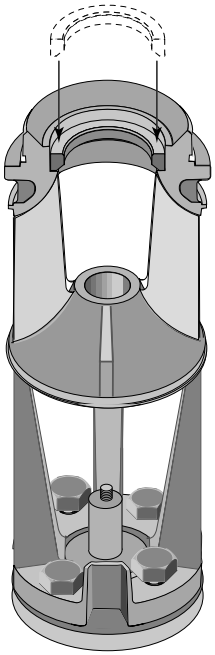
NOTICE: ***Before beginning assembly of Models 6T-75, 6T-90, 6T-115, or 6T-155:*** Install a press-fit wear ring in the suction bracket of these models. **See Page 13 for Fixture drawing and dimensions.**

See Page 7 for rubber bearing replacement procedure.

MODEL 6T SUBMERSIBLE TURBINE ASSEMBLY

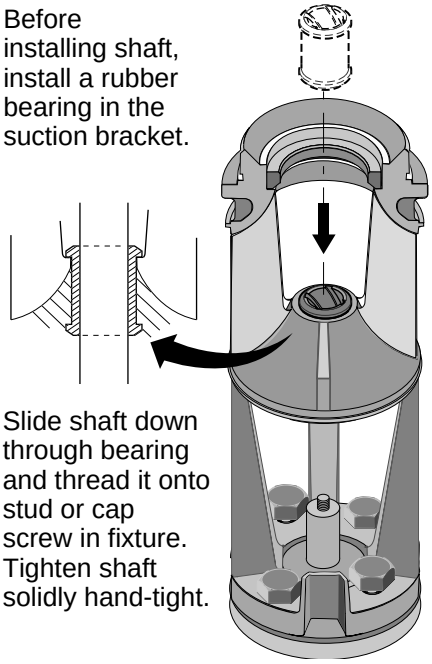
Step 1

Press a wear ring into the suction bracket as shown. See **NOTICE** above. Install ring with large (internal) chamfer going first.



Step 2

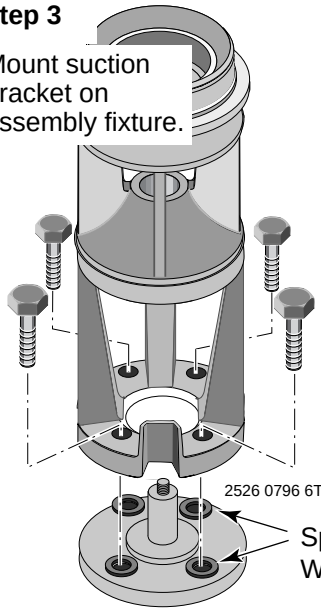
Before installing shaft, install a rubber bearing in the suction bracket.



Slide shaft down through bearing and thread it onto stud or cap screw in fixture. Tighten shaft solidly hand-tight.

Step 3

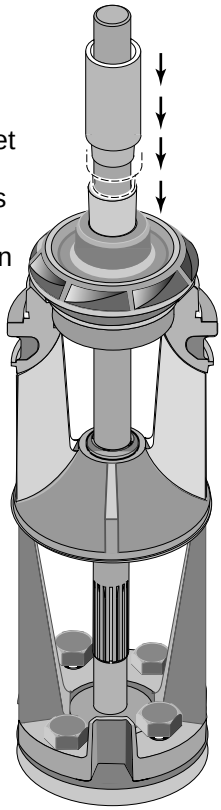
Mount suction bracket on assembly fixture.

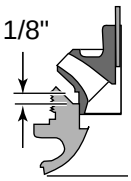


Install 1/8” Spacing Washers under suction bracket.

Step 4

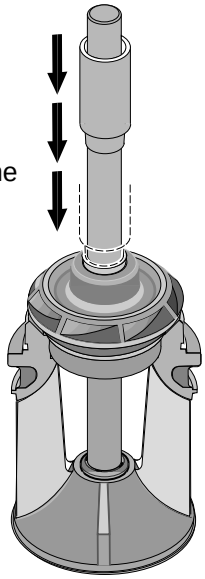
Clean shaft and collet to remove all oils and contaminants. Lift the impeller about 1/4” and lightly tap the collet in with the collet driver until there is about 1/8" clearance between the impeller and the bracket.





