Reverse Osmosis System

Service Manual

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HANNA REVERSE OSMOSIS SYSTEMS

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HANNA REVERSE OSMOSIS UNIT

System Description

The Hanna Reverse Osmosis (Spot Free Rinse System) is engineered with the best available components on the market to deliver low pressure, spot free water to the tunnel. The system can be installed on any existing car wash, as well as, new installations. Years of trouble free service, with little maintenance, can be expected. The following equipment is included in your Hanna Reverse Osmosis Pumping and Storage tank.

1. Spot Free Water Storage Tank
2. Blue Charcoal Filter
3. Chlorine Test Kit
4. 10' 3/4" Product Hose
5. R.O. Owner's and Installation Manual.

The following should be installed for the R.O. Unit by its appropriate installer:

1. 208/220 Volt Single-Phase or Three phase electricity, ground and other electrical hook-ups as required by local Electrical Codes and City Ordinances.

2. 1/2" (Use 1" for 4000 GPD, Use 1 ½" for 6000 GPD or Above Units) Water Supply Line. This line should be taken off of the existing water softener to provide softened water to the R.O. Unit.

   NOTE: If the water supplied to the R.O. Unit is below 50º F, then hot and cold water must be blended together to provide a consistent water temperature between 70º and 90º F.

3. 1/2" (Use 1" for 4000 GPD, Use 1 ½" for 6000 GPD or Above Units) Drain Line.

4. A clean floor and working space for the R.O. Unit and Spot Free Storage Tank.

HANNA REVERSE OSMOSIS UNIT EQUIPMENT INSTALLATION

1. Position plastic storage tank in equipment room as close to the production unit as possible.

   NOTE: When installing tank, make sure that the area the tank is clean and free of dirt and debris, so as not to damage the Spot Free Storage tank.

2. Place blue charcoal filter between softened water supply and R.O. unit. Hook-up incoming water into the inlet side then turn on water supply and allow the unit to flush with water for at least 10 minutes or until water that is coming out of filter outlet that is clean and clear. Turn water supply off.

3. Install a hose from the outlet side of the charcoal filter to the inlet hook-up on the R.O. unit. This connecting point is located on the back of the R.O. unit behind the 0-100 psi pressure gauge.

4. On the back of the R.O. unit control panel is a blue hose that attaches to the top of the Spot Free storage tank. This hose provides a route for the spot-free water to get from the R.O. unit to the storage tank.

5. On the back of the R.O. unit control panel is a red hose that goes to the drain provided for the unit. **NOTE: This water can be returned to the wash tank if desired.**

6. Inside the R.O. unit control box is a 4-conductor cable coming from the computer. This control cable goes to the float switch that is located in the Spot Free storage tank. The proper connection sequence is as follows:

   Red Lead ------ Lower Float Switch
   Green Lead ------ Upper Float Switch
   White Lead ------ Mid Level Float Switch
   Black Lead ------ Upper, Mid and Lower Float

   (See Appendix A)

7. Install ¾" line between the outlet of the Spot Free storage tank (lower fitting) and the inlet side of the delivery pumps (elbow located on top of pump).

HANNA REVERSE OSMOSIS UNIT CHECKOUT PROCEDURE

Before continuing installation, perform the following checks:

1. Turn on water supply valve and check for leaks of any kind. If any are found, turn off the valve, repair leak and retest. The water pressure should read between 40-60 psi, at the 0-100 psi gauge, depending on the city water pressure.

2. Perform chlorine test according to the instructions provided in the test kit. If any trace of yellow is found, re-check installation of charcoal filter for a reversed hook-up. Properly install charcoal filters, and retest. If the charcoal filter is properly installed and the chlorine test fails again then the charcoal filter is defective and must be replaced.

<<< CAUTION HIGH VOLTAGE >>>

3. Check electrical voltage at breaker and verify that 220 Volts single phase or three phase is provided to unit depending on the model.

4. Check that drain hose has been connected from R.O. unit to drain.

5. Check to see if the "run" and "power" lights on the Omron computer are lit.

Reverse Osmosis System Electrical Spec's

System Size	Production			
	Voltage	Amps	Delivery pump	Total amps
2000 GPD System	230v single Phase	5.4	9.9 amps/single ph	15.3
4000 GPD System	230v Three Phase	4.7	4.7 amps/ three ph	9.4
6000 GPD System	230v Three Phase	9.4	4.7 amps/ three ph	14.1
8000 GPD System	230v Three Phase	9.4	4.7 amps/ three ph	14.1
10,000 GPD System	230v Three Phase	14.1	4.7 amps/ three ph	18.8

Total amps is based upon one delivery pump. If additional delivery pumps are used then add to the total amps the amount of amp draw per delivery pump.

HANNA REVERSE OSMOSIS UNIT TURN-ON PROCEDURE

Now that the Hanna Reverse Osmosis Unit is installed, Spot Free water can be produced. Turn power on to the R.O. unit and it should start to produce Spot Free water (Product Water). There should be a supply of water going to the Spot Free storage tank and a small amount of water coming out of the drain hose (Reject Water). The pressure gauge on the front of the R.O. control panel will indicate the product supply pump pressure. It should read between 130-195 psi. The unit should run for several minutes, allowing air to escape the system.

Do not make any adjustments until the unit has been turned on for about 10-15 minutes. This unit was factory run and tested and should not need any adjustments, but if needed, proceed as follows:

To adjust the amount of Product Water or Reject Water adjust the regulator. The regulator is located in the middle of the R.O. control panel, for the supply pump. When the regulator is increased (turned clockwise) there will be less flow indicated on the reject flow meter and more flow on the product flow meter.

NOTE: Never exceed 195 psi, or damage will occur to the R.O. Unit pump and membrane.

To properly set the ratio of Product Water to reject water, adjust the regulator starting out at about 100 psi and increase the pressure in 10-psi increments. You will notice that, even though you keep increasing the pressure, the product water does not increase (only the reject water decreases). At this point, by increasing the pressure, you are only working the membranes harder and harder, but yet not producing any more water. A lot of systems run typically at 150-170 psi.

HANNA REVERSE OSMOSIS UNIT RATINGS

Typical recovery rates and settings for a Hanna R.O. System are as follows:

System Size	Product Water		Reject Water	
	Minimum GPM	Maximum GPM	Minimum GPM	Maximum GPM
2000 GPD System	.7	1.0	1.4	1.5
4000 GPD System	1.6	2.0	3.0	3.5
6000 GPD System	2.5	3.0	4.0	4.5
8000 GPD System	3.5	4.0	5.0	5.5
10,000 GPD System	4.5	5.0	6.0	6.5

Never exceed the above listed recovery rates or severe fouling will result and membrane warranty will be void. It is best and most economical to have a high rate of reject water, than to take a chance in damaging membranes by pushing the R.O. unit too hard.

If the unit is not producing the anticipated amount of Spot Free water, the following factors can usually be contributing to its failure:

A. TDS (Total Dissolved Solids) above 300 PPM

B. Water temperature is too cold

C. Hard water

Important Note: Once the Spot Free tank has about 2-3' of water, you will need to prime the delivery pump. To do this, simply loosen the hose fitting on the discharge side of the pump, allowing water and air to flow through the pump until all air is purged from the line.

If there are any problems, questions, or concerns on setting up this unit contact Jim Coleman Company at 800-999-9878 or 713-683-9878.

HANNA REVERSE OSMOSIS UNIT DELIVERY AND HOOK-UP

Now the R.O. Unit is producing Spot Free Water and it is time to hook-up the tunnel delivery system.

Install 3/4" hose from the solenoid on the delivery pump to the top of the Versa arch or the rinse curtain arch in the tunnel.

Make sure the test switch located in front of the R.O. Unit control box is in the off position. This will allow the unit to automatically shut off when the plastic storage tank is full. The test switch is used to by pass the tank switches so that the operator can verify that the system is working.

