GOULDS PUMPS

4" Submersible Pumps

Installation and Operation Instructions

Owner's Information

Pump Model #: _____

Pump Serial #: _____

Motor Model #: _____

Motor Serial #: _____

Dealer: _____

Dealer Telephone: _____

Purchase Date: _____

Installation Date: _____

Volts: _____

Amps: _____

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Goulds Pumps

ITT Industries

SAFETY INSTRUCTIONS

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

THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH 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.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

Important notice: Read safety instructions before proceeding with any wiring

⚠ WARNING All electrical work must be performed by a qualified technician. Always follow the National Electrical Code (NEC), or the Canadian Electrical Code, as well as all local, state and provincial codes. Code questions should be directed to your local electrical inspector. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer's installation instructions may result in electrical shock, fire hazard, personal injury or death, damaged equipment, provide unsatisfactory performance, and may void manufacturer's warranty.

⚠ WARNING Standard units are not designed for use in swimming pools, open bodies of water, hazardous liquids, or where flammable gases exist. Well must be vented per local codes.

Only pumps specifically Listed for Class 1, Division 1 are allowable in hazardous liquids and where flammable gases may exist. *See specific pump catalog bulletins or pump nameplate for all agency Listings.*

⚠ WARNING Disconnect and lockout electrical power before installing or servicing any electrical equipment. Many pumps are equipped with automatic thermal overload protection which may allow an overheated pump to restart unexpectedly.

⚠ CAUTION	All three phase (3Ø) controls for submersible pumps must provide Class 10, quick-trip, overload protection.
⚠ WARNING	Do not lift, carry or hang pump by the electrical cables. Damage to the Electrical Cables can cause shock, burns or death.
⚠ WARNING	Use only stranded copper wire to pump/motor and ground. The ground wire must be at least as large as the power supply wires. Wires should be color coded for ease of maintenance and troubleshooting.
⚠ DANGER	Install wire and ground according to the National Electrical Code (NEC), or the Canadian Electrical Code, as well as all local, state and provincial codes.
⚠ WARNING	Install an all leg disconnect switch where required by code.
⚠ WARNING	The electrical supply voltage and phase must match all equipment requirements. Incorrect voltage or phase can cause fire, motor and control damage, and voids the warranty.
⚠ WARNING	All splices must be waterproof. If using splice kits follow manufacturer's instructions.
⚠ WARNING	Select the correct type and NEMA grade junction box for the application and location. The junction box must insure dry, safe wiring connections.
⚠ WARNING	Failure to permanently ground the pump, motor and controls before connecting to power can cause shock, burns or death.
⚠ WARNING	4" motors ≥ 2 HP require a minimum flow rate of .25 ft/sec. or 7.62 cm/sec. past the motor for proper motor cooling. The following are the minimum flows in GPM per well diameter required for cooling: 1.2 GPM/4", 7 GPM/5", 13 GPM/6", 20 GPM/7", 30 GPM/8" or 50 GPM in a 10" well. Pumps ≥ 2 HP installed in large tanks should be installed in a flow inducer sleeve to create the needed cooling flow or velocity past the motor.
⚠ CAUTION	This pump has been evaluated for use with Water Only.

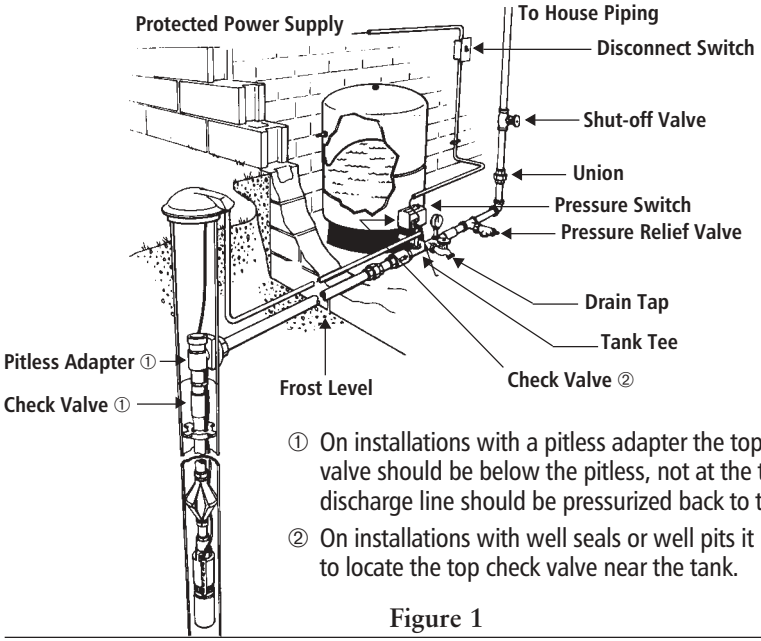
INSTALLATION CHECK LIST

- Enter the pump and motor information and other requested data on the front of this manual.
- Inspect all components for shipping damage, report damage to the distributor immediately.
- Verify that motor HP and pump HP match.
- Match power supply voltage and phase to motor and control specifications.
- Select a dry, shaded location in which to mount the controls.
- Make all underwater and underground splices with waterproof splice connections.
- Hold the pump at the discharge head when installing threaded pipe or an adapter fitting as most pumps have left hand threads which will be loosened if you hold the pump anyplace except the discharge head.
- Check all plumbing connections to insure they are tight and sealed with Teflon tape.
- Verify that the pipe pressure rating is higher than pump shut-off pressure.
- Install a pressure relief valve on any system capable of creating over 75 PSI.
- Locate the pressure switch within 4' of the pressure tank to prevent switch chatter.
- Adjust tank pre-charge to 2 PSI below the system cut-in pressure setting, ex. 28 on a 30/50 system.
- Set the pump 10' above the well bottom to keep above sediment and debris.
- Insure that main power is disconnected, turned OFF, before wiring any components.
- Wiring should be performed only by qualified technicians.
- Wiring and Grounding must be in compliance with national and local codes.
- Restrict the flow with a ball or globe valve, 1/3 open, before starting pump for first time.
- Open a faucet or discharge valve on start-up to keep dirty water from entering the tank.
- Turn main breaker or disconnect ON.
- Run through several on/off cycles to verify proper switch operation.
- Check amps and enter the data on the front of this manual.
- Leave the manual with the owner or at the job site.