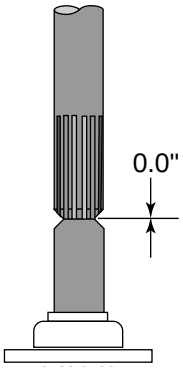
Step 5

Set the collet with two or three hard blows on the collet driver (until the impeller touches the bracket).



Step 6

Check the shaft position. The shaft should be down solidly on the fixture. If not, the stud or cap screw in the fixture has broken. Replace it before proceeding.

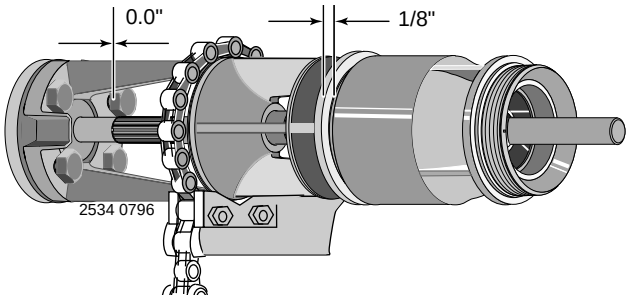


After the impeller is correctly set, remove the 1/8” spacers from the fixture. Bolt the suction bracket tightly to the fixture.

Step 7

Clamp the assembly (with fixture attached) in a chain vise. There should be no clearance between the shaft end and the fixture.

Apply Loctite 271 to the first stage bowl and thread it onto the suction bracket. Stop it with the leading edge about 1/8" away from the suction bracket flange.

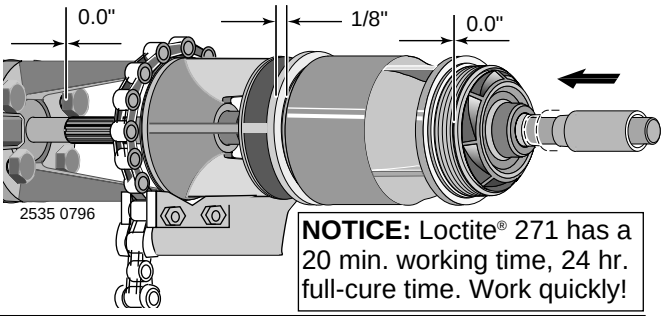


Step 8

Clean shaft and collet. Slide the next impeller over the shaft and insert the collet. Tap the collet in with the collet driver (see Steps 4, 5, and 6) until the impeller is seated on the bowl.

Drive the collet home with the driver.

Check the shaft to make sure that it has not moved away from the fixture.

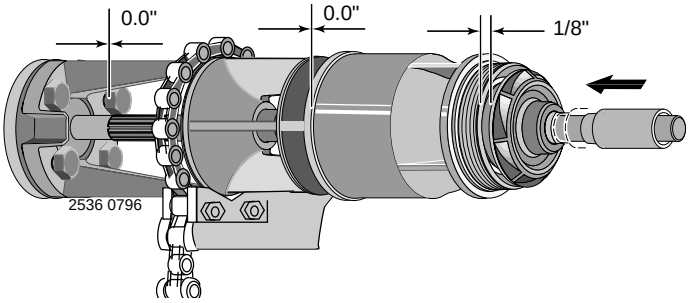


NOTICE: Loctite® 271 has a 20 min. working time, 24 hr. full-cure time. Work quickly!

Step 9

Thread the bowl down tight on the suction bracket.

At the end of this step, the bowl should be tight on the suction bracket, and the impeller should clear the bowl by about 1/8".



Repeat steps 7, 8, and 9 for the remaining bowls and impellers, up to but not including the last stage bowl (which takes the discharge but no impeller).

After installing each stage, make sure that the impeller has approximately 1/8" clearance from its bowl.

When you have installed all stages except the last stage bowl, go on to Step 10, below.

