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A RUTHMAN COMPANY

# **VERTICAL AND HORIZONTAL END SUCTION PUMPS INSTALLATION, OPERATION AND MAINTENANCE MANUAL**

**MAINTENANCE • INSTALLATION • OPERATIONS**

**Installation  
Instruction  
Manual**

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### General Information:

Although Gusher Pumps, Inc. have taken every precaution to prevent damage in shipment we recommend that you check the pump for visible damage such as cracks, holes, indentations, etc. upon arrival. Some damage isn't visible such as a bent shaft. This is checked by turning the rotating element of the pump by hand to assure free rotation (remove the motor fan cover if necessary). You should now check the name plate to be sure that you have received what you ordered. Here we provide a list of the things to check and record for future reference.

Keep this manual in a convenient location for quick reference.

Model .....

Motor frame size .....; Impeller Dia. ....

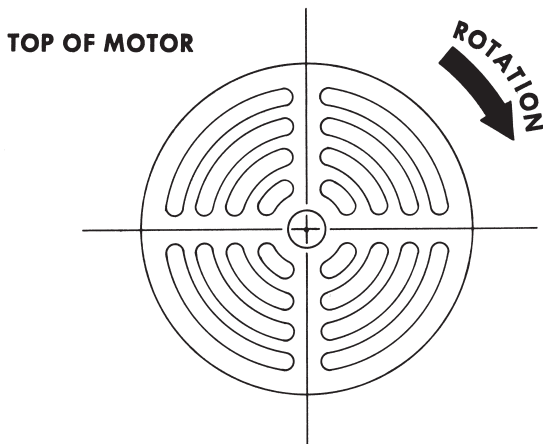
H.P. ....; Ph. ....; Cy. ....; RPM .....; Amps .....

Voltage .....; Serial No. ....

Performance G.P.M. .... @ T.D.H. .... in p.s.i.

## Installation Vertical Pump:

Gusher vertical end suction pumps with integral shaft is easily installed and put into service. With the one piece shaft design there is no couplings to align, no shims or no special adjustments to make. With the use of one of Gusher's clamp on brackets that fit around the stem's column the pump can be quickly set into position and bolted down. When piping your machine we recommend the use of as large a pipe as is practical from the pump to the point of delivery. It is advisable to install a pressure gauge in the discharge line as close to the pump as possible. It is also recommended to install a gate valve in the discharge line down stream from the pressure gauge. It is **IMPORTANT** to note that the machine piping should be self supporting and in no way supported by the pump impeller housing or discharge connection. After the pipe is installed we recommend the pump rotating element be turned by hand to check for bind-



ing. This is done by inserting a screw driver in the slots in the fan cover and turning the pump by hand. If there is a drag or if there is a tight spot you should check the piping system to be sure it is supported properly, if not, secure properly and recheck. When you are positive the pump is rotating free, wire the motor being sure to conform to all state and local electrical codes. Before putting the unit into operation, check the direction of rotation by jogging the motor starter on and off. The direction of rotation is clockwise when viewing from the top of the motor. If the pump is turning the wrong direction, reverse any two of the line wires at the motor in the conduit box or at the motor starter.

## Installation 'CM' and 'CDM' Style:

For jobs requiring coupled motors the above installation instructions apply with the addition of the coupling alignment, see page 5 for details on coupling alignment.

## Operation:

Before starting the pump the reservoir should be filled to the minimum level so as to completely submerge the pump impeller housing in the liquid which assures priming of the pump. Upon initial start-up we recommend that you check and maintain the minimum liquid level in your reservoir, it is also advisable to check your piping for leak at this time. We also recommend that you check and record (use space provided) the pump discharge pressure, line voltage, amperage being drawn by the motor and the operating temperature of the ball bearings.

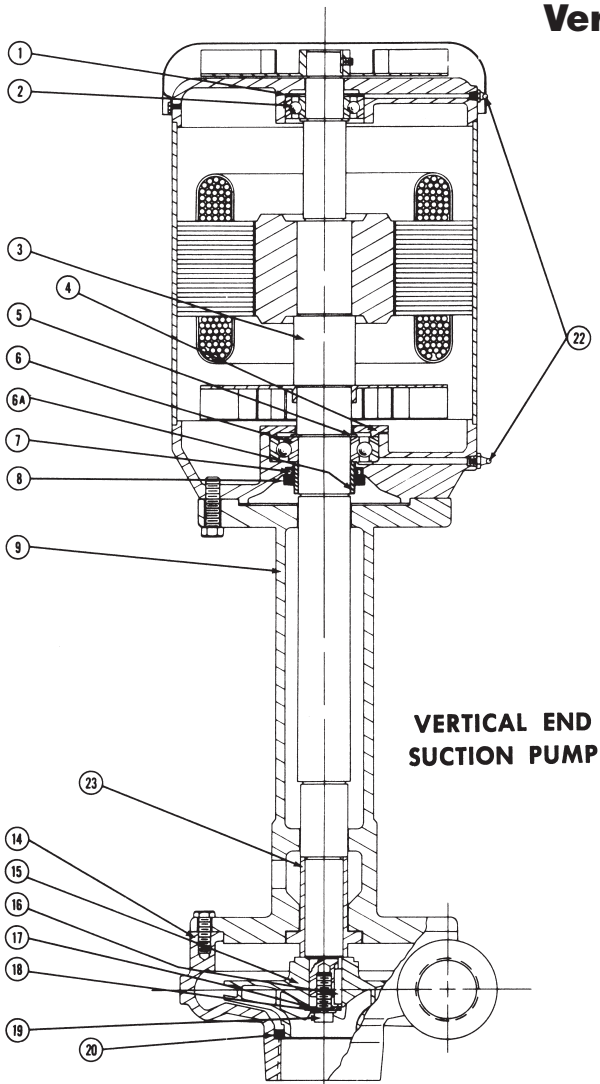
	At shut-off (valve in discharge line closed)	At operating condition
Pressure	.....	.....
Voltage	.....	.....
Amperage	.....	.....
Temperature	.....	.....

