

# Installation, Operation and Maintenance Instructions

# Model ICS/ICS-F



### Owner's Information

Model Number: \_\_\_\_\_  
 Serial Number: \_\_\_\_\_  
 Dealer: \_\_\_\_\_  
 Date of Purchase: \_\_\_\_\_ Date of Delivery: \_\_\_\_\_

### Table of Contents

SUBJECT	PAGE
Safety Instructions .....	2
Description and Specifications .....	2
Installation – General .....	2
Close Coupled Units .....	2
Frame Mounted Units .....	2
Piping – General .....	3
Piping – Suction .....	3
Piping – Discharge .....	3
Wiring and Grounding .....	3
Motor to Pump – Shaft Alignment .....	4
Operation .....	4
Maintenance .....	4
Disassembly .....	4
Reassembly .....	5
Trouble Shooting Guide .....	5
Sectional Assembly .....	6
Parts List and Materials of Construction .....	6
Engineering Data .....	7
Goulds Pumps Limited Warranty .....	8

## SAFETY INSTRUCTIONS

**TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN THE MANUAL AND ON THE PUMP.**



This is a **SAFETY ALERT SYMBOL**. When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.



**DANGER** Warns of hazards that **WILL** cause serious personal injury, death or major property damage.



**WARNING** Warns of hazards that **CAN** cause serious personal injury, death or major property damage.







**CAUTION** Warns of hazards that **CAN** cause personal injury or property damage.


**NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.**

**THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT. THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.**

**MAINTAIN ALL SAFETY DECALS.**



-  Install, ground and wire according to local and National Electrical Code Requirements.
-  Install an all leg disconnect switch near the pump.
-  Disconnect and lockout electrical power before installing or servicing the pump.
-  Electrical supply must match motor's nameplate specifications. Incorrect voltage can cause fire, damage motor and void the warranty.

-  Single phase pump motors are equipped with an automatic thermal protector, which opens the motor's electrical circuit when an overload condition exists. This can cause the pump to start unexpectedly.

## DESCRIPTION and SPECIFICATIONS

The Models ICS, close coupled, and ICS-F, frame mounted, are single stage, end suction pumps designed for ultra pure water systems, beverage processing, chemical service and selected OEM applications.

The pumps are of back pullout configuration, with NPT suction and discharge connections and have investment cast AISI Type 316 stainless steel casings, open impellers and seal housing. All pumps are equipped with O-ring shaft sleeve protection and are available with a variety of optional mechanical seals.

Close coupled units are equipped with C-face NEMA motors with threaded shaft extensions. Frame mounted units can be baseplate mounted and are available with spacer couplings or may be belt driven.

Close coupled units are available with single and three phase ODP, TEFC and explosion proof motors. Consult with your distributor/dealer for additional information.

**NOTICE: INSPECT UNIT FOR DAMAGE AND REPORT ALL DAMAGE TO CARRIER IMMEDIATELY.**

### MAXIMUM OPERATING LIMITS

Liquid Temperature:

212° F (100° C) – standard mechanical seal

250° F (120° C) – OPTIONAL mechanical seal

Operating Pressure: 175 PSI (1203 kPa)

Starts per Hour: 20, evenly distributed

### Installation – General

- Locate the pump as near to the liquid source as possible.
- If pump repriming capability is required, the pump suction **MUST** be below the source of the liquid level.
- Protect the pump and piping from freezing temperatures.
- Allow adequate space around the unit for service and ventilation.

### Close Coupled Units

- Units may be installed horizontally, inclined or vertically.



**Hazardous voltage**

**DO NOT MOUNT MOTOR BELOW PUMP. FLUID LEAKAGE ONTO MOTOR CAN CAUSE A SHOCK, BURN OR DEATH.**

- Unit foundation must be flat and substantial to avoid pipe strains when bolts are tightened. Use rubber mounts under motor to minimize noise and vibration.
- Tighten motor holddown bolts **BEFORE** connecting the suction and discharge piping.

### Frame Mounted Units

- Place the baseplate upon the foundation and disconnect the coupling halves. **DO NOT** reconnect the coupling until the alignment procedures have been completed.
- The baseplate **MUST** be grouted to a foundation with a solid footing, per Figure 1.