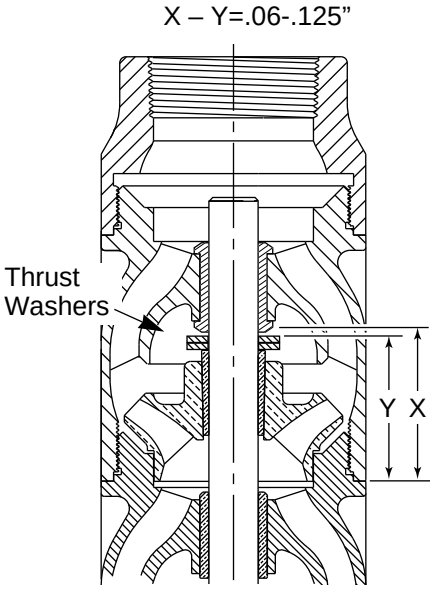
Step 10

Install rubber bearing in last stage bowl bore.

Slide one or two upthrust washers (depending on clearances – see picture, at right) over shaft and onto impeller hub.

Install the last stage bowl and tighten. Remove fixture bolts and unscrew the fixture from the shaft; check the pump for free rotation. Shaft end play should be 1/16-1/8" (.0625–.125")

Add the discharge and tighten. Recheck for free rotation.



Step 11

Take the pump out of the vise and install it on the motor.

Install the lead guard.

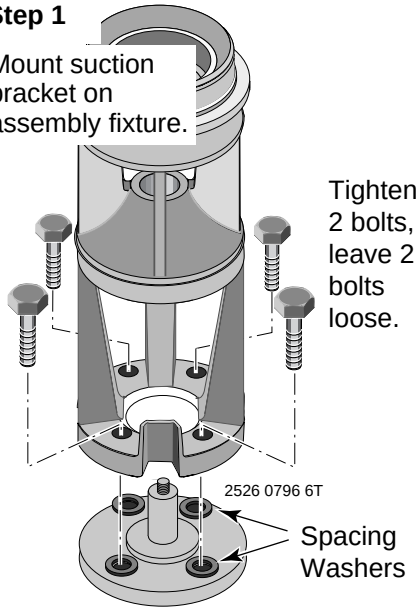
The pump is now ready for service.

NOTICE: ***Before beginning assembly of Model 7T-175:*** Install a press-fit wear ring in the suction bracket of this model. **See Page 13 for Fixture drawing and dimensions.**

MODEL 7T, 8T, AND 10T SUBMERSIBLE TURBINE ASSEMBLY

Step 1

Mount suction bracket on assembly fixture.



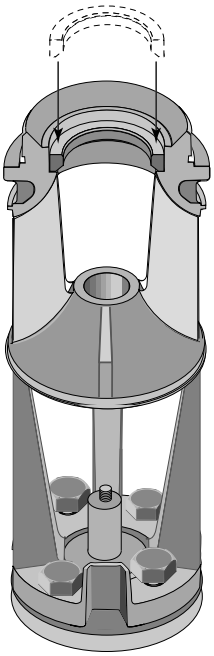
Install 1/8” Spacing Washers under suction bracket.

Step 2

Certain 7T-models require press fit wear rings as shown, one in the suction bracket and one in each stage.

See **NOTICE** above. Install rings with large (internal) chamfer going first.

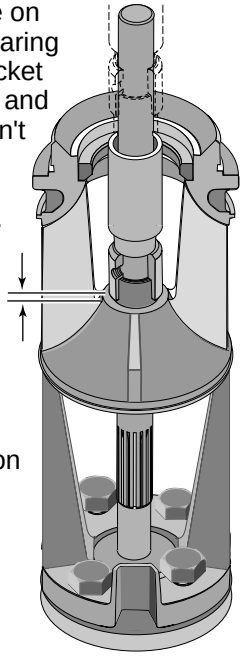
7-T models have a threaded shaft. Tighten shaft onto stud or cap screw on fixture to hold shaft in place during assembly.



Step 3

With shaft loose on fixture, Drive bearing into suction bracket with sand collar and collet driver. Don't use a press; it could deform or cock bearing. Leave shaft loose and the bearing will center itself.

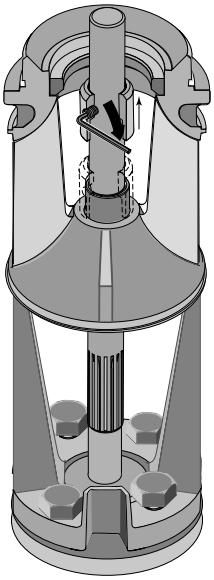
1/8" Final clearance between sand collar and suction bracket.