Temperature should be checked with a pyrometer, do not check by touch, temperatures that are hot to the touch are often well within the maximum operating temperature of 225°F.

If a problem develops check trouble shooting section on page 11. If you are unable to solve your problem using this section, contact Gusher Pumps, Inc. for assistance.

# Vertical End Suction Pumps

## INTEGRAL SHAFT



Part No.	Description
1	Load Spring
2	Ball Bearing
3	Shaft
4	Ball Bearing Retainer
5	Snap Ring
6	Ball Bearing
6A	Press Collar
7	Grease Seal
8	Rubber Slinger
9	Stem
14	Impeller Housing
15	Impeller
16	Square Key or Woodruff Key
17	Impeller Retaining Washer
18	Lock Washer
19	Impeller Retaining Screw
20	Wear Ring
22	Grease Fitting
23	Throttle Sleeve
24	Adapter
25	Locknut & Washer
26	Ball Bearing Housing
27	Motor Base Bracket ('CM' Models)
28	Ball Bearing Retainer ('CM' Models)
30	Discharge Flange

### General Repair:

**DISASSEMBLY.** . . Shut off main power switch and disconnect the motor wiring. Close the inlet and outlet valves, disconnect the piping at the unions and remove from service. Remove the screws securing the impeller housing (14) to the stem (9), remove the impeller housing. Take off the retaining screw (19) and slide the impeller ( 15) and throttle sleeve (23) off the shaft (3). Take off the stem (9) by removing four screws securing it to motor end bell and slide it off the shaft. Check for wear, replace worn parts where necessary and reassemble by reversing the procedure.

**BALL BEARING REPLACEMENT...**Follow the above steps to stem removal. Remove screws in fan cover & remove cover, loosen set screw in fan and remove fan, remove four screws securing upper end bell to stator and remove end bell, remove screws in bearing retainer (4), lay a block of wood or some other soft material on the floor and tap the shaft (3) and ball bearing (6) out of the stator and lower end bell using the weight of the stator as you drop the shaft on the block of wood lightly. (Fig. 1) Tap the old bearings off the shaft and install new ones by following the instructions on page 10. To reassemble, reverse procedure.

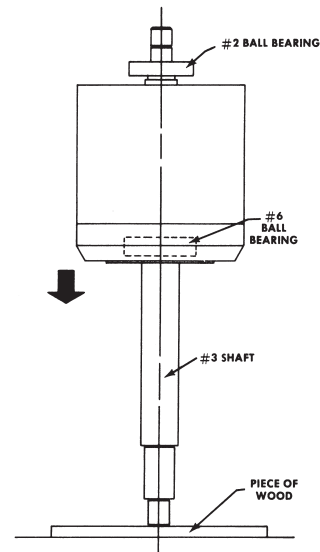
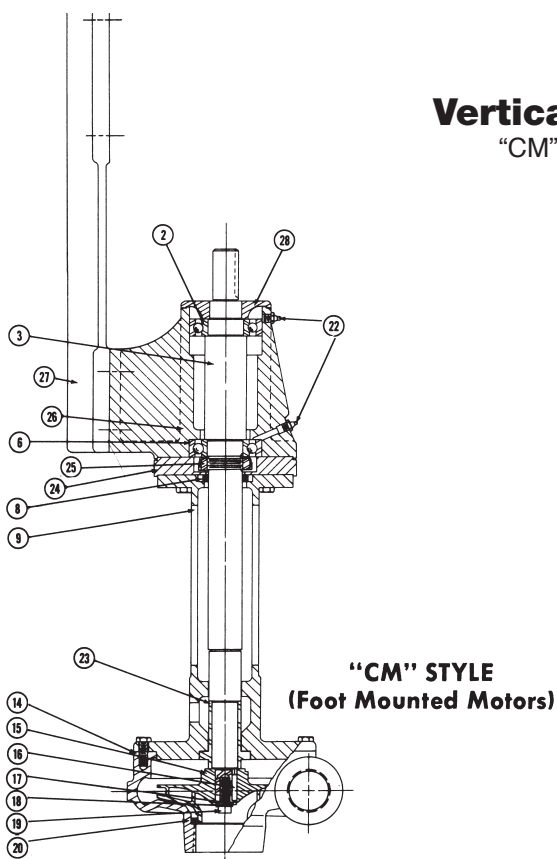