AUTOMATIC HOOK UP

You will need to run two wires from the R.O. Electrical Panel to the Tunnel Controller.
On the R.O. Electrical panel connect one wire to input # 010 on the OMRON computer and the other wire to 24 VOLT AC common on the output side of the OMRON computer. The Tunnel controller needs to send a 24v ac signal to the Omron to turn on the delivery pump when the arch should deliver spot free water.

COMPUTER OPERATION DESCRIPTION

PRODUCTION

Computer receives a signal from upper float switch and mid level float switch that tank is low on water. If signal is present over 10 seconds the computer will turn on water solenoid valve to production pump. After 10 seconds the computer then determines that if the water pressure is above 20 PSI, to turn on the production pump motor starter. If at any time the computer does not receive a signal from the pressure switch that water pressure is above 20 PSI, then the computer will flash output 107 and turn off the production pump.

DELIVERY

When the computer receives a 24V signal from the tunnel controller (inputs 10-11), it has a one second delay in turning on the delivery pump motor starter. If at anytime the computer receives a signal from low water cut off that the poly tank is empty the computer will shut down the delivery pump and flash output 106.

Power and the run light on the Omron computer must be on for the computer to function properly.

REVERSE OSMOSIS SIZE

To determine what size your R.O. Unit is, simply measure the membranes mounted on the unit.

If the membrane is 4"x40" the unit is capable of producing 2,000 gallons per day.
If the membrane is (2) 4"x40" the unit is capable of producing 4,000 gallons per day.
If the membrane is (3) 4"x40" the unit is capable of 6,000 gallons per day and so on.
If the membrane is (4) 4"x40" the unit is capable of 8,000 gallons per day and so on.
If the membrane is (5) 4"x40" the unit is capable of 10,000 gallons per day and so on.

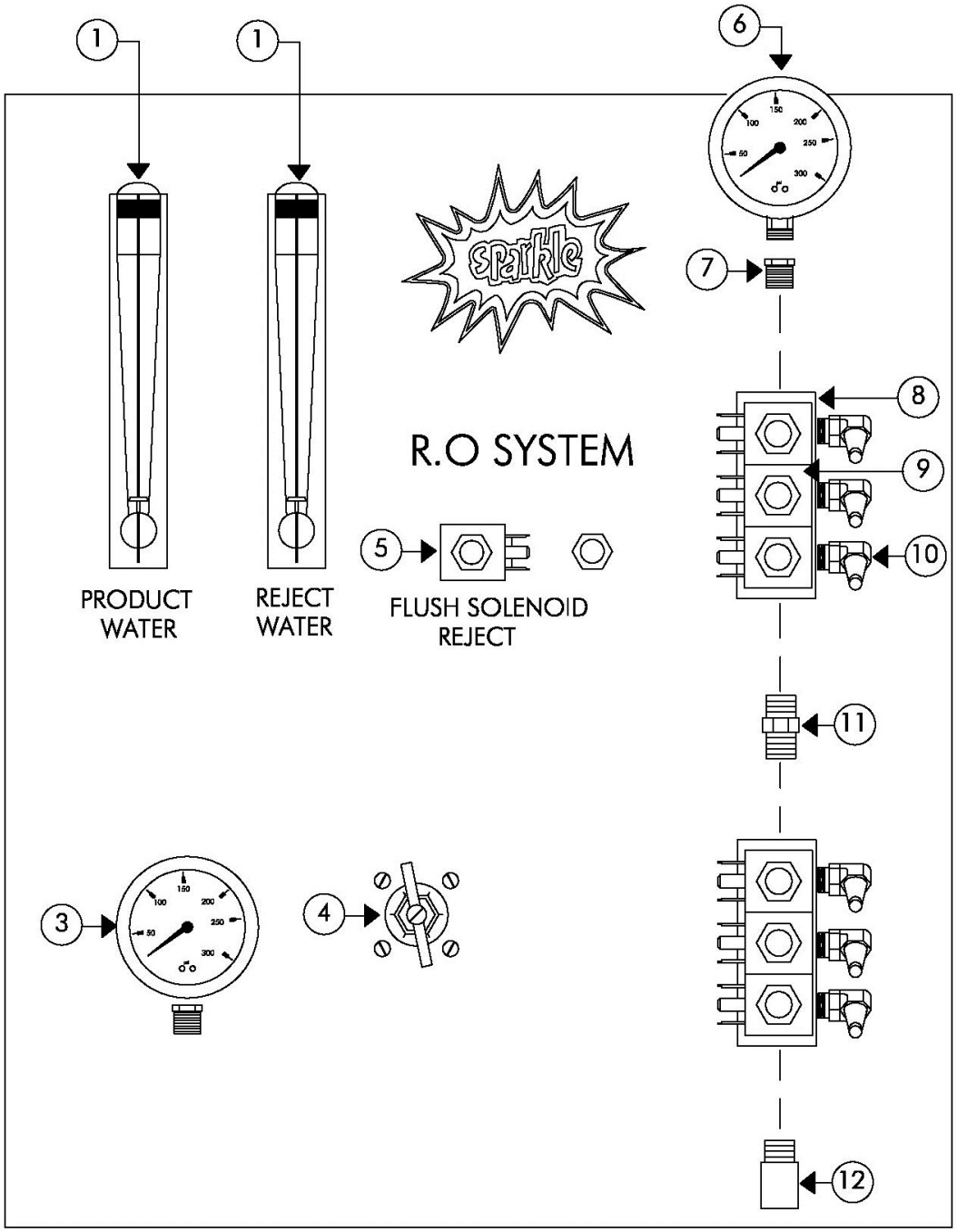
REVERSE OSMOSIS PARTS LIST

ITEM	PART #	DESCRIPTION
1	47030	.2-2.0 GPM Flow Meter
	47040	.1-1.0 GPM Flow Meter
	47044	.5-5.0 GPM Flow Meter
	47048	1.0-10.0 GPM Flow Meter
3	47010	0-300 PSI Panel-Mount Gauge
4	58020	Pressure Regulator
5	64070	24V ½ Solenoid Valve
	64035	24V 1" Solenoid Valve
6	47011	0-300 PSI Lower-Mount Pressure Gauge
8	64019	Two-Stage Solenoid
	64021	Three-Stage Solenoid
	64023	Four-Stage Solenoid
9	64026	24V Solenoid Coil
10		¼ MPT x 3/8 Poly Flow Tubing Fitting
11	22164	¼ HEX Nipple
12	22052	¼ ST ELL
13	22228	3/8 Hose Fitting Swivel
14		3/8 MP x 3/8 Flare X 90 °
15	22046	3/8 Elbow
16	22200	38 ST Tee
17	22102	3/8 x ½ Bushing
18	64002	½ Solenoid Valve
19	22216	½ MPT x 3/8 Flare
20	22218	½ MPT x ½ Hose Barb
22	34020	3/8 Check Valve
21		3/8 MPT x 3/8 Flare
22	222212	3/8 MP x 3/8 Hose Barb
23	22046	3/8 Elbow
24	22226	¼ Hose Barb Swivel
25		¼ FPT x ¼ Flare x 90°
26		¼ MPT x ¼ Flare x 90°
27	22088	¼ x 3/8 Bushing
28	22102	½ x 3/8 Bushing
29	22176	½ x 3/8 Bushing
30	62130	Reverse Osmosis Membrane AKA-500 2 ½" x 4
	62130-1	Reverse Osmosis Element for AKA-500
	62130-2	Reverse Osmosis Housing AKA-500