Step 4

Slide the sand collar up and tighten the set screw to hold it up and out of the way.

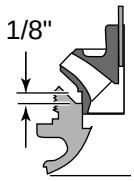
The sand collar must not interfere with the shaft during impeller installation.

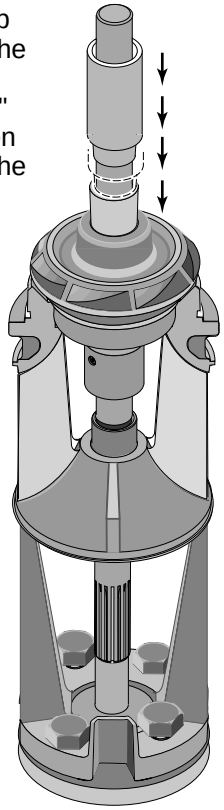


Step 5

Clean shaft and collet to remove all oils and contaminants.

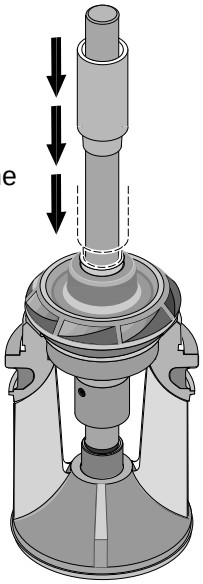
Lift the impeller about 1/4” and lightly tap the collet in with the collet driver until there is about 1/8" clearance between the impeller and the bracket.



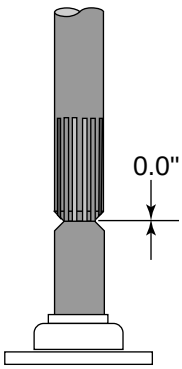


Step 6

Set the collet with two or three hard blows on the collet driver (until the impeller touches the bracket).



Check the shaft position. The shaft should be down solidly on the fixture. If not, see Step 7.

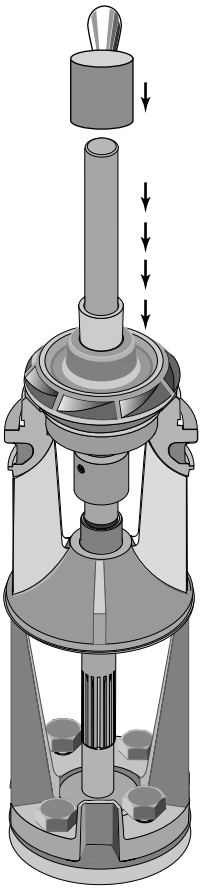


Step 7

If the shaft is up from the fixture, use the rubber mallet to tap down the entire shaft, collet, and impeller assembly until the shaft is solidly in position. Don't move the impeller along the shaft!

NOTE: Shafts on 7T models thread onto stud or capscrew in fixture; don't hammer on the shaft on these models. If shaft has lifted off of fixture, stud has broken; replace it before proceeding.

After the impeller is correctly set, remove the 1/8" spacers from the fixture. Bolt the suction bracket tightly to the fixture.



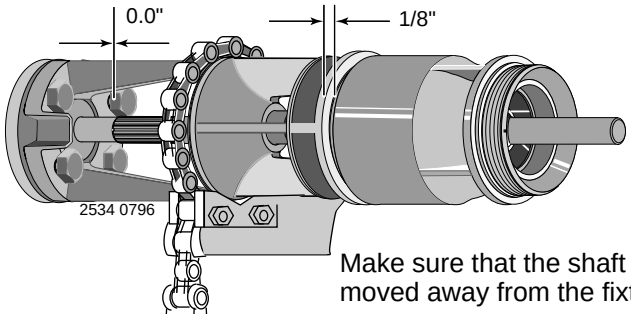
NOTICE: Each stage gets either a rubber bearing or a pressed-in bronze bearing. See Page 8 for bearing replacement procedure and for location of pressed-in bronze bearings (Table VI).

Step 8

Clamp the assembly (with fixture attached) in a chain vise. If there is any clearance between the shaft end and the fixture, reset the shaft as shown in Step 7.