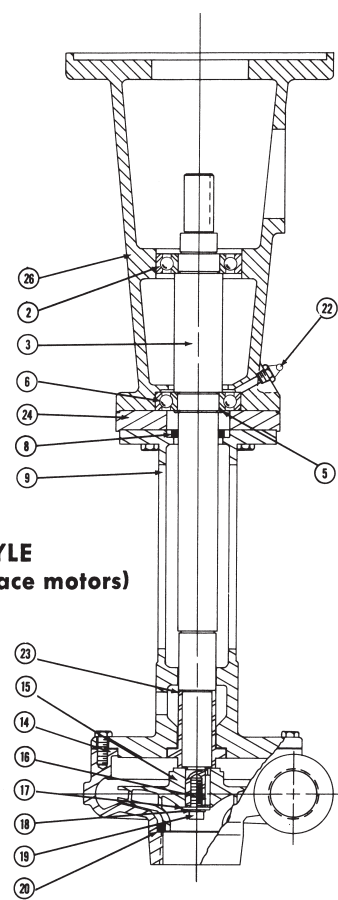
FIG. 1

## Vertical End Suction "CM" & "CDM" STYLE



**"CM" STYLE  
(Foot Mounted Motors)**

**"CDM" STYLE  
(For use with "C" Face motors)**

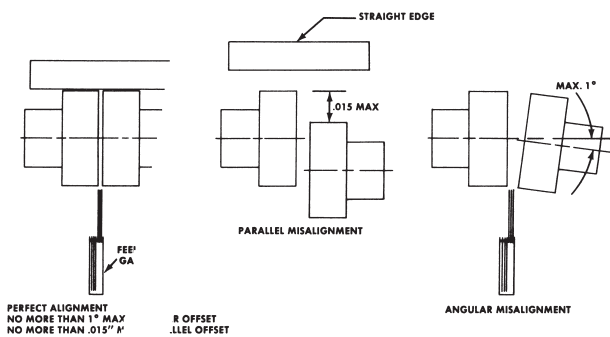


### Coupling Alignment:

You will need a straight edge and a feeler gage to check coupling alignment. To check parallel alignment, place the straight edge on four sides of the coupling. If the edge lies flat on all four sides, parallel alignment is okay.

To check angular alignment, the feeler gage is placed in four different locations between the coupling halves 90° apart, if the distance is the same in all four positions, the angular alignment is okay.

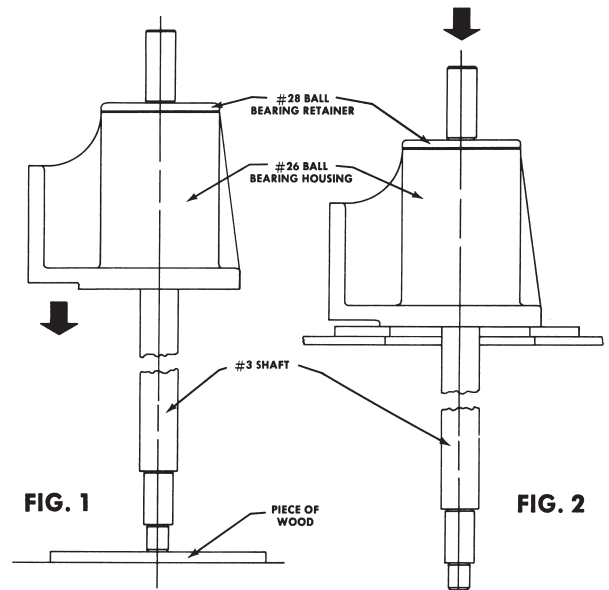
The faces of the coupling should be spaced apart slightly, just enough that the two faces don't rub (approx. 1/8").



### General Repair:

**DISASSEMBLY...** Shut off main power switch and disconnect the motor wiring. Close inlet and outlet valves, disconnect the piping at the union and remove from service. Remove screws securing the impeller housing (14) to the stem (9), remove the impeller housing. Take off the retaining screw (19) and slide the impeller (15) and throttle sleeve (23) off the shaft (3). Take off the stem (9) by removing four screws securing stem to bearing housing (26). Check for wear, replace worn parts and reassemble by reversing procedure.

**BALL BEARING REPLACEMENT...** Follow the disassembly procedure to stem removal. Remove four screws securing pump to motor base bracket (27), remove retaining rings from coupling spider and remove spider, and separate pump from motor. Remove lock nut & washer (25), drop pump shaft end on piece of wood placed on the floor. (Fig. #1) Ball bearing retainer (28) is installed using the thermo expansion method of installing ball bearings and you may have to put the unit in an arbor press to remove. (Figure #2) Ball bearing (2) is mounted on the shaft prior to reassembly and ball bearing (6) is installed in bearing housing (26) prior to reassembly. For proper method of ball bearing installation see page 10. To assemble, insert shaft through bearing housing and reverse above procedure.