1.0 TYPICAL INSTALLATIONS

CAPTIVE AIR TANK INSTALLATION

NOTICE: TANK PRE-CHARGE PRESSURE CHANGES MUST BE MADE USING THE AIR VALVE ON TOP OF THE TANK.



① On installations with a pitless adapter the top check valve should be below the pitless, not at the tank, as the discharge line should be pressurized back to the pitless.

② On installations with well seals or well pits it is allowable to locate the top check valve near the tank.

Figure 1

GALVANIZED TANK INSTALLATION

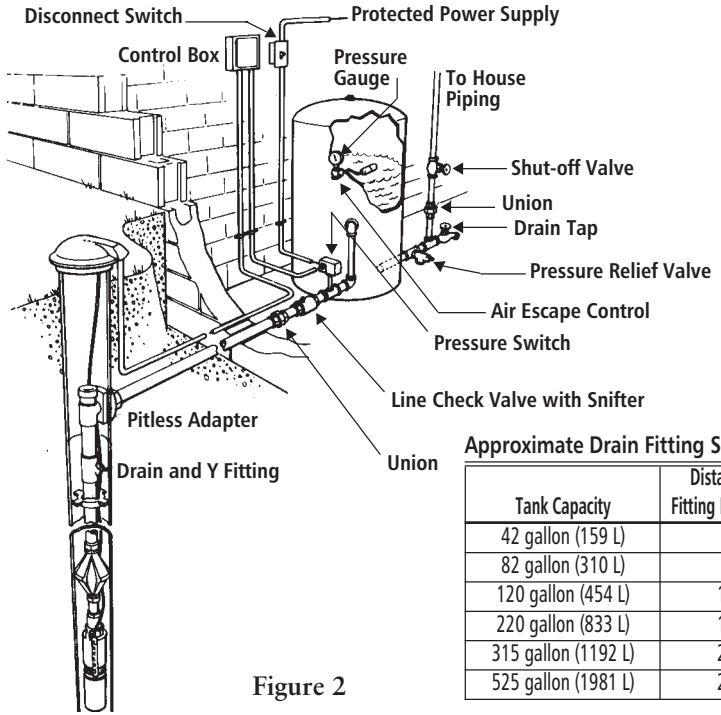


Figure 2

Approximate Drain Fitting Setting

Tank Capacity	Distance Drain and "Y" Fitting Below the Line Check
42 gallon (159 L)	7 feet (2.1m)
82 gallon (310 L)	10 feet (3m)
120 gallon (454 L)	15 feet (4.6m)
220 gallon (833 L)	15 feet (4.6m)
315 gallon (1192 L)	20 feet (6.1m)
525 gallon (1981 L)	20 feet (6.1m)

2.0 PIPING

Notice: Most 4" submersibles have left-hand discharge head threads, hold the pump only at the "discharge head" when installing fittings or threaded pipe.

2.1 General

The pump discharge piping should be sized for efficient pump operation. Use the Friction Loss Tables to calculate total dynamic head using different pipe sizes. As a rule of thumb, use 1" for up to 10 gpm, 1¼" for up to 30 gpm, 1½" for up to 45 gpm, and 2" for up to 80 gpm. In the case of long pipe runs it is best to increase pipe size.

Some pumps are capable of very high discharge pressures, please select pipe accordingly. Consult with your pipe supplier to determine the best type of pipe for each installation.

2.2 Pressure Tank, Pressure Switch and Pressure Relief Valve

Select an area in which the ambient temperature is always above 34° F (1° C) in which to install the tank, pressure switch, and pressure relief valve. The tank should be located in an area where a leak will not damage property.

The pressure switch should be located at the tank cross tee and never more than 4' from the tank. Locating the switch more than 4' from the tank will cause switch chatter.

There should be no valves, filters, or high loss fittings between the switch and the tank(s) as switch chatter may result. As an example, a 1¼" spring check valve has friction loss equal to 12' of pipe, placing the valve between the pressure switch and the pressure tank is the same as moving the pressure switch 12' away from the tank. It will create switch chatter.

On multiple tank installations the switch should be as close to the center of the tanks as possible. Multiple tank installations should have a manifold pipe at least 1½ times the size of the supply pipe from the pump. This will reduce the Friction Head in the manifold and reduce the possibility of switch chatter.

The cut-in setting on a 30 - 50 pressure switch is 30 psi. Cut-in is the lower of the pressure settings.

Pressure relief valves are required on any system that is capable of producing 100 psi or 230' TDH. If in an area where a water leak or blow-off may damage property connect a drain line to the pressure relief valve. Run it to a suitable drain or an area where the water will not damage property.

2.3 Adjusting Tank Pre-Charge

Insure that the tank is empty of water. Use a high quality pressure gauge to check the tank pre-charge pressure. The pressure should be 2 psi below the pump cut-in pressure. As an example, a 30-50 psi system would use a tank pre-charge of 28 psi.

2.4 Discharge Pipe

Note: Most discharge heads are threaded into the casing with left-hand threads. Hold the pump only at the discharge head when installing fittings. Failure to hold the discharge head will loosen it and pump damage will result on start-up.

If your pipe requires an adapter we strongly recommend using stainless steel. Galvanized fittings or pipe should never be connected directly to a stainless steel discharge head as galvanic corrosion may occur. Plastic or brass pumps can use any material for this connection. Barb type connectors should always be double clamped.

The pump discharge head has a loop for attaching a safety cable. The use of a safety cable is at the discretion of the installer.

2.5 Installing Pump in Well

If you are using a torque arrestor, install it per the manufacturer's installation instructions. Consult the seller for information on torque arrestors and for installation instructions.