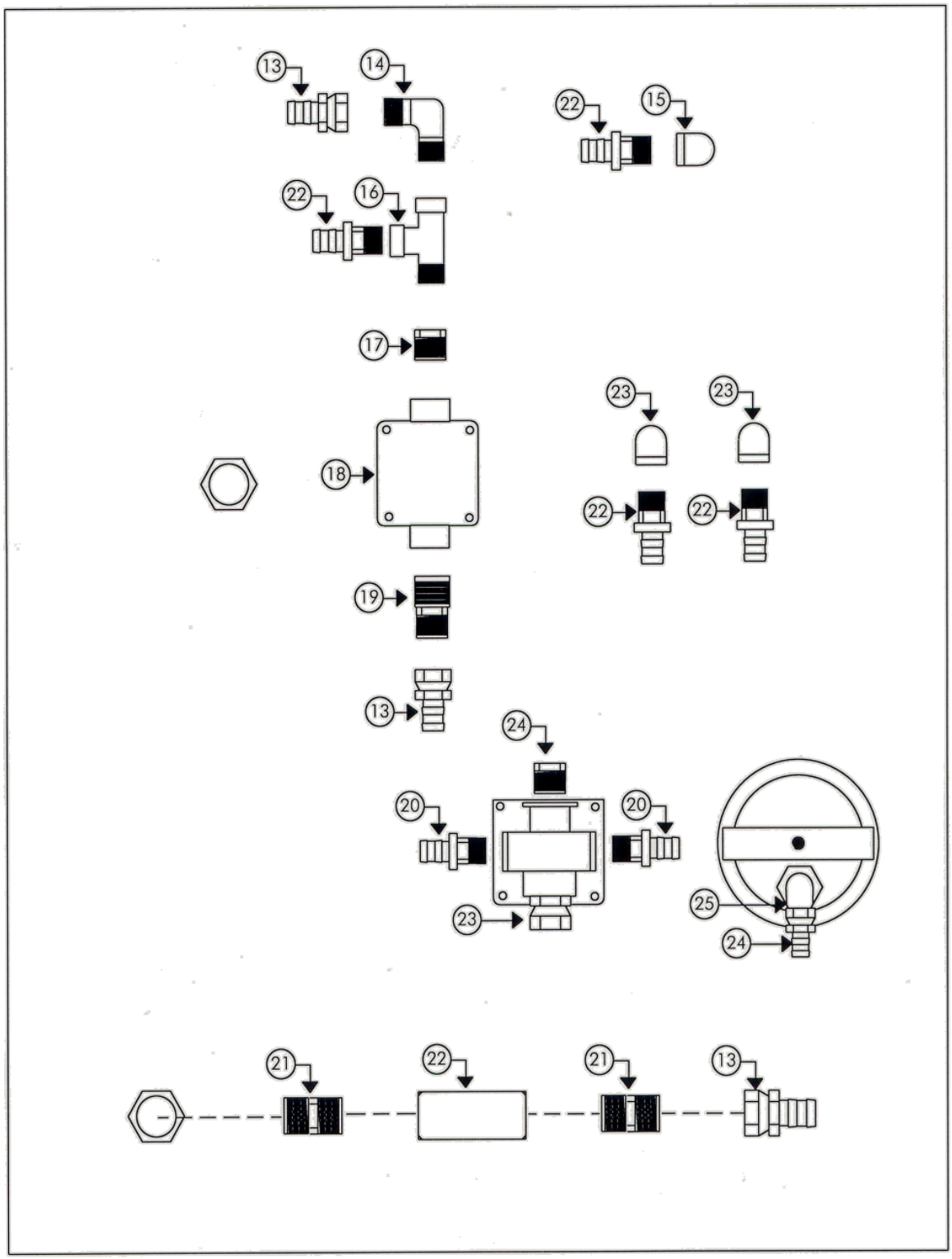
REVERSE OSMOSIS PARTS LIST cont.

ITEM	PART #	DESCRIPTION
	62132	Reverse Osmosis Membrane AKA-2000 4"x 40
	62132-2	Reverse Osmosis Element for AKA-2000
31	22084	½ MPT x ½ FPT Coupling
32		½ MPT x ½ Flare x 90°
34	57002	Procon Pump For 500 GPD Reverse Osmosis
	57030	Procon Pump for 1600 GPD Reverse Osmosis
ITEM	**PART #**	**DESCRIPTION**
35	22056	½ ST Ell
37	22172	½ Hex Nipple
39	22166	3/8 x ¼ Hex Nipple
40		Pressure Switch Reverse Action 69WR5
41	66004	3/8 Filter Housing
	66034	¾ Filter
42	57050	PB-10 Pump
43	22108	¾ x ½ Bushing
ITEMS	**PART #**	**DESCRIPTION**
NOT	33460	Omron Controller (may vary with unit size)
SHOWN	66054	2 Cubic Feet Charcoal Filter
	95404	4 Cubic Feet Charcoal Filter
	66064	Bag Charcoal 2 Cubic Feet