## Installation Horizontal Pump:

Before starting any centrifugal pump the suction line and impeller housing must be filled with liquid being pumped. If the pump is located below the liquid level in the reservoir the pump may be primed by removing the vent plug and allowing liquid to fill the suction line and impeller housing. To prime a pump operating under suction lift condition there must first be a foot valve installed in suction line. Liquid is then poured into the impeller housing through the vent plug or through the check valve in the discharge line until suction line and housing is filled with liquid being pumped. The unit will remain primed as long as the foot valve is operational.

**SUCTION PIPING...**The suction pipe must be kept free of air leaks. This is particularly important when the suction line is long or the static lift is high. The suction pipe should always slope gradually up toward the pump. Any high point in the pipe will become filled with air and prevent proper operation of the pump. A concentric reducer should not be used in a suction line, it forms air pockets in the top of the reducer and the pipe. Use an eccentric reducer instead (see illustrations). Small air pockets that may cause problems are often formed in the top of gate valves mounted vertically in suction line. We recommend gate valves in suction lines be laid so that the stem is in horizontal position.

**DISCHARGE PIPING...**We recommend the use of a check valve and a gate valve in the discharge line. The check valve should be placed between the pump and gate valve to prevent liquid from running back through the pump and possibly causing damage to the drive motor. The gate valve is used when starting and priming and when the pump is to be shut down. This valve should be closed when stopping the pump when a foot valve is used, this prevents water hammer. This is important when the pump is used against a high static lift. We recommend increasing the discharge pipe to the next size larger than the pump discharge size. This is done by placing a concentric reducer between the check valve and the pump. Both suction piping and discharge piping must be self supporting and in no way supported by the pump suction or discharge connection.

After the pipe is installed we recommend the pump rotating element be turned by hand to check for binding. This is done by inserting a screw driver in the slots in the fan cover and turning the pump by hand. If there is a drag or if there is a tight spot you should check the piping system to be sure it is supported properly, if not, secure properly and recheck.

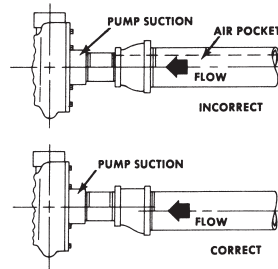


FIG. 1

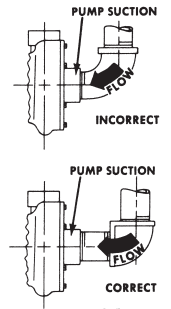


FIG. 3

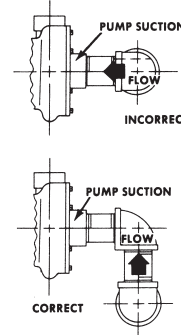


FIG. 2

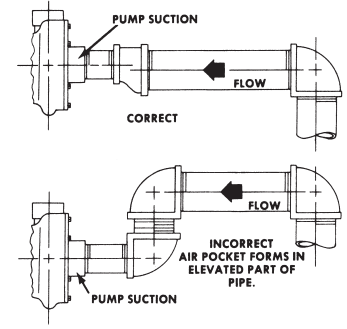
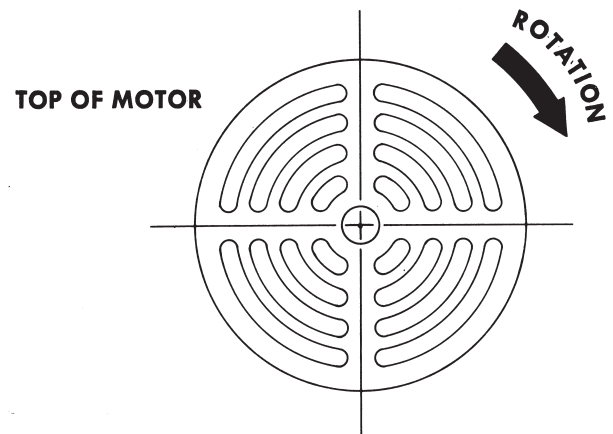


FIG. 4

When you are positive the pump is rotating free, wire the motor being sure to conform to all state and local electrical codes. Before putting the unit into operation, check the direction of rotation by jogging the motor starter on and off. The direction of rotation is clockwise when viewing from the top of the motor. If the pump is turning in the wrong direction, reverse any two of the line wires at the motor in the conduit box or at the motor starter.