Connect the discharge pipe to the discharge head or adapter you previously installed. Barb style connectors should always be double clamped. Install the pump into the well using a pitless adapter or similar device at the wellhead. Consult the fitting manufacturer or pitless supplier for specific installation instructions.

Using waterproof electrical tape, fasten the wires to the drop pipe at 10' intervals. Make sure that the tape does not loosen as it will block the pump suction if it falls down the well. Pump suppliers also sell clip-on style wire connectors that attach to the drop pipe.

2.6 Special Piping For Galvanized Tank Systems

When using a galvanized tank you should install an AV11 Drain & Y fitting in the well and an AV9 check valve with snifter valve at the tank. This will add air to the tank on each pump start and prevent water logging the tank. Use an AA4 Air Escape on the tank to allow excess air to escape. The distance between the AV11 and AV9 determines the amount of air introduced on each cycle. See the table for recommended settings. *See Figure 2 in Sec 1.0*.

Gaseous wells should use galvanized tanks with AA4 air escapes to vent off excess air and prevent "spurting" at the faucets.

Methane and other explosive or dangerous gases require special water treatment for safe removal. Consult a water treatment specialist to address these issues.

Installations with top feeding wells should use flow sleeves on the pump.

2.7 Check Valves

Our pumps use four different style check valves. We recommend check valves as they prevent back-spinning the pump and motor which will cause premature bearing wear. Check valves also prevent water hammer and upthrust damage. Check valves should be installed every 200' – 250' in the vertical discharge pipe.

The following information is for customers who wish to disable a check valve for a drain back system, these systems should use other means to prevent water hammer and upthrust damage:

- **Built-in stainless steel valves** have a flat which is easily drilled through using an electric drill and a ¼" or ⅜" drill bit to disable the valve.
- **Poppet style check valves which are threaded in from the top** of the discharge head can be easily removed using a ½" nut driver or deep socket. The hex hub is visible and accessible from the top.

- **Internal Flomatic™ design plastic poppet style valves** must be removed from inside which requires pump disassembly.
- **Built-in plastic poppet style valves with a stem through the top** may be removed from discharge head by pulling on the stem with pliers.

3.0 WIRE SIZING, SPLICING and POWER SUPPLY

Always follow the National Electric Code (N.E.C.), Canadian Electrical Code, and any state, provincial, or local codes.
We suggest using only copper wire. Size wire from the charts found in the Technical Data section of this manual, in the Franklin Electric AIM manual, or an N.E.C. (National Electric Code) code book. If discrepancies exist the N.E.C. book takes precedence over a manufacturer's recommendations.

3.1 Splicing Wire to Motor Leads

When the drop cable must be spliced or connected to the motor lead it is necessary that the splice be watertight. The splice can be done with heat shrink kits or waterproof tape.

A. Heat Shrink Splice Instructions
To use a typical heat shrink kit: strip ½" from the motor wires and drop cable wires, it is best to stagger the splices. Place the heat shrink tubes on the wires. Place the crimps on the wires and crimp the ends. Slide the heat shrink tubes over the crimps and heat from the center outward. The sealant and adhesive will ooze out the ends when the tube shrinks. The tube, crimps, sealant, and adhesive create a very strong, watertight seal.

B. Taped Splice Instructions

A) Strip individual conductor of insulation only as far as necessary to provide room for a stake type connector. Tubular connectors of the staked type are preferred. If connector O.D. is not as large as cable insulation, build-up with rubber electrical tape.

B) Tape individual joints with rubber electrical tape, using two layers; the first extending two inches beyond each end of the conductor insulation end, the second layer two inches beyond the ends of the first layer. Wrap tightly, eliminating air spaces as much as possible.

C) Tape over the rubber electrical tape with #33 Scotch electrical tape, or equivalent, using two layers as in step "B" and making each layer overlap the end of the preceding layer by at least two inches.

In the case of a cable with three conductors encased in a single outer sheath, tape individual conductors as described, staggering joints.

Total thickness of tape should be no less than the thickness of the conductor insulation.

4.0 WIRING THE CONTROLS and SWITCH

4.1 Mounting the Motor Control Box

Single phase 3-wire control boxes meet U.L. requirements for Type 3R enclosures. They are suitable for vertical mounting in indoor and

outdoor locations. They will operate at temperatures between 14°F (-10°C) and 122°F (50°C). Select a shaded, dry place to mount the box. Insure that there is enough clearance for the cover to be removed.

4.2 Verify Voltage and Turn Supply Power Off

Insure that your motor voltage and power supply voltage are the same.

Place the circuit breaker or disconnect switch in the OFF position to prevent accidentally starting the pump before you are ready.

Three-phase starter coils are very voltage sensitive; always verify actual supply voltage with a voltmeter.

High or low voltage, greater than ± 10%, will damage motors and controls and is not covered under warranty.

4.3 Connecting Motor Leads to Motor Control Box, Pressure Switch or Starter

Caution Do not power the unit or run the pump until all electrical and plumbing connections are completed. Verify that the disconnect or breaker is OFF before connecting the pressure switch line leads to the power supply. Follow all local and national codes. Use a disconnect where required by code.

A. Three-Wire Single Phase Motor
Connect the color coded motor leads to the motor control box terminals - Y (yellow), R (red), and B (black); and the Green or bare wire to the green ground screw.

Connect wires between the Load terminals on the pressure switch and control box terminals L1 and L2. Run a ground wire between the switch ground and the control box ground. *See Figure 4 or 5*.

B. Two-Wire Single Phase Motor
Connect the black motor leads to the Load terminals on the pressure switch and the green or bare ground wire to the green ground screw. *See Figure 3*.

C. Three phase motors
Connect the motor leads to T1, T2, and T3 on the 3 phase starter. Connect the ground wire to the ground screw in the starter box. Follow starter manufacturers instructions for connecting pressure switch or *see Figure 6*.