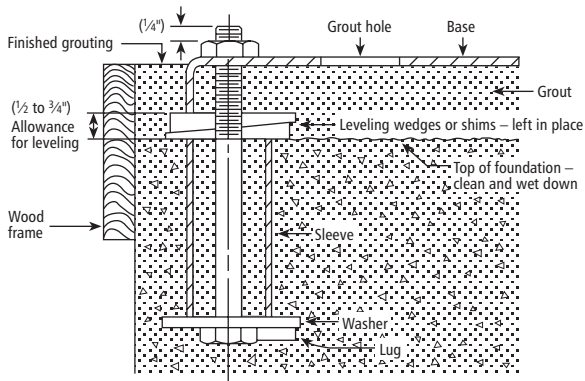


Figure 1

- As depicted in Figure 1, place the baseplate on wedges, locating two wedges at each foundation bolt location. A gap of 3/4" to 1 1/2" (19 mm to 64 mm) is recommended between the baseplate and the foundation for grouting. Adjust the wedges as necessary to level the baseplate.
- Inspect baseplate for any distortion, and adjust as necessary. Make sure that any necessary final coupling alignments are possible within the motor movements and shim limits. Tighten the 4 foundation bolts finger tight.
- Build a dam around foundation and pour grout under the baseplate, insuring that the areas under the pump and motor are filled completely.
- Allow grout to harden for 48 hours before tightening 4 foundation bolts.

### Piping – General

- For maximum pump capacity, piping should not be smaller than the pump suction and discharge.
- To minimize pipe friction losses, avoid unnecessary pipe and fittings.
- All piping **MUST** be independently supported and **MUST NOT** place any piping loads on pump.

**NOTICE: DO NOT FORCE PIPING INTO PLACE AT PUMP SUCTION AND DISCHARGE CONNECTIONS.**

### Piping – Suction

- Short and direct suction piping is recommended. For suction lifts of over 10' (3 m) and liquid temperatures over 120° F (49° C), consult pump performance curve for net positive head required (NPSH<sub>R</sub>).
- If a pipe size larger than the pump suction is required, an eccentric pipe reducer, with the straight side up, **MUST** be installed at the pump suction.
- If the pump is installed below the liquid source, install a full flow isolation valve in the suction for pump inspection and maintenance.

**NOTICE: DO NOT USE THE ISOLATION VALVE TO THROTTLE PUMP. THIS MAY CAUSE LOSS OF PRIME, EXCESSIVE TEMPERATURES AND DAMAGE TO PUMP, VOIDING WARRANTY.**

- If pump must be installed above the liquid source, the following **MUST** be provided:
  - To avoid air pockets, no part of the piping should be above the pump suction connection.
  - Slope the piping upward from liquid source.
  - All pipe joints **MUST** be airtight.
  - Use a foot valve **ONLY** if necessary for priming or to hold prime during intermittent duty.
- The suction strainer or suction bell **MUST** be at least 3 times the suction pipe diameter area.
- Insure that the size and minimum submergence over suction inlet is sufficient to prevent air from entering pump through a suction vortex. See Figures 2 through 5.

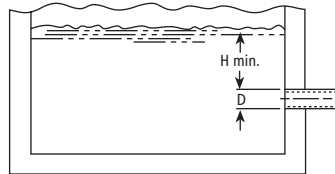


Figure 2

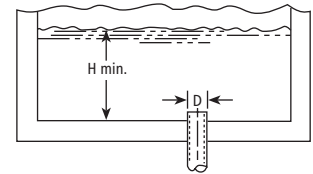


Figure 3

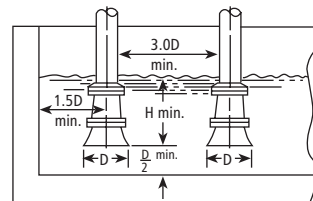


Figure 4

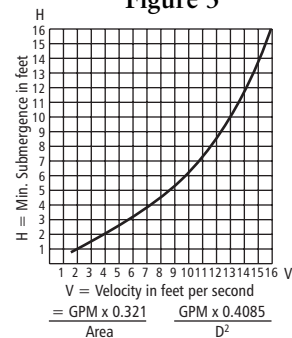
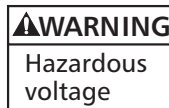


Figure 5

### Piping – Discharge

- Install a check valve, suitable to handle the flow and liquids, to prevent backflow. After the check valve install an appropriately sized gate valve to be used to regulate the pump capacity, pump inspection and maintenance.
- When required, the pipe increaser should be installed between the check valve and the pump discharge.