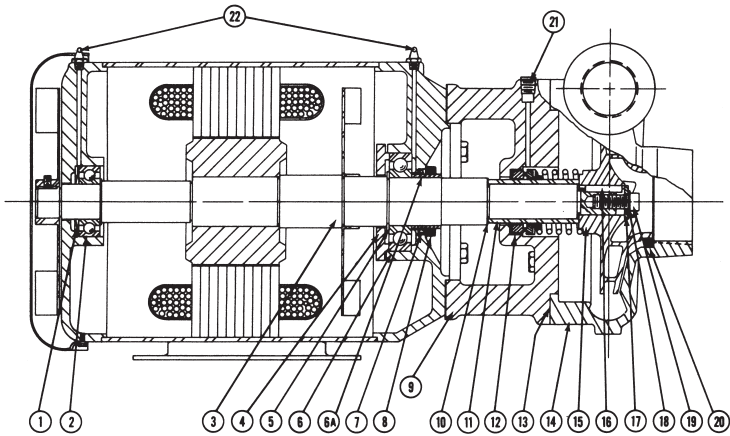


## Installation 'CM' Style:

For jobs requiring coupled motors the above installation instructions apply with the addition of the coupling alignment, see page 5 for details on coupling alignment.



# Horizontal End Suction CLOSE COUPLED PUMP



**HORIZONTAL CLOSE COUPLED PUMP**

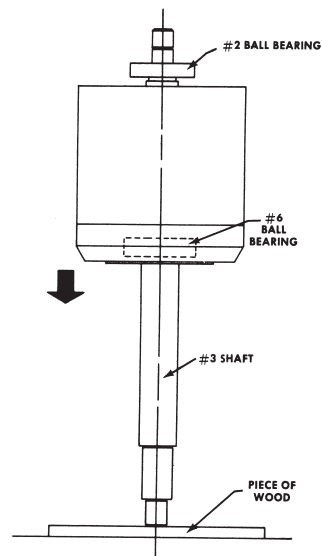
Part No.	Description	Part No.	Description
1	Load Spring	13	Impeller Housing Gasket
2	Ball Bearing	14	Impeller Housing
3	Shaft	15	Impeller
4	Ball Bearing Retainer	16	Square Key or Woodruff Key
5	Snap Ring	17	Impeller Retaining Washer
6	Ball Bearing	18	Lock Washer
6A	Press Collar	19	Impeller Retaining Screw
7	Grease Seal	20	Wear Ring
8	Rubber Slinger	21	Pipe Plug
9	Stem	22	Grease Fitting
10	Shaft Sleeve Gasket	29	Impeller Retaining Nut
11	Shaft Sleeve	30	Discharge Flange
12	Mechanical Seal		

## General Repair:

Close gate valve in discharge line, turn power off to pump and turn off main power switch. Remove drain plug and drain liquid from the pump. Disconnect piping at the suction and discharge, disconnect all other connections from the pump to the control panel, disconnect motor wires and remove from service.

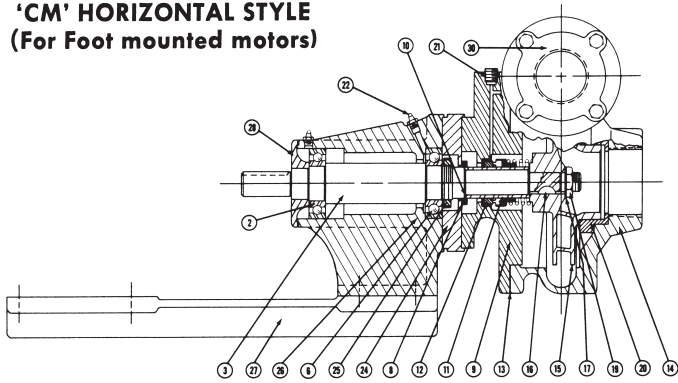
**SEAL REPLACEMENT...**Remove screws securing impeller housing (14) to stem (9), remove impeller housing. Take impeller (15) off by removing retaining nut or screw (19) and slide impeller off the shaft (3), seal spring will be loose and may be taken out of seal cavity, slide shaft sleeve (11) off shaft and remove rotating member of seal, inspect sleeve for wear, replace with new one if necessary. Remove screws securing stem (9) to motor end bell and take stem off, remove stationary seal seat by tapping out with screw driver thru top of stem. Clean seal cavity in stem thoroughly, apply oil to rubber cup of stationary seat and insert into bore by hand, mount stem on motor. Clean shaft sleeve and oil thoroughly, slide rotating member of seal onto shaft sleeve by hand, install new shaft sleeve gasket (10) and slide sleeve onto motor shaft so that the carbon ring of rotating member is facing stationary seat in stem, install impeller, check wear ring (20) and replace if worn, install impeller housing and put unit back into service.

**BALL BEARING REPLACEMENT...**Follow the above steps to stem removal. Removal screws in fan cover and remove cover, loosen set screw in fan and remove fan, remove four screws securing upper end bell to stator and remove end bell, remove screws in bearing retainer (4), lay a block of wood or some other soft material on the floor and tap the shaft (3) and ball bearing (6) out of the stator and lower end bell using the weight of the stator as you drop the shaft on the block of wood lightly. (Fig. 1) Tap the old bearings off the shaft and install new ones by following the instructions on page 10. To reassemble, reverse above procedure.