4.4 Connect To Power Supply

Complete the wiring by making the connection from the single phase pressure switch Line terminals to the circuit breaker panel or disconnect where used.

Three phase - make the connections between L1, L2, L3, and ground on the starter to the disconnect switch and then to the circuit breaker panel.

Three phase installations must be checked for motor rotation and phase unbalance. To reverse motor rotation, switch (reverse) any two leads. See the instructions for checking three phase unbalance in section 4.6. Failure to check phase unbalance can cause premature motor failure and nuisance overload tripping. If using a generator, see Technical Data for generators.

4.5 Three Phase Overload Protection

Use only Class 10, quick-trip overload protection on three-phase submersible motors. Furnas Class 14 NEMA starters with ESP100

overloads and Class 16 starters equipped with "K" overload heaters or ESP100 overloads will provide adequate protection.

The Franklin Electric Application Manual lists several acceptable starter/overload combinations. Call the FE hotline at 800-348-2420 or the pump manufacturer's Customer Service group for selection assistance.

Note - If replacing an above ground motor with a submersible, verify that the overloads provide Class 10 protection, most above ground motors have Class 20 overloads. Use of Class 20 overloads on submersible motors will not protect the motors and voids the warranty.

4.6 Three Phase Power Unbalance

A full three phase supply consisting of three individual transformers or one three phase transformer is recommended. "Open" delta or wye connections using only two transformers can be used, but are more likely to cause poor performance, overload tripping or early motor failure due to current unbalance.

Check the current in each of the three motor leads and calculate the current unbalance as explained below.

If the current unbalance is 2% or less, leave the leads as connected.

If the current unbalance is more than 2%, current readings should be checked on each leg using each of the three possible hook-ups. Roll the motor leads across the starter in the same direction to prevent motor reversal.

To calculate percent of current unbalance:

A. Add the three line amp values together.
B. Divide the sum by three, yielding average current.
C. Pick the amp value which is furthest from the average current (either high or low).
D. Determine the difference between this amp value (furthest from average) and the average.
E. Divide the difference by the average.
Multiply the result by 100 to determine percent of unbalance.

	Hookup 1			Hookup 2			Hookup 3		
Starter Terminals	L1	L2	L3	L1	L2	L3	L1	L2	L3
	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥
	⊤	⊤	⊤	⊤	⊤	⊤	⊤	⊤	⊤
Motor Leads	R	B	Y	Y	R	B	B	Y	R
	T3	T1	T2	T2	T3	T1	T1	T2	T3

Example:

T3-R = 51 amps	T2-Y = 50 amps	T1-B = 50 amps
T1-B = 46 amps	T3-R = 48 amps	T2-Y = 49 amps
T2-Y = 53 amps	T1-B = 52 amps	T3-R = 51 amps
Total = 150 amps	Total = 150 amps	Total = 150 amps
÷ 3 = 50 amps	÷ 3 = 50 amps	÷ 3 = 50 amps
— 46 = 4 amps	— 48 = 2 amps	— 49 = 1 amps
4 ÷ 50 = .08 or 8%	2 ÷ 50 = .04 or 4%	1 ÷ 50 = .02 or 2%

Current unbalance should not exceed 5% at service factor load or 10% at rated input load. If the unbalance cannot be corrected by rolling leads, the source of the unbalance must be located and corrected. If, on the three possible hookups, the leg farthest from the average stays on the same power lead, most of the unbalance is coming from the power source.

Contact your local power company to resolve the imbalance.

5.0 STARTING THE PUMP

5.1 Throttle the Discharge Before Starting Pump

Install a ball valve in the discharge line and set it ⅓ open before operating the pump in an open discharge manner. This will protect the pump from upthrust damage and also prevent over pumping the well and reduce turbidity. Keep the valve partially closed until the water runs clear.

5.2 Throttling A High Static Level Well To Prevent Upthrust

Any well with a high static water level may allow the pump to operate off the curve to the right or outside the "Recommended Range" shown on the pump curve. We recommend using a "Dole" flow restrictor or throttling with a ball valve to prevent upthrust damage to the pump and motor. The maximum flow must be restricted to be within the pumps recommended operating range. If you use a ball valve, set it, remove the handle, tape the handle to the pipe, and tag the valve with a note saying, "Do not open this valve or pump may be damaged". The easiest way to "set" the flow is to fill a 5 gallon bucket and time how long it takes to produce 5 gallons. Calculate the flow in gpm based on this value. As the water level drops in the well the flow will be reduced due to increased head and the valve will not interfere with performance.

5.3 Start the Pump

Partially open a valve (faucet) in the system and turn the breaker to the ON position.

Check all fittings for leaks.

Close the valve when the water clears and allow the pressure to build. If properly adjusted the switch should turn the pump off at the preset pressure. Open a few faucets and allow the pump to run through a few cycles. Check switch operation and verify that pressure settings are correct.

Recheck all fittings for leaks.

6.0 PAPERWORK and IOM

Please give this filled-in IOM and your business card to the owner. A sticker with your name and phone number on the tank or control box is a great sales tool for future business!