FRONT OF R.O. SYSTEM BOARD PANEL



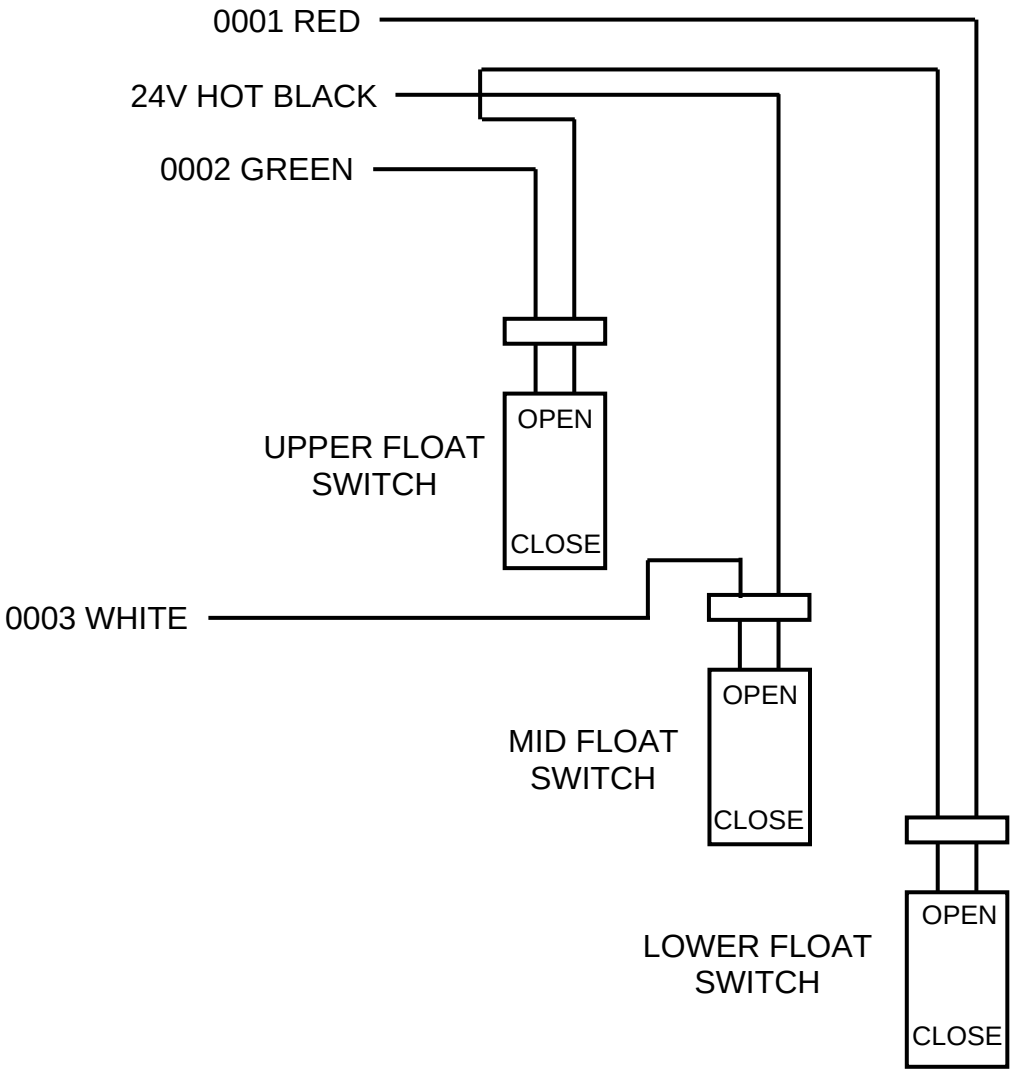
BACK OF R.O. SYSTEM BOARD PANEL



TROUBLE SHOOTING GUIDE

NO.	INPUTS	LIGHTS	LIGHT OPERATION
0000	Water Pressure Switch	**On**	Turns off when pressure is low
0001	Low Water Float Switch	**Off**	Turns on when Tank Runs Empty
0002	Upper Water Float Switch	**Off**	Turns on When Tank is Low on Water
0003	Mid Level Float Switch	**Off**	Turns on when water level drops below float switch
0004	Bay 1 Input	**Off**	Turns on When Bay 1 is on SF
0005	Bay 2 Input	**Off**	Turns on When Bay 2 is on SF
0006	Bay 3 Input	**Off**	Turns on When Bay 3 is on SF
0007	Bay 4 Input	**Off**	Turns on When Bay 4 is on SF
0008	Bay 5 Input	**Off**	Turns on When Bay 5 is on SF
0009	Bay 6 Input	**Off**	Turns on When Bay 6 is on SF
0010	Tunnel 1 input	**Off**	Turns on When tunnel controller is sending a signal
0011	Tunnel 2 Input	**Off**	Turns on When tunnel controller is sending a signal
	OUTPUTS	**LIGHTS**	**LIGHT OPERATION**
100	Self Serve Delivery Pump	**Off**	Turns on When Bay 1-6 is on SF
101	Water Solenoid	**Off**	Turns on to Feed Production Pump
102	Production Pump	**Off**	Turns on Refill Storage Tank
103	Flush Solenoid	**Off**	Turns on to Flush Membranes
104	Tunnel #1 Delivery Pump	**Off**	Turns on When Tunnel1 Calls for SF
105	Tunnel #2 Delivery Pump	**Off**	Turns on When Tunnel 2 Calls for SF
106	Flashing Low Water Light	**Off**	Flashes When Tank is Empty
107	Flashing Low Press. Light	**Off**	Flashes When Water Pressure is Low

FLOAT SWITCH HOOK-UP



(Appendix A)

Operating Instructions & Parts Manual

FW0154
0112
Supersedes
0907

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Pressure Booster Pumps

Description

Pressure booster pumps increase water pressure from city mains or private water systems. Applications include providing high water pressure for washing buildings, dairy walls or floors, hog parlors, poultry houses, rinsing or spray cooling equipment, lawn sprinkling and insecticide spraying. Stainless steel models can handle salt-water and contaminated water in reverse osmosis filter and other aggressive water applications.

Single-phase models are equipped with a capacitor start, thermal protected motor. Three-phase models require separate overload protection.

Unpacking

When unpacking the unit, inspect carefully for any damage that may have occurred during transit.

NOTE: Use pump with clear water only.

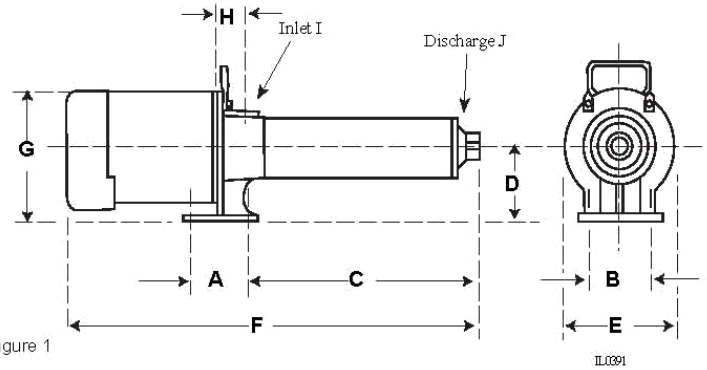


Figure 1

60 Hz Motor Driven Pump Dimensions (See Figure 1) •													Chart A
Stainless Steel Fitted	Powder-Coated Cast Iron Fitted	Cast Iron Fitted	Dimensions In Inches A	B	C	D	E	F	G	H	I	J	Lbs. Ship Wt.
PB0508S031	PB0508C031	PB0508A031†	3-1/4	3-3/4	10-3/16	3-7/8	6-1/2	19-15/16	7-3/8	1-7/16	3/4	3/4	35
PB0512S051	PB0512C051	PB0512A051†	3-1/4	3-3/4	13-3/8	3-7/8	6-1/2	23-3/8	7-3/8	1-7/16	3/4	3/4	38
PB0516S071	PB0516C071	PB0516A071	3-1/4	3-3/4	16-1/2	3-7/8	6-1/2	27	7-3/8	1-7/16	3/4	3/4	43
PB0712S071	PB0712C071	PB0712A071	3-1/4	3-3/4	13-3/8	3-7/8	6-1/2	23-7/8	7-3/8	1-7/16	3/4	3/4	42
PB1014S101	PB1014C101	PB1014A101	3-1/4	3-3/4	16-5/16	3-7/8	6-1/2	27-1/4	7-3/8	1-7/16	3/4	3/4	48
PB1016S151	PB1016C151	PB1016A151	3-1/4	3-3/4	17-5/8	3-7/8	6-1/2	29-3/16	7-3/8	1-7/16	3/4	3/4	51
PB1914S201	PB1914C201	PB1914A201	3-1/4	3-3/4	18-1/8	3-7/8	6-1/2	29-11/16	7-3/8	1-7/16	3/4	3/4	51
PB2711S201	PB2711C201	PB2711A201	3-1/4	3-3/4	15-3/8	3-7/8	6-1/2	27-1/2	7-3/8	1-7/16	1	1	52
PB3506S201	PB3506C201	PB3506A201	3-1/4	3-3/4	13-15/16	3-7/8	6-1/2	25-7/8	7-3/8	1-7/16	1	1	51
PB2714S301	PB2714C301	PB2714A301	3-1/4	3-3/4	18-1/2	3-7/8	6-1/2	30-9/16	7-3/8	1-7/16	1	1	54
PB3508S301	PB3508C301	PB3508A301	3-1/4	3-3/4	17-1/8	3-7/8	6-1/2	29-3/16	7-3/8	1-7/16	1	1	53
-	-	PB5504A201	3-1/4	3-3/4	13-3/4	3-7/8	6-1/2	25-15/16	7-3/8	2-1/8	2	2	57-
	-	PB5506A301	3-1/4	3-3/4	18-1/16	3-7/8	6-1/2	30-3/16	7-3/8	2-1/8	2	2	57-
	-	PB8504A201	3-1/4	3-3/4	16-1/2	3-7/8	6-1/2	28-5/8	7-3/8	2-1/8	2	2	58-
	-	PB8505A301	3-1/4	3-3/4	19-5/16	3-7/8	6-1/2	31-1/2	7-3/8	2-1/8	2	2	58
50 Hz Motor Driven Pump Dimensions (See Figure 1) •58													
PB0508Y031	-	PB0508X031	3-1/4	3-3/4	10-3/16	3-7/8	6-1/2	20-3/16	7-3/8	1-7/16	3/4	3/4	34
PB0514Y051	-	PB0514X051	3-1/4	3-3/4	14-7/16	3-7/8	6-1/2	25-7/16	7-3/8	1-7/16	3/4	3/4	41
PB0714Y071	-	PB0714X071	3-1/4	3-3/4	14-15/16	3-7/8	6-1/2	25-15/16	7-3/8	1-7/16	3/4	3/4	47
PB1020Y101	-	PB1020X101	3-1/4	3-3/4	21-11/16	3-7/8	6-1/2	33-5/16	7-3/8	1-7/16	3/4	3/4	53
PB1023Y101	PB1023Z101	PB1023X101	3-1/4	3-3/4	24-3/8	3-7/8	6-1/2	36	7-3/8	1-7/16	3/4	3/4	55
PB2717Y201	-	-	3-1/4	3-3/4	21-5/16	3-7/8	6-1/2	33-7/16	7-3/8	1-7/16	1	1	56
-	-	PB3508X151	3-1/4	3-3/4	16-13/16	3-7/8	6-1/2	29-11/16	7-3/8	1-7/16	1	1	52
PB1021Y101	-	-	3-1/4	3-3/4	22-1/2	3-7/8	6-1/2	34-3/16	7-3/8	1-7/16	3/4	3/4	54
PB1920Y151	-	-	3-1/4	3-3/4	24-1/16	3-7/8	6-1/2	34-3/8	7-3/8	1-7/16	3/4	3/4	56
-	PB1922Z201	-	3-1/4	3-3/4	26-1/8	3-7/8	6-1/2	37-3/16	7-3/8	1-7/16	3/4	3/4	59

(*) NOTE: Figure 1, holes in mounting base are open slotted 3/8" wide x 1/2" long; dimension A & B are centerline from these open slotted holes. These holes are suitable for 1/4 to 3/8" bolts. Dimensions also apply to three phase models.