**FIG. 1**

**'CM' HORIZONTAL STYLE  
(For Foot mounted motors)**



**General Repair:**

Close gate valve in discharge line, turn power off to pump and turn off main power switch. Remove drain plug and drain liquid from the pump. Disconnect piping at the suction and discharge, disconnect all other connections from the pump to the control panel, disconnect motor wires and remove from service.

**SEAL REPLACEMENT...**Remove screws securing impeller housing (14) to stem (9), remove impeller housing. Take impeller (15) off by removing retaining nut or screw (19) and slide impeller off the shaft (3), seal spring will be loose and may be taken out of seal cavity, slide shaft sleeve (11) off shaft and remove rotating member of seal, inspect sleeve for wear, replace with new one if necessary. Remove screws securing stem (9) to motor end bell and take stem off, remove stationary seal seat by tapping out with screw driver thru top of stem. Clean seal cavity in stem thoroughly, apply oil to rubber cup of stationary seat and insert into bore by hand, mount stem on motor. Clean shaft sleeve and oil thoroughly, slide rotating member of seal onto shaft sleeve by hand, install new shaft sleeve gasket (10) and slide sleeve onto motor shaft so that the carbon ring of rotating member is facing stationary seat in stem, install impeller, check wear ring (20) and replace if worn, install impeller housing and put unit back into service.

Part No.	Description	Part No.	Description
1	Load Spring	17	Impeller Retaining Washer
2	Ball Bearing	18	Lock Washer
3	Shaft	19	Impeller Retaining Screw
4	Ball Bearing Retainer	20	Wear Ring
5	Snap Ring	21	Pipe Plug
6	Ball Bearing	22	Grease Fitting
6A	Press Collar	23	Throttle Sleeve
7	Grease Seal	24	Adapter
8	Rubber Slinger	25	Lock Nut & Washer
9	Stem	26CM	Ball Bearing Housing, 'CM' Models
10	Shaft Sleeve Gasket	27	Motor Bracket, 'CM' Models
11	Shaft Sleeve	28	Ball Bearing Retainer, 'CM' Models
12	Mechanical Seal	29	Impeller Retaining Nut
13	Impeller Housing Gasket	30	Discharge Flange
14	Impeller Housing	31	Coupling Guard
15	Impeller		
16	Square Key or Woodruff Key		

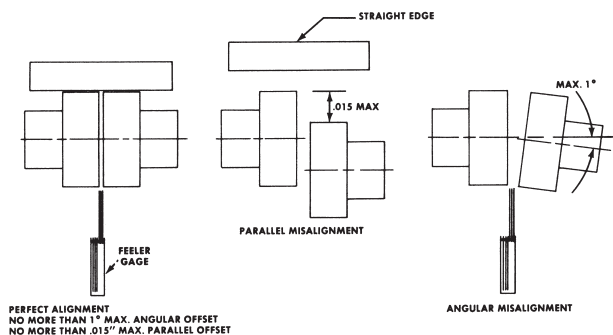
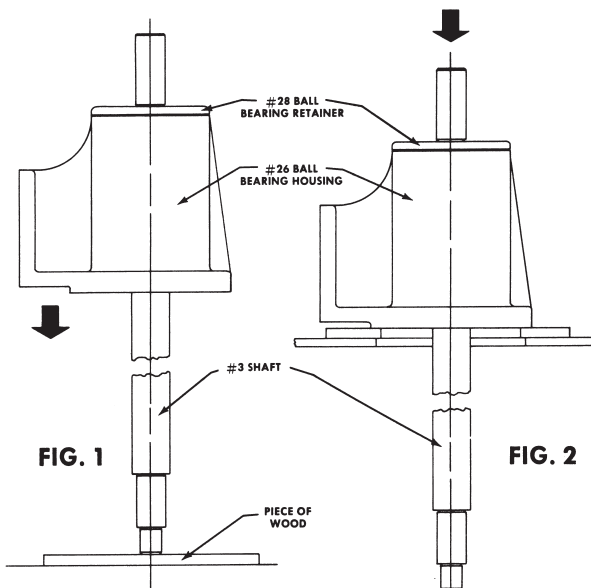
**BALL BEARING REPLACEMENT...**Follow the above procedure to stem removal. Remove four screws securing pump to motor base bracket (27), remove retaining rings from coupling spider and remove spider, and separate pump from motor. Remove lock nut and washer (25), invert unit and drop pump coupling shaft end on piece of wood placed on the floor. (Fig. #1) Ball bearing retainer (28) is installed using the thermo expansion method of installing ball bearings and you may have to put the unit in an arbor press to remove. (Fig. #2) Ball bearing (2) is mounted on the shaft prior to reassembly and ball bearing (6) is installed in bearing housing (26) prior to reassembly. For proper method of ball bearing installation see page 10. To reassemble, insert shaft through bearing housing and reverse above procedure.

**Coupling Alignment:**

You will need a straight edge and a feeler gage to check coupling alignment. To check parallel alignment, place the straight edge on four sides of the coupling. If the edge lies flat on all four sides, parallel alignment is okay.