For flanged bowls, space each stage as you did the suction bracket, using the 1/8" spacers between the bowl flanges.

For threaded bowls, apply Loctite 271 to the first stage bowl and thread it onto the suction bracket. Stop it with the leading edge about 1/8" away from the suction bracket flange.



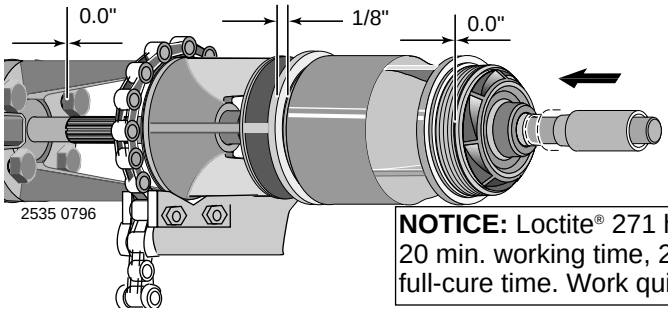
Make sure that the shaft has not moved away from the fixture.

Step 9

Clean shaft and collet. Slide the next impeller over the shaft and insert the collet. Tap the collet in with the collet driver (see Steps 5, 6, and 7) until the impeller is seated on the bowl.

Drive the collet home with the driver.

Check the shaft to make sure that it has not moved away from the fixture.



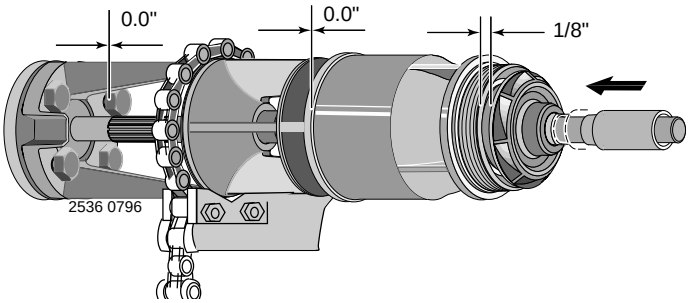
NOTICE: Loctite® 271 has a 20 min. working time, 24 hr. full-cure time. Work quickly!

Step 10

Threaded bowls: Thread the bowl down tight on the suction bracket.

Flanged bowls: Remove the spacers and bolt the bowl tightly to the suction bracket.

At the end of this step, the bowl should be tight on the suction bracket, and the impeller should clear the bowl by about 1/8".



Repeat steps 8, 9, and 10 for the remaining bowls and impellers, up to but not including the last stage bowl (which takes the discharge but no impeller).

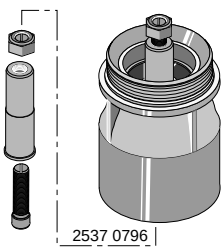
After installing each stage, make sure that the shaft is still solidly against the fixture and that each impeller has approximately 1/8" clearance from its bowl.

When you have installed all stages except the last stage bowl, go on to Step 10, below.

Step 11

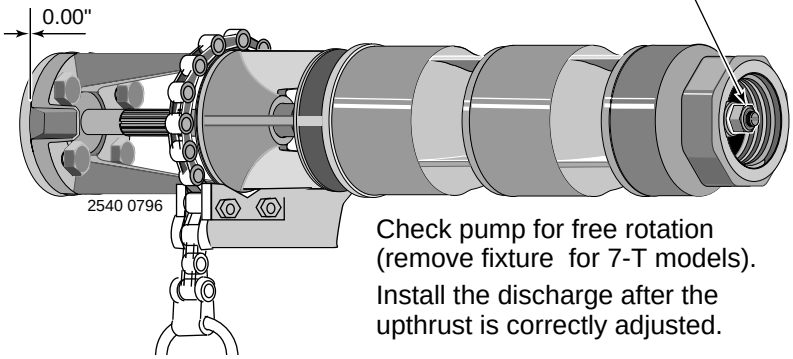
Assemble the upthrust bearing and insert it into the last stage bowl as shown.

Back out the upthrust bearing as far as possible and then thread this bowl onto the preceding bowl and tighten it.