(†) Equipped with carrying handle. 132079 handle available as an option on other models. Add 1-3/8" to "G" if handle is included.

 132934

PERFORMANCE SPECIFICATIONS

PRESSURE ADDED - PSI					10	20	40	60	80	100	120	140	160	180	200	Max. Press. PSI	Suction Pipe Tap NPT	Disch. Pipe Tap NPT
Stainless Steel Fitted	Powder Coated Cast Iron Fitted	Cast Iron Fitted	HP	Stage	Output - Gallons per Minute													
	PB0508C031	PB0508A031•	1/3	8	9.5	8.7	7.3	5.8	3.5							87		
PB0512S051	PB0512C051	PB0512A051•	1/2	12	9.8	9.2	8.2	7.3	6.3	5.2	3.5					131		
PB0516S071	PB0516C071	PB0516A071	3/4	16	9.9	9.5	8.7	8.0	7.3	6.5	5.8	4.8	3.5			175		
PB0712S071	PB0712C071	PB0712A071•	3/4	12	14.0	13.4	12.2	10.9	9.5	7.9	6.0	3.6				152	3/4"	3/4"
PB1014S101	PB1014C101	PB1014A101	1	14	*	*	14.5	13.4	12.3	11.2	9.8	8.3	6.3	3.3		185		
PB1016S151	PB1016C151	PB1016A151	1-1/2	16	*	*	14.7	13.8	12.9	11.9	10.8	9.7	8.2	6.6	4.3	211		
PB1914S201	PB1914C201	PB1914A201	2	14	27.5	27.0	25.7	24.2	22.6	20.8	18.7	16.2	13.0	7.8		190		
PB3506S201	PB3506C201	PB3506A201	2	6	41.5	41.1	40.5	34.2	23.3							90		
PB2711S201	PB2711C201	PB2711A201	2	11	*	*	31.3	29.3	26.8	23.8	19.8	13.0				150	1"	1"
PB3508S301	PB3508C301	PB3508A301	3	8	41.5	41.1	40.9	40.0	34.2	26.4	10.0					120		
PB2714S301	PB2714C301	PB2714A301	3	14	*	*	32.2	30.6	28.9	27.0	24.8	22.0	18.4	12.2		190		
-	-	PB5504A201	2	4	77.6	71.5	52.5									55		
-	-	PB5506A301	3	6	77.8	74.4	65.0	51.1	31.9							89	2"	2"
-	-	PB8504A201	2	4	105.8	90.0	47.0									49		
-	-	PB8505A301	3	5	108.8	98.8	60.0	25.0								80		

† Example: If PB0508A031 pump is connected to supply line of sufficient capacity, carrying water at 40 PSI, and the output of the pump is held to 7.3 GPM by a gate valve, the pump will add 40 PSI to line pressure for a total output pressure of 80 PSI.

* Operation of pump in this range may result in reduced pump life and/or motor damage.
To keep pump and seal lubricated, a minimum flow of 1.5 GPM must always be maintained through the pump.

Motor voltage: Single Phase 1/3 - 2 HP - 115/230; 3 HP - 230V 60 Hz.
Three Phase 1/2 - 2 HP - 208-230/460, 50/60Hz.
Three Phase 3 HP - 208-230/460, 60 HZ
For three phase models, use suffix "3" on the model no. Example: PB0512A053

• Handle included with these models only.

Single Phase Motor Data 60HZ						Chart C
Single Phase† 60 Hz 3450 RPM Capacitor Start						
HP	Motor Voltage	Factory Connected Motor Voltage	Service Factor Motor Amps		Locked Rotor Motor Amps		Code Letter
			115V	230V	115V	230V	
1/3	115/230	115V	8.6	4.3	26.0	13.0	K
1/2	115/230	115V	13.0	6.5	36.0	18.0	K
3/4	115/230	115V	14.0	7.0	52.0	26.0	K
1	115/230	230V	18.0	9.0	78.0	39.0	L
1-1/2	115/230	230V	21.0	10.5	98.0	49.0	J
2	115/230	230V	25.0	12.5	116.0	58.0	H
3	230	230V	-	13.5	-	53.0	D
Single Phase Motor Data 50HZ						
Single Phase† 50 Hz 2850 RPM Capacitor Start						
1/2	115/230	115V	10.0	5.0	48.0	24.0	M
3/4	115/230	115V	14.4	7.2	64.0	32.0	L
1	115/230	230V	16.4	8.2	72.0	36.0	K1-1/2
	115/230	230V	23.6	11.8	104.0	52.0	K
2	230	230V	-	13.2	-	55.0	H

†Thermal overload protector - automatic reset

Three Phase Motor Data							Chart D
Three Phase† 60/50 Hz 3450/2850 RPM Capacitor Start							
HP	Motor Voltage	Factory Connected Motor Voltage	Service Factor Motor Amps		Locked Rotor Motor Amps		Code Letter
			230V	460V	230V	460V	
3/4	208-230/460	230V	3.5	1.75	19.0	9.5	K
1	208-230/460	230V	4.5	2.25	26.9	13.5	K
1-1/2	208-230/460	230V	5.7	2.85	33.5	16.8	K
2	208-230/460	230V	7.4	3.70	44.0	22.0	K
3□	208-230/460	230V	9.8	4.90	48.0	24.0	D

□

††3 HP, 3 Phase motor operable on 60Hz only.

Material Construction		Chart E
Component	Standard Models*	Stainless Steel Models
Motor	Rear access - Nema 56J face	Rear access - Nema 56J face
Bearings	Ball-ball, permanently lubricated	Ball-ball, permanently lubricated
Impellers	Noryl with 304 stainless steel bearing insert	Noryl with 304 stainless steel bearing insert
Diffuser	Noryl	Noryl
Diffuser plates	Delrin	Delrin
Pump shaft	416 Stainless steel	304 Stainless steel
Pump shaft coupling	316 Stainless steel	316 Stainless steel
Pump shell	304 Stainless steel	304 Stainless steel
Discharge & inlet casting	Cast iron	304 Stainless steel
O-Rings	Buna-N	Viton
Seal composition	Carbon-silicon carbide, stainless steel spring and Buna-N	Carbon-silicon carbide, stainless steel spring and Viton

*Models with powder coated inlet & discharge also available.