### Wiring and Grounding



**DISCONNECT AND LOCKOUT THE ELECTRICAL POWER BEFORE ATTEMPTING ANY MAINTENANCE. FAILURE TO DO SO CAN CAUSE A SHOCK, BURN OR DEATH.**

- All wiring and grounding connections must be in accordance with Local and National Electrical Code requirements.
- Use only stranded copper wire to the motor and ground. Wire size **MUST** limit the maximum voltage drop to 10% of the motor nameplate voltage, at the motor terminals. Excessive voltage drop may affect performance and will void the motor warranty.
- Single phase motors supplied by Goulds, have built in thermal overloads. Other motors not so equipped **MUST** use a properly sized contactor and overload. Fuses are permissible.
- Three phase motors require all leg protection with properly sized magnetic starters and thermal overloads.

**NOTICE:** UNIT ROTATION IS CLOCKWISE WHEN VIEWED FROM MOTOR END. INCORRECT ROTATION MAY CAUSE DAMAGE TO THE PUMP AND VOIDS WARRANTY.

- Three Phase Motors **ONLY:**  
To check the pump rotation, observe pump while switching the electrical power **ON** then **OFF** quickly. If incorrect, have a qualified electrician interchange two of the three motor power wires.

### Motor to Pump – Shaft Alignment

- After completion of the frame mounted unit baseplate installation, the motor and pump shaft alignment **MUST** be checked, see Figure 6, and the coupling spacer must be reinstalled.
- Before checking shaft alignment, insure that the foundation, pump and motor holddown bolts are properly tightened.
- If realignment is required, **ALWAYS** make the required adjustments to the motor, shimming as necessary.

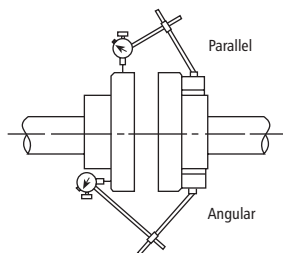


Figure 6

- To check for **PARALLEL** misalignment, place a dial indicator on one coupling hub, rotate the hub 360° while observing the indicator readings from the outside diameter of the other hub. Parallel alignment requires a Total Indicator Reading (TIR) of 0.005" (0.13 mm), or less.
- To check for **ANGULAR** misalignment, place a dial indicator on one coupling hub, rotate the hub 360° while observing the indicator readings from the face of the other hub. Angular alignment requires 0.005" (0.13 mm) TIR, or less.
- Correct alignment is achieved when parallel and angular TIR requirements are satisfied and motor holddown bolts are tight.

**NOTICE:** RECHECK SHAFT ALIGNMENT AFTER MAKING ANY ADJUSTMENTS.

### Operation



**DO NOT OPERATE UNIT WITHOUT SAFETY GUARD IN PLACE. TO DO SO CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.**

**NOTICE:** PUMP MUST BE COMPLETELY PRIMED BEFORE OPERATION.



**DO NOT OPERATE PUMP AT OR NEAR ZERO FLOW. TO DO SO CAN CAUSE EXTREME HEAT, DAMAGE TO THE PUMP, PERSONAL INJURY OR PROPERTY DAMAGE.**

- After stabilizing the system at normal operating conditions, check the piping and coupling for correct alignments. If necessary, adjust pipe supports and realign the shafts following the procedures provided.

### Maintenance

- Close coupled pump motors and frame mounted pump frames have permanently lubricated bearings. Additional lubrication is not necessary or possible.
- Follow the coupling and motor manufacturer's recommendations regarding maintenance.

### Disassembly



**DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING ANY MAINTENANCE. FAILURE TO DO SO CAN CAUSE A SHOCK, BURN OR DEATH.**



**CASING MAY CONTAIN HAZARDOUS FLUIDS THAT CAN CAUSE SERIOUS PERSONAL INJURY OR PROPERTY DAMAGE.**

- Drain and flush system, as required.
- For close coupled or frame mounted units:
  - Remove the motor or bearing frame holddown bolts
  - Remove the coupling guard and coupling spacer
- Remove the 4 casing screws (370), then utilizing the slots provided about the casing (100), pry the back pull-out assembly from casing. Carefully remove the casing shims.

**NOTICE:** IMPELLER COMPRESSES THE MECHANICAL SEAL SPRING – BE PREPARED FOR THE IMPELLER TO SPRING FROM THE SHAFT WHEN UNSCREWED.

- To remove the impeller it is necessary to heat the center hub area with a hand propane torch for approximately 30 seconds. Unscrew the impeller (101) from the shaft, turn the impeller **COUNTERCLOCKWISE** while holding the shaft. Motors have a screwdriver slot or hex provided under the motor end cap. Examine the impeller for wear or damage and replace as necessary. Discard the shaft sleeve O-ring (412A).