Step 12

With the fixture still bolted to the pump and all the bowls tightened down, adjust the upthrust bearing. Tighten upthrust bearing until it bottoms on the end of the shaft, then back it off 1 to 1-1/2 turns to give 1/16-3/32"(.0625-.094") clearance.



Check pump for free rotation (remove fixture for 7-T models).

Install the discharge after the upthrust is correctly adjusted.

Step 13

Take the pump out of the vise.

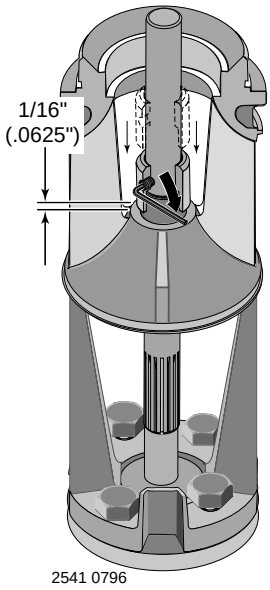
Slide the sand collar down and set it with about 1/16" (.0625") clearance to the suction bracket.

Prick punch, drill, and tighten the set screw; use Loctite to hold it.

Remove the pump from the fixture and install it on the motor.

Install the lead guard.

The pump is now ready for service.



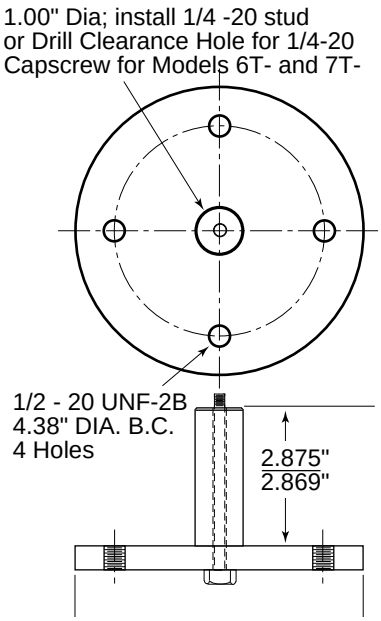


Figure 6: Assembly fixture dimensions for 6" motor; stickup is motor height. Use 1/4–20 stud or capscrew to hold shaft of 6T- and 7T- models only. When using cap screw, it must be long enough to pass through fixture and clamp shaft tight against fixture post.