Minimum Wire Size Chart (Gauge)								Chart F
Motor HP	Volts	Phase	Distance In Feet From Motor To Service Panel					Breaker Size (Amps)
			0-50	50-100	100-150	150-200	200-300	
			Wire Size					
1/3	115/230	1	14/14	14/14	14/14	12/14	12/14	15/15
1/2	115/230	1	12/14	12/14	12/14	12/14	10/14	20/15
3/4	115/230	1	12/14	12/14	10/14	10/12	8/12	20/15
1	115/230	1	10/14	10/14	10/12	8/12	6/10	30/15
1½	115/230	1	10/12	8/12	6/12	*/10	*/10	30/20
2	115/230	1	10/12	8/12	6/12	*/10	*/10	30/20
3	230	1	10	10	10	10	8	30
3/4	230/460	3	14/14	14/14	14/14	14/14	14/14	15/15
1	230/460	3	14/14	14/14	14/14	14/14	12/14	15/15
1½	230/460	3	14/14	14/14	14/14	12/14	12/14	15/15
2	230/460	3	14/14	14/14	14/14	12/14	10/12	15/15 3
3	230/460	3	14/14	14/14	14/14	12/14	10/12	15/15

(*) Not economical to run in 115V, use 230V.

General Safety Information

Carefully read and follow all safety instructions in this manual and on pump. Keep safety labels in good condition. Replace missing or damaged safety labels.

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 if ignored.*

⚠WARNING *Warns of hazards that CAN cause serious personal injury or death, if ignored.*

⚠CAUTION *Warns of hazards that MAY cause minor personal injury, product or property damage if ignored.*

IMPORTANT: Indicates factors concerned with operation, installation, assembly or maintenance which could result in damage to the machine or equipment if ignored.

NOTE: Indicates special instructions which are important but are not related to hazards.

⚠WARNING

Hazardous voltage. Can shock, burn or cause death. Ground pump before connecting to power supply.

⚠ *Wire motor for correct voltage. See "Electrical" section and Motor Data Charts C&D of this manual, and motor nameplate.*

⚠ *Ground motor before connecting to power supply.*

⚠ *Meet United States National Electrical Code and local codes for all wiring.*

⚠ *Do not handle a pump or pump motor with wet hands or when standing on a wet or damp surface or in water.*

⚠ *Follow wiring instructions in this manual when connecting to power lines.*

⚠WARNING *Always disconnect power source before performing any work on or near the motor or its connected load.*

Do not use to pump flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. Do not use in flammable and/or explosive atmospheres.

Hazardous pressure! Install pressure relief valve in discharge pipe. Release all pressure on system before working on any component.

1. Make workshop child proof - use padlocks, master switches; remove starter keys.
2. Wear safety glasses when working with pumps.
3. Wear a face shield and proper apparel when pumping hazardous chemicals.
4. Keep work area clean, uncluttered and properly lighted; replace all unused tools and equipment.
5. Provide guarding around moving parts.
6. Keep visitors at a safe distance from the work area.
7. Periodically inspect pump and system components.
8. Protect electrical cord. Replace or repair damaged or worn cords immediately.
9. Do not insert finger or any object into pump or motor openings.
10. Secure the discharge line before starting the pump. An unsecured discharge line will whip, possibly causing personal injury and/or property damage or puncture.

⚠CAUTION *Do not touch an operating motor or engine. They are designed to operate at high temperatures.*

⚠WARNING *This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.*

⚠WARNING *Risk of Electric Shock. This pump has not been investigated for use in swimming pool areas.*
NOTE: Pumps with the "CSA-CUS" mark are tested to UL standard UL778 and certified to CSA standard C22.2 No. 108.

Pre-Installation

HANDLING

1. Use handle supplied to lift pump.
2. Avoid impact on pump or motor. In particular, avoid impact on discharge end of pump or rear motor access cover.

LOCATION

⚠WARNING *In any installation where property damage and/or personal injury might result from an inoperative or leaking pump due to power outages, discharge line blockage, or any other reason, a backup system(s) should be used.*

1. Locate pump as close to the fluid source as possible, keeping the inlet pipe short as possible.
2. Place unit where the pump and piping are protected from the weather and extremes of heat, humidity and below freezing temperatures.
3. Mount unit in a dry location that is easily accessible for inspection and maintenance. If a dry location is not available, mount it on a foundation well above the wet floor.
4. Allow ample clearance around unit for free air circulation.

SUCTION LIMITATIONS

1. Units are non self-priming.
2. Pressure booster pumps are not recommended for suction lift applications.

PIPING

1. Use galvanized piping, rigid plastic or other suitable pipe that will not collapse under suction or rupture due to pressure.

⚠CAUTION ***If hose is used, make sure it is the reinforced industrial type that is rated higher than the shutoff pressure of the system. Ordinary garden hose will collapse and starve the pump of water.***

2. The diameter of the inlet and discharge pipe should be no smaller than the corresponding ports of the pump (See Figure 1). Smaller pipe will reduce the capacity of the pump. Increase pipe size on long runs.
3. Avoid air pockets in inlet piping or air will accumulate at high points, making priming difficult.
4. Use pipe compound on all joints and connections. Use Teflon tape or plastic joint stick, on plastic pipe. Draw all pipe up tightly.

IMPORTANT: The entire system must be air and water tight for efficient/proper operation.

Installation

PUMP INSTALLATION

IMPORTANT: Pump is built to handle clear water only; it is not designed to handle water containing sand, silt or other abrasives.

1. Refer to Figures 6, 7, and 8 for typical installations.

⚠CAUTION *Support pump and piping when assembling and when installed. Failure to do so may cause piping to break, pump to fail, motor bearing failures, etc.*

2. If the pump is used as part of a permanent installation, bolt to a rigid foundation.

⚠WARNING *Use only components that are rated for maximum pressure pump can produce when used in boosting system or any other system. Do not exceed the total maximum pressure boost as listed per model in Performance Charts B.*

PRESSURE BOOST SYSTEMS

1. On pressure boost systems, locate the pump so that there will always be a positive supply of water to the pump (See Figures 6, 7 and 8).
2. For service convenience, install a gate valve and union in the inlet and discharge line.

⚠CAUTION *Do not use a globe valve or other restricting type of valve that will seriously restrict the pumps discharge capacity.*

3. Install a check valve as shown in Figure 6. Be sure check valve flow arrows point in the direction of water flow.
4. Whenever dirt, sand or debris is present in the supply water, install a strainer or filter on the inlet side of the pump (See Figure 7).

NOTE: For heavy amounts of sediment, install a trap filter on the inlet side of the pump (See Figure 5).

NOTE: Pressure gauges installed before and after the filter will show pressure differential indicating the need for filter replacement or cleaning.

Figure 2 - No Air Pockets in Inlet Pipe

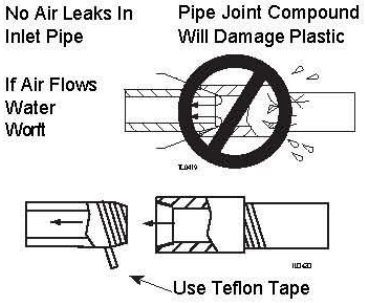
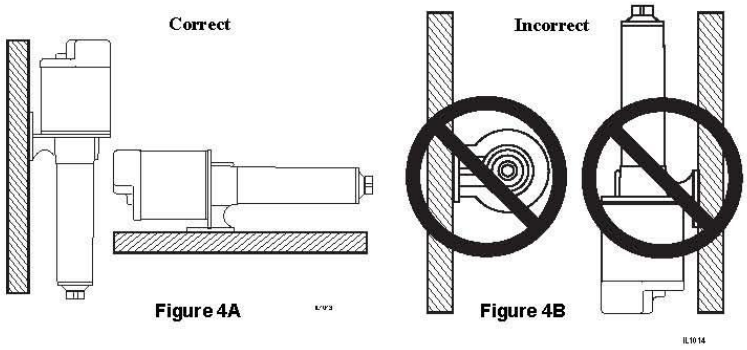


Figure 3 - Inlet Pipe Must Not Leak

⚠CAUTION *Mount pump in correct position or pump failure will result.*



SAND AND SEDIMENT TRAP FILTER

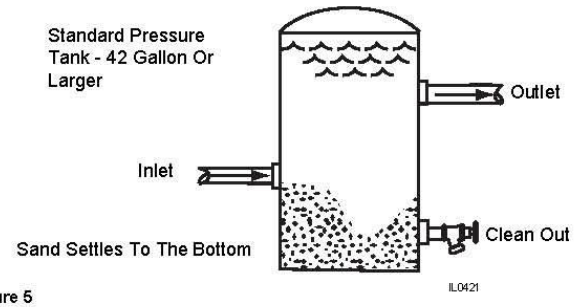


Figure 5

IMPORTANT: Clean all filters and strainers on a regular schedule.