**NOTICE:** EXERCISE CARE HANDLING HOT IMPELLER.

- To remove the mechanical seal, remove the 4 seal housing screws (370H) and slide the seal housing assembly off the shaft. Discard the rotary half of the seal and the seal housing O-ring (513). With an appropriately sized screwdriver handle, push the stationary half of the seal from the seal housing and discard it.

- To remove the shaft sleeve (126) it is necessary to evenly heat the outside of the sleeve, with a hand propane torch, while prying between the shaft shoulder and the sleeve.

**NOTICE: EXERCISE CARE HANDLING THE HOT SHAFT SLEEVE.**

- Removal of the 4 motor adapter screws (371) and motor adapter (108) from the motor completes the close coupled unit disassembly.
- Disassembly of the bearing frame assembly is accomplished by removing the 4 frame adapter screws (371) and removing the frame adapter (108) from the bearing frame (228).
- Remove the 4 bearing cover (370C) screws, being careful not to damage the lip seal (139). Inspect lip seal for damage and replace as required.
- Remove the shaft assembly from the bearing frame, by pulling the motor end of shaft out of the housing.
- Being careful not to damage the shaft, remove the snap ring (361) and outer bearings (112) from the shaft. If required remove the inner bearing (168). Inspect the bearings for wear or damage and replace as necessary.
- Inspect the inner lip seal (138) and replace as required.
- Disassembly is complete.

### Reassembly

- Reassemble the bearing frame assembly in reverse order of disassembly. Use appropriate tools for bearing installation and press **ONLY** on inner bearing race. Press bearings squarely and completely onto the shaft.
- If the shaft sleeve was replaced, it is required that the new sleeve be bonded to the shaft using Loctite™ #127 or equivalent. Following the manufacturer’s instructions in the preparation of the sleeve and shaft, apply bonding agent to the surfaces then slide the sleeve over the shaft. Remove all excess bonding agent.
- Install the shaft assembly into bearing frame. **DO NOT** damage the inner lip seal.
- Insert and tighten the 4 bearing cover screws.
- Install the bearing adapter, nameplate towards the **TOP**, using the 4 screws.
- Inspect and remove any debris from the seal housing stationary seat bore. Lubricate the outside diameter of the new stationary seat with a good quality O-ring lubricant and press seat squarely and completely into the seal housing. With a clean, lint free cloth remove any debris or lubricant from the seat face. **DO NOT** scratch the face.
- Install a new seal housing O-ring on housing, then carefully slide seal housing over shaft and attach housing to the motor adapter with the 4 screws. **DO NOT** damage the mechanical seal stationary seat.
- Install the new shaft sleeve O-ring.
- Slide the new mechanical seal rotary assembly over shaft sleeve. Apply Loctite™ primer N (or equivalent) and Loctite™ #271 to the motor shaft thread and then screw on the impeller by turning impeller **CLOCKWISE**. Torque the impeller to 12 ft lbs (1.7 kg/m).

- Shim pack (330) permits renewal of impeller clearance to compensate for impeller or casing wear. The shim thicknesses, in the shim pack, range from 0.003" to 0.025" (0.08 mm to 0.64 mm). The factory shim pack thickness is approximately 0.060" (1.52 mm). To set the suggested nominal impeller clearance of 0.020" (0.51 mm) proceed as follows:
  - Establish a shim pack thickness that allows for the impeller to just touch the inside of the casing surface, when pump is assembled.
  - Add an additional 0.020" (0.51 mm) thickness of shims.
- When the proper impeller clearance has been achieved, install and tighten the 4 casing screws.
- Install the 4 bearing frame holddown bolts for the frame mounted units or the 4 motor holddown bolts for the close coupled units.
- On frame mounted units, check the coupling alignment as specified in the “**MOTOR TO PUMP – SHAFT ALIGNMENT**” section of this manual.
- Inspect unit rotation for binding and correct as required.
- Reinstall the safety guard.
- Reassembly is complete.