SINGLE PHASE – 60 HZ MOTOR SPECIFICATIONS

Type	Goulds Motor #/ Control Box	Franklin Motor Model Prefix	HP	Volts	Hz	S.F.	Amps	S.F. Amps	Ohms M=Main S=Start	Inverse Time Breaker	Dual Ele. Time Del. Fuse
4" 2W	S04932/ NR	2445040	½	115	60	1.60	10.0	12.0	1.0 – 1.3	30	20
	S04942/ NR	2445050	½	230	60	1.60	5.0	6.0	4.2 – 5.2	15	10
	S05942/ NR	2445070	¾	230	60	1.50	6.8	8.0	3.0 – 3.6	20	15
	S06942/ NR	2445081	1	230	60	1.40	8.2	9.8	2.2 – 2.7	25	20
	S07942/ NR	2445091	1½	230	60	1.30	10.6	13.1	1.5 – 1.9	30	20
4" 3W	S04930/ 00043	2145044	½	115	60	1.60	Y=10.0 B=10.0 R=0.0	Y=12.0 B=12.0 R=0.0	M = 1.0 – 1.3 S = 4.1 – 5.1	30	20
	S04940/ 00044	2145054	½	230	60	1.60	Y=5.0 B=5.0 R=0.0	Y=6.0 B=6.0 R=0.0	M = 4.2 – 5.2 S = 16.7 – 20.5	15	10
	S05940/ 00054	2145074	¾	230	60	1.50	Y=6.8 B=6.8 R=0.0	Y=8.0 B=8.0 R=0.0	M = 3.0 – 3.6 S = 11.0 – 13.4	20	15
	S06940/ 00064	2145081	1	230	60	1.40	Y=8.2 B=8.2 R=0.0	Y=9.8 B=9.8 R=0.0	M = 2.2 – 2.7 S = 10.1 – 12.3	25	20
4" 3W with RunCap	S07940/ 00074	2243001	1½	230	60	1.30	Y=10.0 B=9.9 R=1.3	Y=11.5 B=11.0 R=1.3	M = 1.5 – 2.3 S = 6.2 – 12.0	30	20
	S08940/ 00084	2243011	2	230	60	1.25	Y=10.0 B=9.3 R=2.6	Y=13.2 B=11.9 R=2.6	M = 1.6 – 2.3 S = 5.2 – 7.15	25	20
	S09940/ 00094	2243027	3	230	60	1.15	Y=14.0 B=12.2 R=4.7	Y=17.0 B=14.5 R=4.5	M = 0.9 – 1.5 S = 3.0 – 4.9	40	30
	S10940/ 00104	2243037	5	230	60	1.15	Y=23.0 B=15.9 R=11.0	Y=27.5 B=19.1 R=10.8	M = 0.68 – 1.0 S = 1.8 – 2.8	60	45

M = Main Winding – Black to Yellow, S = Start Winding – Red to Yellow
Y = Yellow lead – line amps, B = Black lead – main winding amps,
R = Red lead, start or auxiliary winding amps

THREE PHASE – 60 HZ MOTOR SPECIFICATIONS

Type	Goulds Model #	Franklin Motor Model Prefix					Rated Input		Maximum (S.F. Load)		Line to Line	Locked Rotor	KVA	Inverse Time Breaker	Dual Ele. Time Del. Fuse
			HP	Volts	Hz	S.F.	Amps	Watts	Amps	Watts	Res.	Amps	Code		
4" 3450 RPM	S04978	234501	½	200	60	1.6	2.8	585	3.4	860	6.6-7.3	17.5	N	15	5
	S04970	234511	½	230	60	1.6	2.4	585	2.9	860	9.5-10.4	15.0	N	15	5
	S04975	234521	½	460	60	1.6	1.2	585	1.5	860	38.4-41.6	7.5	N	15	3
	S05978	234502	¾	200	60	1.5	3.7	810	4.4	1150	4.66-5.12	24.6	M	15	8
	S05970	234512	¾	230	60	1.5	3.2	810	3.8	1150	7.24-7.84	21.4	M	15	6
	S05975	234522	¾	460	60	1.5	1.6	810	1.9	1150	27.8-30.2	10.7	M	15	3
	S06978	234503	1	200	60	1.4	4.6	1070	5.4	1440	4.1-4.5	31.0	M	15	10
	S06970	234513	1	230	60	1.4	4.0	1070	4.7	1440	5.2-5.6	27.0	M	15	8

THREE PHASE – 60 HZ MOTOR SPECIFICATIONS

Type	Goulds Model #	Franklin Motor Model Prefix					Rated Input		Maximum (S.F. Load)		Line to Line	Locked Rotor	KVA	Inverse Time Breaker	Dual Ele. Time Del. Fuse
			HP	Volts	Hz	S.F.	Amps	Watts	Amps	Watts	Res.	Amps	Code		
4" 3450 RPM	S06975	234523	1	460	60	1.4	2.0	1070	2.4	1440	21.2-23.0	13.5	M	15	4
	S07978	234504	1½	200	60	1.3	5.6	1460	6.8	1890	2.5-3.0	38.1	K	15	10
	S07970	234514	1½	230	60	1.3	4.9	1460	5.9	1890	3.2-4.0	33.1	K	15	10
	S07975	234524	1½	460	60	1.3	2.5	1460	3.0	1890	13.0-16.0	16.6	K	15	5
	S07979	234534	1½	575	60	1.3	2.0	1460	2.4	1890	20.3-25.0	13.2	K	15	4
	S08978	234305	2	200	60	1.25	7.9	2150	9.3	2700	1.9-2.4	53.6	L	20	15
	S08970	234315	2	230	60	1.25	6.9	2150	8.1	2700	2.4-3.0	46.6	L	20	15
	S08975	234325	2	460	60	1.25	3.5	2150	4.1	2700	9.7-12.0	23.3	L	15	8
	S08979	234335	2	575	60	1.25	2.8	2150	3.2	2700	15.1-18.7	18.6	L	15	5
	S09978	234306	3	200	60	1.15	11.3	2980	12.4	3420	1.3-1.7	71	K	30	20
	S09970	234316	3	230	60	1.15	9.8	2980	10.8	3420	1.8-2.2	62	K	25	20
	S09975	234326	3	460	60	1.15	4.9	2980	5.4	3420	7.0-8.7	31	K	15	10
	S09979	234336	3	575	60	1.15	3.9	2980	4.3	3420	10.9-13.6	25	K	15	8
	S10978	234307	5	200	60	1.15	18.4	5050	20.4	5810	.70-.94	122	K	50	35
	S10970	234317	5	230	60	1.15	16.0	5050	17.7	5810	.93-1.2	106	K	40	30
	S10975	234327	5	460	60	1.15	8.0	5050	8.9	5810	3.6-4.4	53	K	20	15
	S10979	234337	5	575	60	1.15	6.4	5050	7.1	5810	5.6-6.9	43	K	20	15
	S119784	234308	7½	200	60	1.15	27.1	7360	29.9	8450	.46-.57	188	K	70	50
	S119704	234318	7½	230	60	1.15	23.6	7360	26.0	8450	.61-.75	164	K	60	45
	S119754	234328	7½	460	60	1.15	11.8	7360	13.0	8450	2.4-3.4	82	K	30	25
	S119794	234338	7½	575	60	1.15	9.4	7360	10.4	8450	3.5-5.1	66	K	25	20
	S129724	234329	10	460	60	1.15	17.0	10,000	18.5	11400	1.8-2.3	116	L	45	30
	S119794	234339	10	575	60	1.15	13.6	10,000	14.8	11400	2.8-3.5	92.8	L	35	25