To check angular alignment, the feeler gage is placed in four different locations between the coupling halves 90° apart, if the distance is the same in all four positions, the angular alignment is okay.

The faces of the coupling should be spaced apart slightly, just enough that the two faces don't rub (approx. 1/8").





## **Maintenance:**

Normally after proper installation and under normal operating conditions (8 hours daily duty in clean liquid with S.G. of 1) the pump requires very little attention.

Before shipment all Gusher pumps have been tested and greased at the plant, therefore lubrication is not necessary for approximately six to eight months. Remember, when lubricating ball bearings that too much grease will cause bearings to run hot, so grease bearings sparingly when it is necessary. We recommend the use of SRI #2 Chevron ball bearing grease.

Because of the vast range of operating conditions it is difficult to recommend one set schedule for periodic maintenance. The more severe the application the more attention the pump will require. When a pump operates in a high temperature application (over 150°F.) it is recommended to grease the ball bearings sparingly once a month (approx. one gram -no more). In applications where there is high abrasion, the pump may have to be inspected quarterly for wear

on impeller, impeller housing, throttle sleeve and wear ring. In applications requiring a high degree of solids, handling the bearings may require more frequent lubrication because of the abnormal radial load adherent to that type application.

On coupled motor type pumps it is recommended to check coupling alignment every six months. If misalignment recurs frequently, inspect the entire piping system. Unbolt the suction and discharge lines, if it springs away there is strain being exerted on the pump by the piping. System should be checked and piping supported properly.

At any rate, it is recommended that a routine maintenance schedule be set up and followed for the best service from the pump. A periodic comparison of existing operating conditions and data against data taken when pump was initially started (pressure, amps, voltage and temperature) may indicate a problem developing and allow for a planned maintenance check before a breakdown occurs.

## Bearing Installation:

Begin by cleaning your work area thoroughly, contaminants can cause bearing failures as fast as any other reason.

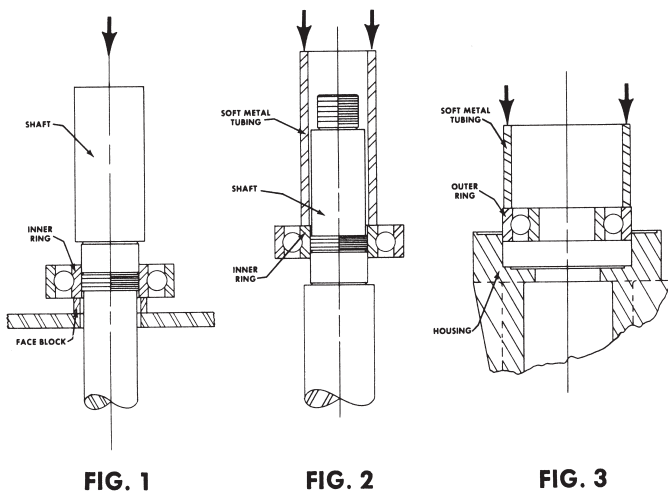
When a bearing is installed, the mounting force should be applied against the ring, and only the ring, which is being press-fitted. A bearing should never be forced onto a shaft by pressure or hammer blows applied to the outer ring, nor should the bearing be press-fitted into a housing by force applied to the inner ring.

Using an arbor press, the bearing may be laid on a face block which contacts only the bearing inner ring and which has a hole diameter greater than the bearing bore, as shown in figure 1. The shaft is pressed through the bearing until it is seated firmly against the shaft shoulder.

If the shaft is not too long, it can be supported beneath the table of the arbor press and the bearing pressed onto it by ram pressure against a piece of soft metal tubing, as shown in figure 2. The tubing must be clean, inside and out, and the inside diameter of the tubing should be slightly greater than the bearing bore. The ends of the tubing should be square (with corners chamfered to avoid flaking) and should contact only the bearing inner ring. The shaft must be held in line with the ram of the arbor press to avoid cocking the bearing on the shaft seat.

When an arbor press is not available, the bearing can be driven onto the shaft seat by light hammer blows against the end of the soft metal tubing. These blows should be made alternately against opposite sides of the tubing face, and great care must be taken to avoid cocking the bearing as it is driven onto the shaft seat.

When a ball bearing is installed into the housing it is normally a slip fit, however if force is necessary to install bearing the force should be exerted on the outer ring of the bearing as shown in fig. 3. Again the force must be applied evenly so as not to cock the bearing in the bore.



## Thermal Expansion Method:

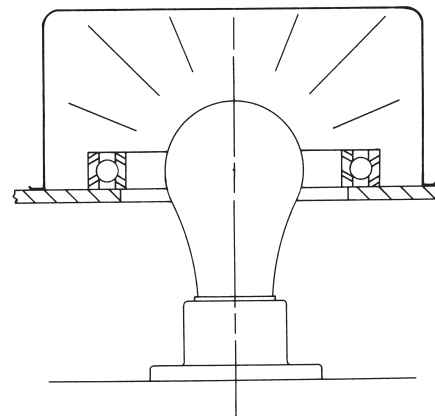
When a bearing must be pressed over a considerable length of shaft, or over another tight fitting bearing seat before it reaches its own bearing seat, thermal expansion of the bearing often facilitates installation and prevents damage to the ground surfaces of both shaft and bearing bore. Immersion of bearings in hot oil to achieve thermal expansion is not recommended. Temperatures are hard to control and it is difficult to keep the oil clean. Two dry-heat methods are recommended.