### Trouble Shooting Guide



**DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING ANY MAINTENANCE. FAILURE TO DO SO CAN CAUSE A SHOCK, BURN OR DEATH.**

#### SYMPTOM

##### MOTOR NOT RUNNING

See Probable Cause – 1 through 5

##### LITTLE OR NO LIQUID DELIVERED BY PUMP

See Probable Cause – 6 through 13

##### POWER CONSUMPTION TOO HIGH

See Probable Cause – 3, 13, 14, 15, 18

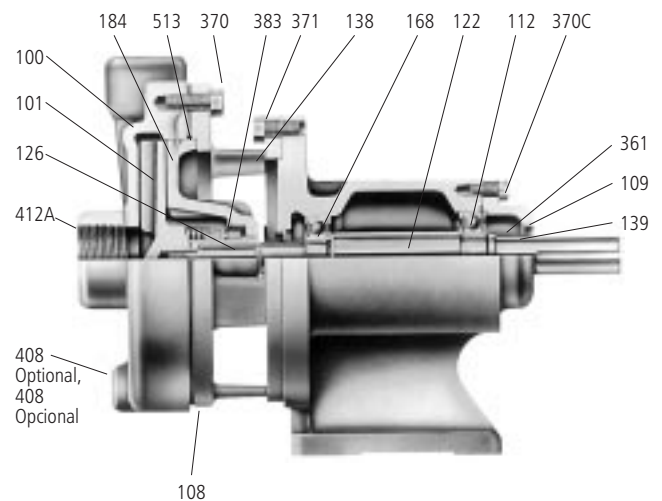
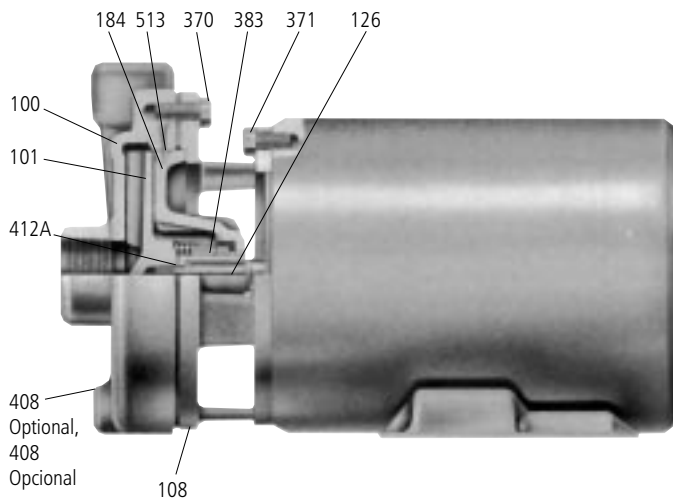
##### EXCESSIVE NOISE and VIBRATION

See Probable Cause – 3, 6, 7, 8, 10, 12, 14, 16, 17, 18

#### PROBABLE CAUSE

1. Motor thermal protector tripped
2. Open circuit breaker or blown fuse
3. Impeller binding
4. Motor improperly wired
5. Defective motor
6. Pump is not primed, air or gases in pumpage
7. Discharge, suction plugged or valve closed
8. Incorrect rotation (3 phase only)
9. Low voltage or phase loss
10. Impeller worn or plugged
11. System head too high
12. NPSH<sub>A</sub> too low – Suction lift or suction losses excessive
13. Incorrect impeller diameter
14. Discharge head too low – excessive flow rate
15. Fluid viscosity, specific gravity too high
16. Worn bearing
17. Pump, motor or piping loose
18. Pump and motor shafts misaligned

## ICS & ICS-F Sectional Assemblies



## Parts List and Materials of Construction

### LIQUID END COMPONENTS

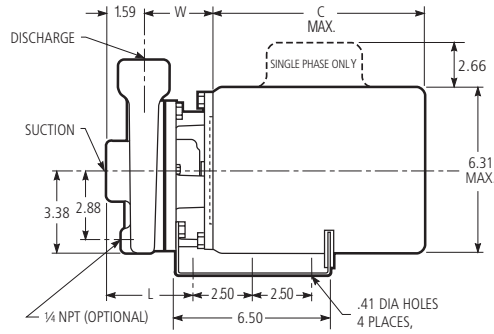
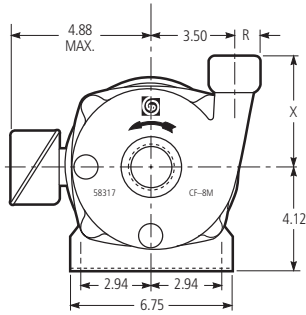
Item No.	Number/Pump	Part Name	Material
100	1	Casing – 1 x 1¼ - 5	ASTM A744 Grade CF-8M
	1	Casing – 1¼ x 1½ - 5	ASTM A744 Grade CF-8M
101	1	Impeller	ASTM A744 Grade CF-8M
126	1	Shaft Sleeve	ASTM A276 Type 316 SS
184	1	Seal Housing	ASTM A744 Grade CF-8M
330*	1	Shim Pack	Mylar
370	4	Hex Cap Screws – adapter to casing	ASTM A276 Type 304 SS
370H*	4	Hex Cap Screws – adapter to seal housing	ASTM A276 Type 304 SS
383	1	Mechanical Seal (standard)	Carbon/Sil Car/Viton
		Mechanical Seal (optional)	Carbon/Sil Car/EPR
412A	1	O-ring – Shaft Sleeve	Viton
513	1	O-ring – Seal Housing	Viton