NOTES: Model numbers are three lead motors. Six lead motors with different model numbers have the same running performance, but when wye connected for starting have locked rotor amps 33% of the values shown. **For additional motor data call Franklin Electric at 1-800-348-2420.**

FURNAS STARTERS AND HEATERS

Motor Size	HP	Volts	FURNAS Class 16		ESP100	Inverse Time Breaker	Dual Ele. Time Del. Fuse
			Order Number	Heaters	Order Number		
4" 3Ø	½	200	16AD	K29	CSBD	15	5
		230	16AG	K28	CSBA	15	5
		460	16AH	K21	CSBC	15	5
	¾	200	16AD	K33	CSBD	15	8
		230	16AG	K31	CSBA	15	6
		460	16AH	K22	CSBC	15	3
	1	200	16AD	K37	CSDD	15	10
		230	16AG	K34	CSDA	15	8
		460	16AH	K26	CSBC	15	4
	1½	200	16AD	K41	CSDD	15	10
		230	16AG	K37	CSDA	15	10
		460	16AH	K28	CSDC	15	5
		575	16AE	K26	CSBE	15	4
	2	200	16AD	K49	CSDD	20	15
		230	16AG	K43	CSDA	20	15

NOTE: The Class 16 starter chart shows the order number for matched coil and load voltage, i.e. a 230 volt power supply with a 230 volt coil. To use a different coil voltage select the same size starter with a different coil.

Nomenclature: Ex. **16 B H;**

16 = Class 16 DP Starter

B = Starter **size**, sizes are A, B, C, D, E, F, G, H. Size determined by Full Load Amps and Locked Rotor Amps.

Motor Size	HP	Volts	FURNAS Class 16		ESP100	Inverse Time Breaker	Dual Ele. Time Del. Fuse
			Order Number	Heaters	Order Number		
4" 3Ø	2	460	16AH	K32	CSDC	15	8
		575	16AE	K29	CSDE	15	5
	3	200	16AD	K54	CSED	30	20
		230	16AG	K52	CSEA	25	20
		460	16AH	K37	CSDC	15	10
		575	16AE	K33	CSDE	15	8
	5	200	16AD	K61	DSFD	50	35
		230	16AG	K60	DSFA	40	30
		460	16AH	K49	CSDC	20	15
		575	16AE	K41	CSDE	20	15
	7½	200	16CD	K69	DSFD	70	50
		230	16BG	K64	DSFA	60	45
		460	16AH	K54	DSEC	30	25
		575	16AE	K52	DSEE	25	20
	10	460	16AH	K60	DSEC	45	30
		575	16AE	K57	DSEE	35	25

H = coil voltage. Voltages are: D = 200 V, E = 575 V, F = 115 V, G = 230 V, H = 460 V.

The Class 14 starter nomenclature can be found in your Jet & Submersible Price Book.

MOTOR INSULATION RESISTANCE READINGS

Normal Ohm/Megohm readings, ALL motors, between all leads and ground

⚠ CAUTION To perform insulation resistance test, open breaker and disconnect all leads from QD control box or pressure switch. Connect one ohmmeter lead to any motor lead and one to metal drop pipe or a good ground. **R x 100K Scale**

Condition of Motor and Leads	OHM Value	Megohm Value
New motor, without power cable	20,000,000 (or more)	20.0
Used motor, which can be reinstalled in well	10,000,000 (or more)	10.0
Motor in well – Readings are power cable plus motor		
New motor	2,000,000 (or more)	2.0
Motor in reasonably good condition	500,000 to 2,000,000	0.5 – 2.0
Motor which may be damaged or have damaged power cable *Do not pull motor for these reasons*	20,000 to 500,000	0.02 – 0.5
Motor definitely damaged or with damaged power cable *Pull motor and repair*	10,000 to 20,000	0.01 – 0.02
Failed motor or power cable *Pull motor and repair*	Less than 10,000	0 – 0.01

Generator Operation

- For externally regulated generator kilovolt amperes (KVA) ratings see Table 1. Electrical voltage, frequency, phase and ampacity, **MUST** match that shown on the motor nameplate, or pump control box.

FAILURE TO USE A MANUAL OR AUTOMATIC TRANSFER SWITCH WHEN GENERATOR IS USED AS STANDBY OR BACKUP CAN CAUSE SHOCK, BURNS OR DEATH.

Min. Generator Rating	Pump Motor Horsepower ①							
	⅓	½	¾	1	1½	2	3	5
KVA	1.9	2.5	3.8	5.0	6.3	9.4	12.5	18.8
KW	1.5	2.0	3.0	4.0	5.0	7.5	10.0	15.0

① **NOTE:** For two-wire motors, minimum generator ratings 50% higher than shown are necessary.

NOTICE: FOLLOW THE GENERATOR MANUFACTURER'S INSTRUCTIONS CAREFULLY.