In the first, bearings still sealed in their packages are placed on a shelf in an enclosure lined with foil reflector materials. Electric lamp bulbs warm the bearings. Temperatures from 150°F to 225°F are recommended. Temperatures should be controlled by thermostat, rather than by the less reliable method of controlling lamp size and the size of the enclosure.

The second method involves inserting a lamp bulb or electric heating element in the bearing bore, as shown in figure 4. Temperature is controlled by predetermining the time required for heating and making sure the heating element is centered in the bearing bore. An advantage of this method is that the inner ring is heated but the outer ring remains relatively cool. This permits easy handling during installation. Bearings should not be heated above the recommended maximum, and prolonged heating should be avoided. Either or both of these conditions may cause reduction in bearing hardness and damage to lubricant or seals.

Immediately after removal from the heating device, the bearing should be slipped over the shaft to its required position and held firmly against its shaft shoulder (by hand or by gravity) until it contacts the shaft seat. Care must be taken not to cock the bearing during this operation. It is better to position the shaft vertically when using this method, so the weight of the bearing will maintain contact between the inner ring face and the shaft shoulder during cooling.

Thermal expansion methods are used sometimes in conjunction with arbor press mounting to reduce mounting pressures and prevent galling of bearing seats.



## **Trouble shooting:**

### **NO WATER DELIVERED.**

- (1) Pump not primed.
- (2) Speed too low.
- (3) Discharge head too high.
- (4) Suction lift higher than pump is designed for.
- (5) Impeller completely plugged up.
- (6) Wrong direction of rotation.

### **NOT ENOUGH WATER DELIVERED.**

- (1) Air leaks in suction or stuffing boxes.
- ‡ (2) Speed too low.
- (3) Discharge head higher than anticipated.
- (4) Suction lift too high. Check with gages.  
Check for clogged suction line or screen.
- (5) Impeller partially plugged up.
- (6) Not enough suction head for hot water.
- (7) Mechanical defects:
  - Wearing rings worn.
  - Impeller damaged.
  - Casing packing defective.
- (8) Foot valve too small.
- (9) Foot valve or suction opening not submerged deep enough.

### **NOT ENOUGH PRESSURE.**

- ‡ (1) Speed too low.
- (2) Air in water.
- (3) Mechanical defects:
  - Wearing rings worn.
  - Impeller damaged.
  - Casing packing defective.
- (4) Impeller diameter too small.

### **VIBRATION**

- (1) Impeller clogged.
- (2) Coupling alignment off.

### **PUMP WORKS FOR A WHILE AND THEN LOSES SUCTION.**

- (1) Leaky suction line.
- (2) Waterseal plugged.
- (3) Suction lift too high.
- (4) Air or gases in liquid.

### **PUMP TAKES TOO MUCH POWER.**

- (1) Speed too high.
- (2) Head lower than rating, pumps too much water.
- (3) Specific gravity or viscosity too high.
- (4) Mechanical defects:
  - Shaft bent.
  - Rotating element binds.
  - Stuffing boxes too tight.
  - Wearing rings worn.
  - Casing packing defective.

‡ When direct connected to electric motors, check up whether motor is across the line and receives full voltage.



A RUTHMAN COMPANY

[www.Gusher.com](http://www.Gusher.com)

## Ruthman Companies: A family-owned business supplying pumps for over 100 years



Ruthman Companies was co-founded in 1912 by brothers Alois and Edward Ruthman as the "Ruthman Machinery Company." Based in Cincinnati, the company serviced the steamboats that traveled the Ohio River.

In 1924, Alois conceived the first sealless centrifugal pump, coining the term 'coolant pump.' The brothers named this new pump "Gusher," giving birth to what is now Ruthman Companies' flagship brand, Gusher Pumps.

Alois' son Thomas R. Ruthman joined the family business in 1949, growing the business globally through organic growth and the acquisition of complementary technologies. In the early 1990's, Alois' grandson, Thomas G. Ruthman, became the third generation of Ruthmans in the pump business. Over the years, Ruthman Companies has expanded its product line from the original centrifugal coolant pumps to include valves, vertical turbine pumps, positive displacement pumps, gear pumps, and other specialized pump equipment, while upholding its reputation as a leader in the custom engineering of pumps for the most challenging applications.

## GUSHER PUMPS LOCATIONS

### Williamstown Headquarters

115 Industrial Road  
Williamstown, KY 41097  
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### Dry Ridge Training Facility

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### New Castle Sales & Service

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### Fulflo Hydraulic Valves

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### Process Systems Inc., Midwest Service

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### RAE Pumps

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### Ruthman Pumps & Service

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