Installation (Continued)

5. A pressure gauge installed in the inlet pipe close to the inlet port, (See Figure 6) will show if enough water is being supplied to the pump. See Operation Section - Priming, Pressure Boost Installations.
6. On installations that are using nozzles for mist spraying, install a filter in the discharge plumbing to prevent the nozzles from becoming plugged. Multiple filters should be plumbed in parallel.

⚠WARNING *Install a pressure relief valve on any installation where pump pressure can exceed the pressure tank's maximum working pressure or on systems where the discharge line can be shut off or obstructed. Extreme over pressure can result in personal injury or property damage.*

⚠CAUTION *This unit is not waterproof and is not intended to be used in showers, saunas or other potentially wet locations. The motor is designed to be used in a clean dry location with access to an adequate supply of cooling air. Ambient temperature around the motor should not exceed 104°F (40°C). For outdoor installations, motor must be protected by a cover that does not block airflow to and around the motor. This unit is not weatherproof nor is it able to be submersed in water or any other liquid.*

⚠ ***To avoid dangerous or fatal electrical shock, turn off power to motor before working on electrical connections.***

⚠ ***Supply voltage must be within ± 10% of nameplate voltage. Incorrect voltage can cause fire or seriously damage motor and voids warranty. If in doubt, consult a licensed electrician.***

⚠ ***Use wire size specified in wiring Chart F. If possible, connect pump to a separate branch circuit with no other appliances on it. If motor wiring diagram differs from diagram shown below, follow diagram on motor.***

Pump used to boost incoming city pressure (automatic operation).

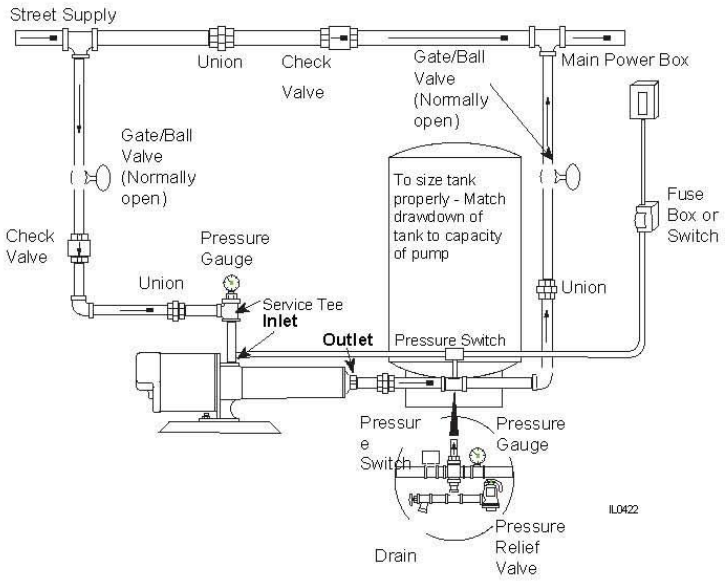


Figure 6

IMPORTANT: A contained air pressure tank and pressure switch is required to keep the pump from rapid cycling and prevent the motor from over heating. Install the tank and switch on the house side of system.

Pump used to boost water pressure in mist spray applications (automatic operation).

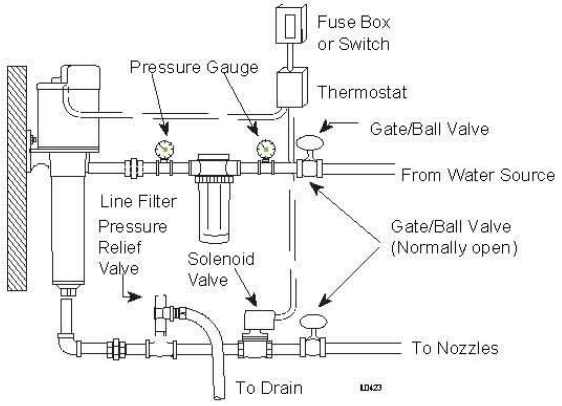


Figure 7

NOTE: Install solenoid valve on discharge side of pump.
IMPORTANT: Clean all filters and strainers on a regular schedule.

Installation (Continued)

⚠WARNING

Hazardous voltage. Can shock, burn or cause death. Ground pump before connecting to power supply.

⚠ *Ground motor before connecting to electrical power supply.*

⚠ *Failure to ground motor can cause severe or fatal electri- cal shock hazard.*

⚠ *Do not ground to a gas supply line.*

⚠CAUTION ***Proper rotation of pump impeller is critical on three phase motors. See Motor Rotation under Operation section and Figure 12.***

WIRING

1. Install, ground, wire and maintain this pump in accordance with your local electrical code and all other codes and ordinances that apply. Consult your local building inspector for local code information.
2. Ground the pump permanently using a wire of size and type specified by local or United States National Electrical Code. **Do not ground to a gas supply line.**
3. Connect ground wire first. Connect to ground first, then to green grounding terminal provided on the motor frame, identified as GRD. Ground connection MUST be made to this terminal. Do not connect motor to electrical power supply until unit is permanently grounded; otherwise serious or fatal electrical shock hazard may be caused.
4. Connect the other end of the ground wire to a properly grounded service panel or to a control panel ground bar if it is connected to the power supply ground.

IMPORTANT: Check local and/or United States National Electric Codes for proper grounding information.

⚠CAUTION *Make certain that the power supply conforms to the electrical specifications of the motor supplied. See Motor Data Charts.*

Pump used to boost incoming pressure from a wall hydrant (manual operation).

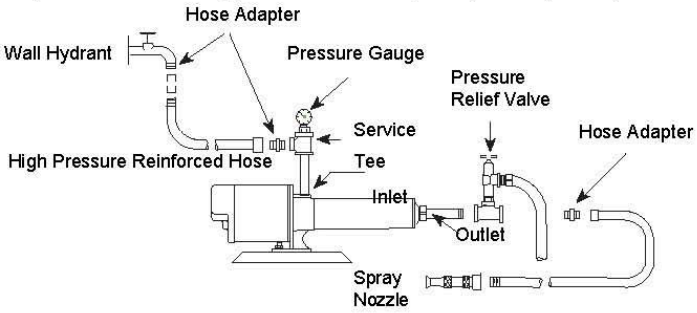
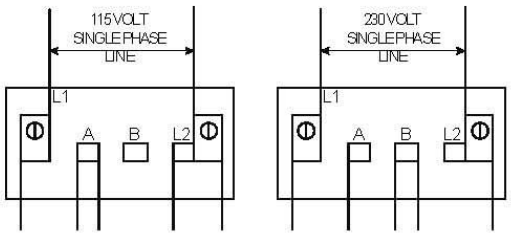
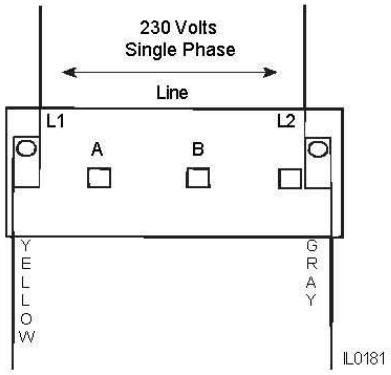


Figure 8



NOTE: Dual voltage motors, change the red and gray wire to the voltage required.

Figure 9 - Wiring Diagram for Single Phase 1/3 - 2 HP Motors



NOTE: Single voltage (230V) motor, and can not be connected to 115V.