Courtesy of Franklin Electric Company

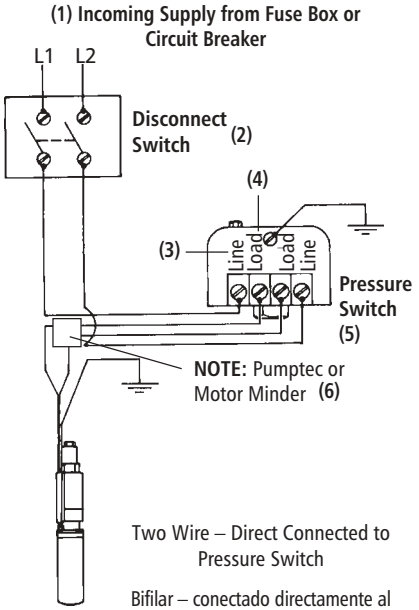


Figure (Figura) 3

1. Suministro de entrada de la caja de fusibles o del cortacircuitos
2. Interruptor de desconexión
3. Línea
4. Carga
5. Interruptor por caída de presión
6. NOTA: Pumptec o Motor Minder
7. Caja de control trifilar
8. Rojo
9. Amarillo
10. Negro

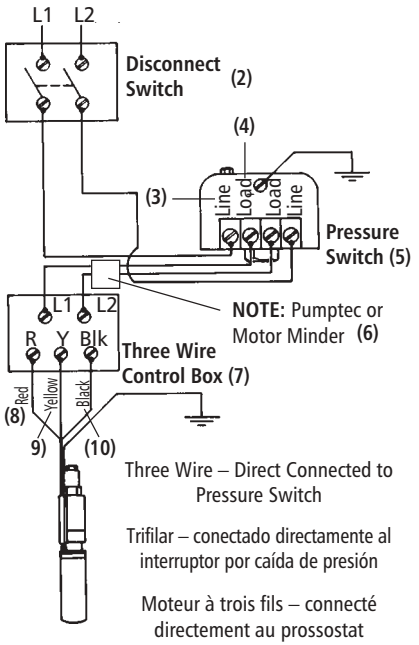


Figure (Figura) 4

1. Courant d'entrée provenant de la boîte à fusibles ou du disjoncteur
2. Sectionneur
3. Ligne
4. Charge
5. Pressostat
6. Protection Pumptec ou Motor Minder
7. Boîte de commande à trois fils
8. Rouge
9. Jaune
10. Noir

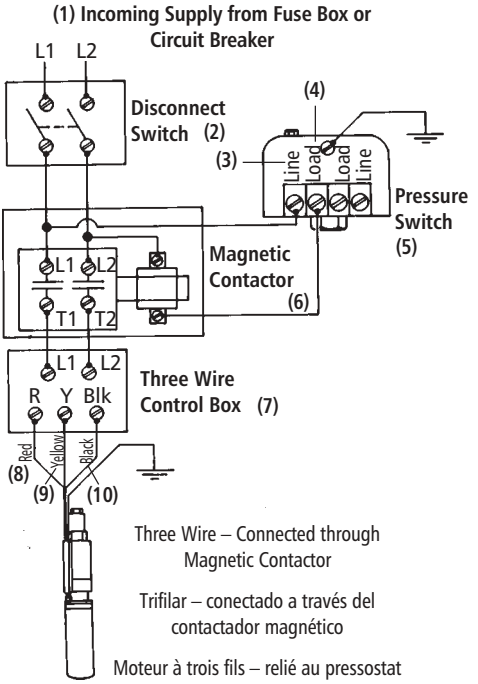


Figure (Figura) 5

1. Suministro de entrada de la caja de fusibles o del cortacircuitos
2. Interruptor de desconexión
3. Línea
4. Carga
5. Interruptor por caída de presión
6. Contactador magnético
7. Caja de control trifilar
8. Rojo
9. Amarillo
10. Negro
11. Calentadores
12. Arrancador magnético con compensación ambiental con calentadores de disparo rápido

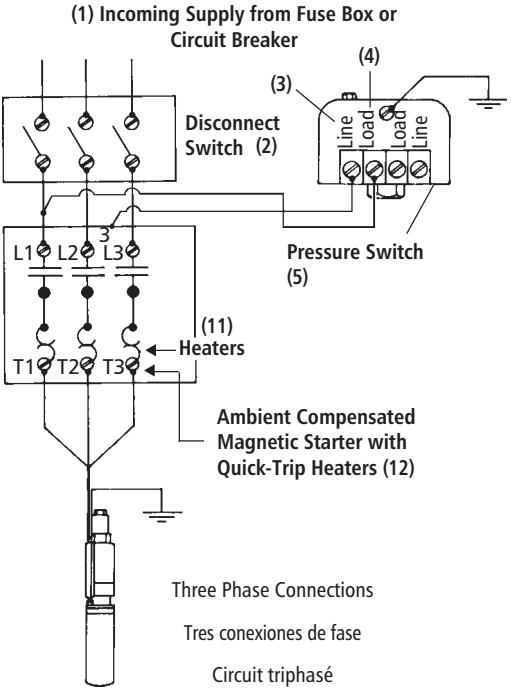
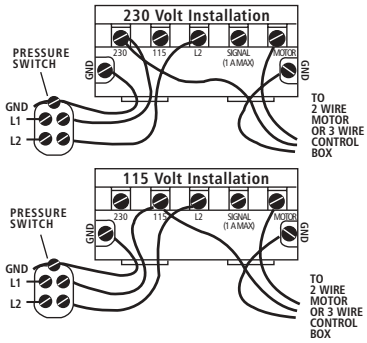


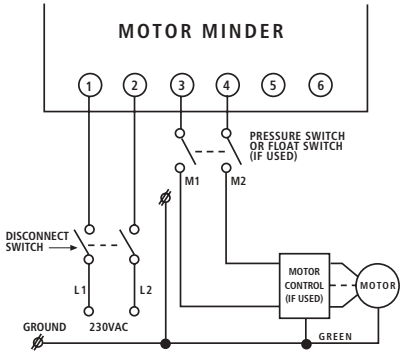
Figure (Figura) 6

1. Courant d'entrée provenant de la boîte à fusibles ou du disjoncteur
2. Sectionneur
3. Ligne
4. Charge
5. Pressostat
6. Contacteur magnétique
7. Boîte de commande à trois fils
8. Rouge
9. Jaune
10. Noir
11. Dispositifs de protection contre la surcharge (DPS)
12. Démarreur magnétique compensé (température ambiante) avec DPS à déclenchement rapide