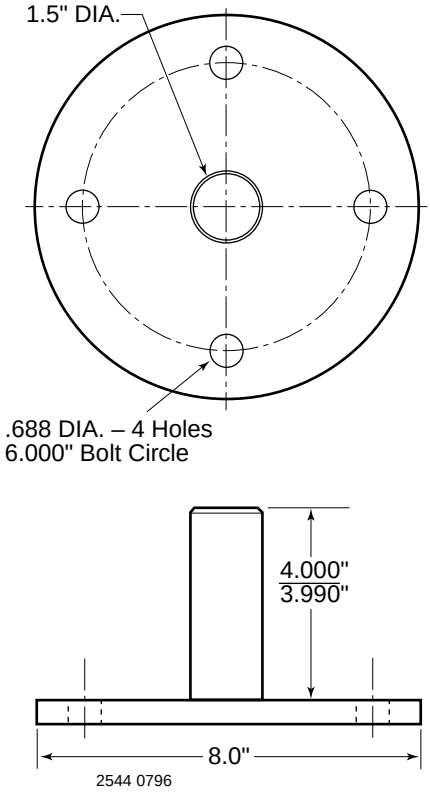
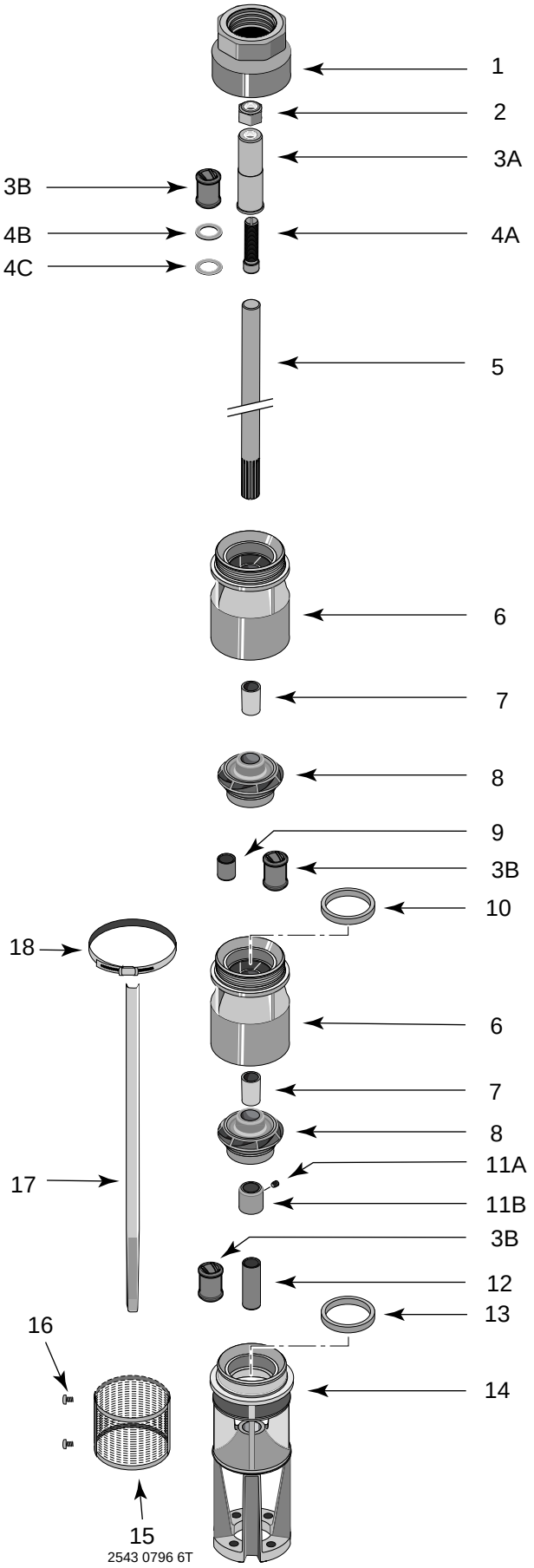


Figure 7: Assembly fixture dimensions for 8" motor; stickup is motor height.

Repair Parts List

6T, 7T, 8T, and 10T Submersible Turbine Pumps



Key No.	Part Description
1	Discharge
2	Upthrust Nut (All 7T-, 8T- and 10T- Models)
3A	Upthrust Bearing (All 7T-, 8T- and 10T- Models)
3B	Rubber Bearing (All 6T- Models)
4A	Upthrust Screw (All 7T-, 8T- and 10T- Models)
4B	Upthrust Washer (All 6T- Models)
4C	Shim (All 6T- Models as required)
5	Pump Shaft
6	Bowl
7	Collet
8	Impeller
9	Bronze Bearing *
10	Wear Ring (Model 7T-175 only)
11A	Set Screw for Sand Collar
11B	Sand Collar
12	Suction Bearing (All 7T-, 8T- and 10T- Models)
13	Wear Ring (Models 6T-75, 6T-90, 6T-115, 6T-155, 7T-175)
14	Suction Bracket
15	Suction Screen
16	Suction Screen Screws
17	Lead Guard
18	Lead Guard Clamp

• Not illustrated.

* See Page 8 for placement of bronze bearings.

Please be sure to include pump model number, horsepower, GPM rating and any other pertinent information when ordering pump parts.

TROUBLESHOOTING

⚠ WARNING Hazardous voltage. Can shock, burn, or kill. When troubleshooting or servicing pump, use all normal precautions for the voltages involved.

1. Disconnect power unless required for testing.
2. Have electrical testing done by a qualified electrician.
3. Most problems occur above ground. Remove pump from well only as a last resort.