\* Not illustrated

### POWER END COMPONENTS

Item No.	Number/Pump	Part Name	Material
108	1	Motor and Bearing Frame Adapter	ASTM A48 Cast Iron
109	1	Bearing Cover	ASTM A48 Cast Iron
112	1	Ball Bearing – outboard	ASTM A108 Steel
122	1	Pump Shaft	ASTM A276 Type 303 SS
168	1	Ball Bearing – inboard	ASTM A108 Steel
361	1	Snap Ring – outboard bearing	ASTM A108 Steel
228	1	Bearing Frame	ASTM A48 Cast Iron
138	1	Lip Seal – inner	BUNA-N and ASTM A108 Steel
139	1	Lip Seal – outer	BUNA-N and ASTM A108 Steel
370C	4	Hex Cap Screws – bearing cover to bearing frame	ASTM A108 Steel
371	4	Hex Cap Screws – adapter to motor/bearing frame	ASTM A276 Type 304 SS

½ HP – 2 HP



Dimensions and Weights – Determined by Pump

Pump	Suction NPT	Discharge NPT	L	R	W	X	*Wt. Max.
1 x 1¼-5	1¼	1	3.75	.94	3.01	4.62	17
1¼ x 1½-5	1½	1¼	3.62	1.06	2.88	4.56	17

NOTES:

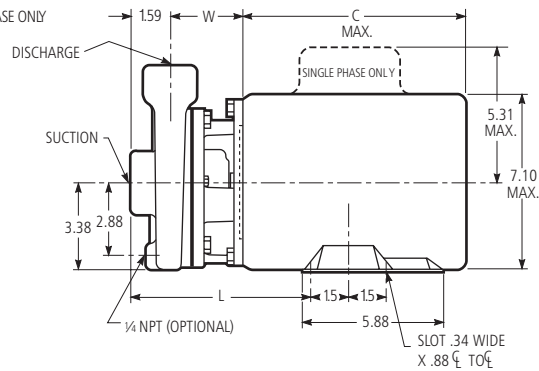
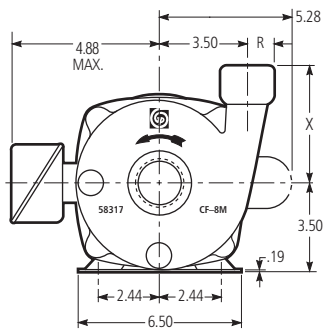
1. Pumps will be shipped with top vertical discharge as standard, for other orientations, remove casing bolts, rotate to desired position, and tighten 3/8" bolts to 24 lbs.-ft.
2. Dimensions in inches, weight in pounds.
3. Not to be used for construction purposes unless certified.
4. Motor dimensions may vary with motor manufacturers.

Available Motor Weights and Dimensions

HP	Motor Weights						C Max. Length
	Single Phase			Three Phase			
	ODP	TEFC	EXP	ODP	TEFC	EXP	
½	16	21	47	19	18	27	9 <sup>15</sup> / <sub>16</sub>
¾	19	24	41	21	21	30	10 <sup>1</sup> / <sub>4</sub>
1	22	26	49	23	21	30	11
1½	28	35	56	27	27	37	11 <sup>5</sup> / <sub>16</sub>
2	33	39	60	32	33	44	12 <sup>1</sup> / <sub>16</sub>

\* Weight is liquid end only. For complete pump, add weight of applicable motor.

3 HP Only



Dimensions and Weights – Determined by Pump

Pump	Suction NPT	Discharge NPT	L	R	W	X	*Wt. Max.
1 x 1¼-5	1¼	1	7.35	.94	3.01	4.62	17
1¼ x 1½-5	1½	1¼	7.22	1.06	2.88	4.56	17

Available Motor Dimensions and Weights

HP	Motor Weights					C Max. Length
	Single Phase		Three Phase			
	ODP	TEFC	ODP	TEFC	X-Proof	
3	40	45	42	37	—	13.34

Dimensions in inches, weight in pounds.