PUMPTEC WIRING



MOTOR MINDER WIRING



SINGLE PHASE MOTOR MAXIMUM CABLE LENGTH (motor to service entrance) (2)

Motor Rating		Copper Wire Size (1)								
Volts	HP	14	12	10	8	6	4	2	0	00
115	⅓	130	210	340	540	840	1300	1960	2910	3540
	½	100	160	250	390	620	960	1460	2160	2630
230	⅓	550	880	1390	2190	3400	5250	7960	11770	
	½	400	650	1020	1610	2510	3880	5880	8720	
	¾	300	480	760	1200	1870	2890	4370	6470	7870
	1	250	400	630	990	1540	2380	3610	5360	6520
	1.5	190	310	480	770	1200	1870	2850	4280	5240
	2	150	250	390	620	970	1530	2360	3620	4480
	3	120*	190	300	470	750	1190	1850	2890	3610
	5	0	0	180*	280	450	710	1110	1740	2170
	7.5	0	0	0	200*	310	490	750	1140	1410
	10	0	0	0	0	250*	390	600	930	1160
	15	0	0	0	0	170*	270*	430	660	820

(1) This table is based on copper wire. If aluminum wire is used it must be two sizes larger.
Example: When the table calls for #12 copper wire you would use #10 aluminum wire.
(2) Single phase control boxes may be connected at any point of the total cable length.

THREE PHASE MOTOR MAXIMUM CABLE LENGTH (motor to service entrance) (3)

Motor Rating		Copper Wire Size (1)										
Volts	**HP**	**14**	**12**	**10**	**8**	**6**	**4**	**2**	**0**	**00**	**000**	**0000**
200 V 60 Hz	.5	710	1140	1800	2840	4420						
	.75	510	810	1280	2030	3160						
	1	430	690	1080	1710	2670	4140					
	1.5	310	500	790	1260	1960	3050					
	2	240	390	610	970	1520	2360	3610	5420			
	3	180	290	470	740	1160	1810	2760	4130			
	5	110*	170	280	440	690	1080	1660	2490	3050	3670	4440
	7.5	0	0	200	310	490	770	1180	1770	2170	2600	3150
	10	0	0	0	230*	370	570	880	1330	1640	1970	2390
230 V 60 Hz	.5	930	1490	2350	3700	5760	8910					
	.75	670	1080	1700	2580	4190	6490	9860				
	1	560	910	1430	2260	3520	5460	8290				
	1.5	420	670	1060	1670	2610	4050	6160	9170			
	2	320	510	810	1280	2010	3130	4770	7170	8780		
	3	240	390	620	990	1540	2400	3660	5470	6690	8020	9680
	5	140*	230	370	590	920	1430	2190	3290	4030	4850	5870
	7.5	0	160*	260	420	650	1020	1560	2340	2870	3440	4160
	10	0	0	190*	310	490	760	1170	1760	2160	2610	3160
460 V 60 Hz	.5	3770	6020	9460								
	.75	2730	4350	6850								
	1	2300	3670	5770	9070							
	1.5	1700	2710	4270	6730							
	2	1300	2070	3270	5150	8050						
	3	1000	1600	2520	3970	6200						
	5	590	950	1500	2360	3700	5750					
	7.5	420	680	1070	1690	2640	4100	6260				
	10	310	500	790	1250	1960	3050	4680	7050			
575 V 60 Hz	.5	5900	9410									
	.75	4270	6810									
	1	3630	5800	9120								
	1.5	2620	4180	6580								
	2	2030	3250	5110	8060							
	3	1580	2530	3980	6270							
	5	920	1480	2330	3680	5750						
	7.5	660	1060	1680	2650	4150						
	10	490	780	1240	1950	3060	4770					

(3) The portion of the total cable which is between the service entrance and a three phase motor starter should not exceed 25% of the total maximum length to assure reliable starter operation.

Lengths marked * meet the U.S. National Electrical Code ampacity only for individual conductor 75°C cable. Only the lengths without * meet the code for jacketed 75°C cable. Local code requirements may vary.

For additional cable information, go to www.franklin-electric.com or call Franklin Electric at 1-800-348-2420.

DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING ANY SERVICE. FAILURE TO DO SO CAN CAUSE SHOCK, BURNS OR DEATH.

Symptom	Probable Cause	Recommended Action
PUMP MOTOR NOT RUNNING	1. Motor thermal protector tripped a. Incorrect control box b. Incorrect or faulty electrical connections c. Faulty thermal protector d. Low voltage e. Ambient temperature of control box/starter too high f. Pump bound by foreign matter g. Inadequate submergence	1. Allow motor to cool, thermal protector will automatically reset a – e. Have a qualified electrician inspect and repair, as required f. Pull pump, clean, adjust set depth as required g. Confirm adequate unit submergence in pumpage
	2. Open circuit breaker or blown fuse	2. Have a qualified electrician inspect and repair, as required
	3. Power source inadequate for load	3. Check supply or generator capacity
	4. Power cable insulation damage 5. Faulty power cable splice	4 – 5. Have a qualified electrician inspect and repair, as required
LITTLE OR NO LIQUID DELIVERED BY PUMP	1. Faulty or incorrectly installed check valve	1. Inspect check valve, repair as required
	2. Pump air bound	2. Successively start and stop pump until flow is delivered
	3. Lift too high for pump	3. Review unit performance, check with dealer
	4. Pump bound by foreign matter	4. Pull pump, clean, adjust set depth as required
	5. Pump not fully submerged	5. Check well recovery, lower pump if possible
	6. Well contains excessive amounts of air or gases	6. If successive starts and stops does not remedy, well contains excessive air or gases
	7. Excessive pump wear	7. Pull pump and repair as required
	8. Incorrect motor rotation – three phase only.	8. Reverse any two motor electrical leads