PROBLEM	POSSIBLE CAUSE	REMEDY
Fuses blow or overload circuit breaker trips when motor starts.	1. Pump sandlocked.	1. a) Check motor winding resistance - see "Circuit (Winding) Resistance", Page 6. b) If motor is not shorted, turn on current and rap discharge pipe sharply to loosen sand. c) Pull pump and clean.
	2. Low or high voltage.	2. Check line voltage (see Page 4). If high or low, contact power company.
	3. Cable damaged or shorted.	3. Check pump cable for ground (see Page 6).
	4. Pump forced into crooked well.	4. Forcing pump into a crooked hole will cause mis-alignment of pump and motor. Consult well driller.
Fuses blow or overload trips while motor is running.	1. Low or high voltage.	1. Check voltage on service lines (see Page 4).
	2. Water contains abrasives.	2. If water contains excessive sand, remove pump and clean sand out of well.
	3. Motor or cable shorted and/or grounded.	3. See "Circuit (Winding) Resistance Test" and "Ground Check", Page 6.
Motor does not start but does not blow fuses or trip circuit breaker.	1. Fuses blown or circuit breaker tripped.	1. Reset circuit breakers or replace fuses.
	2. Voltage does not reach terminals.	2. 3-Phase: Check voltage at controller between wire pairs: L1 – L3, L3 – L2, L2 – L1. Single Phase: Check voltage between L1 and L2 on box terminal strip.
	3. Loose wire in control box.	3. Check and tighten all wires.
	4. Defective magnetic controller coil.	4. Check starter and coil.
Pump does not shut off.	1. Cable leads improperly connected.	1. Check wiring diagram on box cover for correct connections.
Motor runs, but delivers little or no water.	1. Horizontal line check valve installed backwards.	1. Reinstall correctly.
	2. Motor running backwards (3-Phase only).	2. Reconnect motor for proper rotation (see Page 3).
	3. Pump gaslocked.	3. Start and stop pump several times allowing one minute between stops and starts.
	4. Water level in well has dropped.	4. a) Restrict pump flow to equal well production. b) Install liquid level control. c) Reset pump lower in well.
	5. Leak in discharge pipe.	5. Raise pipe until leak is found.
	6. Coupling between motor shaft and pump shaft broken.	6. remove pump from well and check coupling.
	7. Pump parts worn from abrasives.	7. a) Check pump shut-off pressure. Pressure should be at least 90% of pressure at installation. b) Replace worn parts.
	8. Intake screen clogged.	8. Remove pump from well and clean screen.
	9. Pump set below recommended depth.	9. a) Reduce pressure switch setting until pump will shut off. b) Install pump producing higher pressure.
	10. Discharge pipe friction reduces output.	10. Install larger pipe or pump producing higher pressure.

BERKELEY LIMITED WARRANTY

Berkeley/Wicor Canada Company ("Wicor") warrants to the original consumer purchaser ("Purchaser") of its products that they are free from defects in material or workmanship.

If within twelve (12) months from the date of installation or twenty-four (24) months from the date of manufacture any such product shall prove to be defective, it shall be repaired or replaced at Berkeley's/Wicor's option, subject to the terms and conditions set forth below.

General Terms and Conditions

Purchaser must pay all labor and shipping charges necessary to replace product covered by this warranty. This warranty shall not apply to products which, in the sole judgement of Berkeley/Wicor, have been subject to negligence, abuse, accident, misapplication, tampering, alteration; nor due to improper installation, operation, maintenance or storage; nor to other than normal application, use or service, including but not limited to, operational failures caused by corrosion, rust or other foreign materials in the system, or operation at pressures in excess of recommended maximums.

Requests for service under this warranty shall be made by contacting the installing Berkeley/Wicor dealer as soon as possible after the discovery of any alleged defect. Berkeley/Wicor will subsequently take corrective action as promptly as reasonably possible. No requests for service under this warranty will be accepted if received more than 30 days after the term of the warranty.

The warranty on all three phase submersible motors is void if three-leg overload protection of recommended size is not used.

This warranty sets forth Berkeley's/Wicor's sole obligation and purchaser's exclusive remedy for defective products.

BERKELEY/WICOR SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, OR CONTINGENT DAMAGES WHATSOEVER.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS WARRANTIES. IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL NOT EXTEND BEYOND THE DURATION OF THE APPLICABLE EXPRESS WARRANTIES PROVIDED HEREIN.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

In the U.S.: Berkeley, 293 Wright St., Delavan, WI 53115

In Canada: Wicor Canada Company, 1800 Courtney Park Drive East, Unit 5-7, Mississauga, Ontario L5T 1W1

Wicor Canada Company, 200-E, Rue St-Louis, St-Jean-Sur-Richelieu, Québec J3B 1Y1