Figure 10 - Wiring Diagram for Single Phase 3 HP Motors

Installation (Continued)

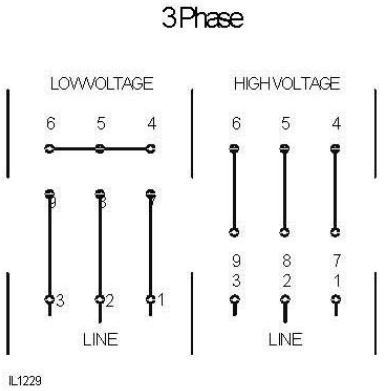


Figure 11 - Wiring Diagram for Baldor TEFC 3 Phase motors

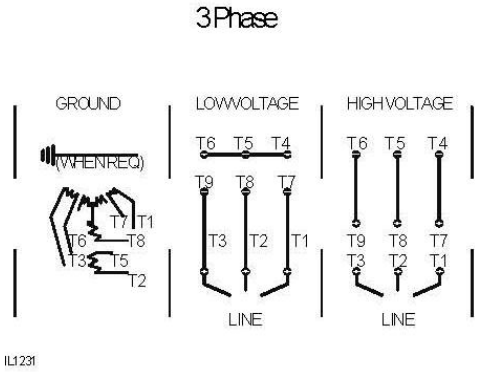


Figure 13 - Wiring Diagram for Marathon TEFC 3 Phase motors

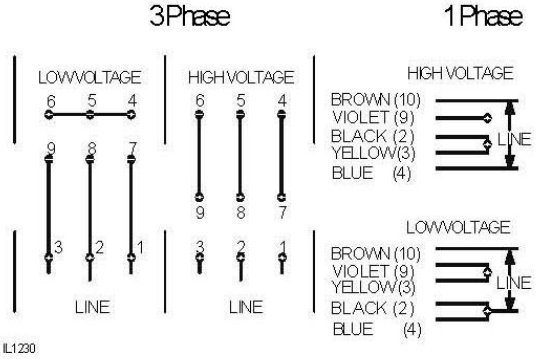
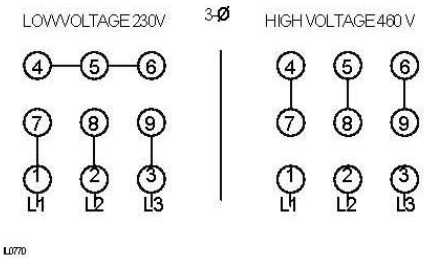


Figure 12 - Wiring Diagram for Franklin Electric TEFC 1 Phase and 3 Phase motors



1 - Tan	4 - Yellow	7 - Purple
2 - Red	5 - Black	8 - Gray
3 - Orange	6 - Blue	9 - White

CONNECTION FOR 3 PHASE, 9 LEADS. IF YOUR 3 PHASE LEADS ARE COLOR CODED, MATCH NUMBER ABOVE TO THE CORRESPONDING COLOR.

NOTE: To reverse rotation, interchange any two incoming lines (Power) leads.

Figure 14 - Wiring Diagram for Three Phase Motors

Installation (Continued)

5.Specific Wiring Procedure (Refer to Figures 9, 10, 11, 12, 13, 14 and Minimum Wire Size Chart).

a. Select the voltage you are to use, either 115V or 230V single phase, 230V or 460V three phase.
b. The 1/3, 1/2 and 3/4 HP single phase pumps are factory connected for 115V at the motor. The 1, 1 1/2, 2 and 3 HP pumps are factory connected for 230V at the motor. Three phase models are factory connected for 230V at the motor.
c. If the motor wiring must be changed to conform to your specific voltage requirements then the motor, pressure switch or other controls should be rewired to conform to one of the wiring diagrams (either 115V or 230V, single phase; 230V or 460V, three phase). Single phase 3 HP motors are 230V only and cannot be wired for 115V service.
d. The motor wiring diagrams are Figures 9, 10, 11, 12, 13 & 14, and also are located on the motor label of the pump.

6. Remove the rear access cover of the motor.
7. Make the wiring change and replace the rear access cover.

⚠WARNING *Replace rear access cover before starting or operating pump. Failure to do so can result in personal injury.*

IMPORTANT: Do not use an extension cord or splice wires. Joints should be made in an approved junction box. If the above information or the following wiring diagrams are confusing, consult a licensed electrician.

8. All units are not supplied with pressure switches, float devices, on/off switches, or the like (control devices). Controls should be wired in at this time, utilizing whatever instructions come with the controls. All units supplied with cords, will run whenever cord is plugged into power and will turn off whenever cord is disconnected from power.

MOTOR PROTECTION

All single phase motors have built in thermal protection for all voltages. The overload protects the motor against burnout from overload of low voltage, high voltage and other causes. The device is automatic and resets itself once the temperature has dropped to a safe point. Frequent tripping of the device indicates trouble in the motor or power lines and immediate attention is needed.

⚠WARNING *Never examine, make wiring changes or touch the motor before disconnecting the main electrical supply switch. The thermal device may have opened the electrical circuit.*

Three phase motors do not have a built in thermal protection. It is recommended that a properly sized magnetic or manual starter (both with properly sized heaters) be used with all three phase motors. Install starters following instructions of the starter manufacturer. See Motor Rotation under Operation Section for changing rotation on three phase motors.

All motors (single and three phase) should be equipped with a correctly fused disconnect switch to provide protection. Consult local or United States National Electric Codes for proper fuse protection based on motor data chart (See Charts C, D and Wire chart F).

Operation

⚠CAUTION *Unit must be full of fluid before operating. Do not run dry, or against a closed discharge. Do not pump dirty water or abrasive liquids. To do so will cause pump failure and will void the warranty.*

VALVES

The inlet valve should be in the full open position and the discharge valve should be partially open, permitting some back pressure to be exerted against the pump when starting up. Open valve after start up is completed.

PRIMING

NOTE: Before starting the pump it is absolutely necessary that **both the pump and the inlet pipe be completely filled with water.**

PRESSURE BOOST INSTALLATIONS

Priming is automatic when pump is connected to a pressure source such as a hydrant or city main (See Figures 6, 7 & 8).

1. Open valves or nozzle on inlet and discharge side of pump.
2. To relieve trapped air, allow water supply to run a minimum of 30 seconds before starting the pump.

IMPORTANT: An adequate flow of water going into the pump is required so that the pumps impellers and shaft seal do not run dry and fail.

3. If you installed a pressure gauge at the pump inlet, a reading of 2 psi minimum should show whenever the pump is in operation (See Figures 6, 7 & 8).

This reading insures that there is an ample supply of water into the pump inlet housing.

MOTOR/PUMP ROTATION

1. Single phase models are one (1) rotation only (counterclockwise when facing the pump end) and cannot be reversed.
2. Proper rotation of pump impeller is critical for three phase pumps. Pump motor should turn counterclockwise (CCW) when facing pump end. Momentarily "bump" (apply power for less than a second) the motor to check for proper rotation. To change rotation on three phase units, interchange any two (2) incoming line (power) leads.

⚠CAUTION *Do not go over recommended maximum operating pressure (see Specifications), while maintaining minimum flow of 1.5 GPM thru the pump. Do not restrict the inlet line to the pump.*
If driver (electric motor) is overloaded, a valve can be installed in the discharge line to increase the back pressure and reduce driver loading.

Operation (Continued)

START - UP PROCEDURE

Once the preceding instructions have been completed, the pump can be started.

1. During the first few hours of operation, inspect the pump, piping and any auxiliary equipment used in connection with the unit.
2. Check for leaks, excessive vibration or unusual noises.

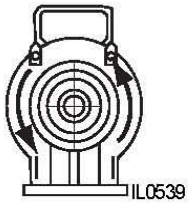


Figure 15 - Correct Motor/Pump Rotation (all units)

NOTE: See rotation arrow on inlet casting.

Maintenance

⚠CAUTION *Disconnect power supply and depressurize system before servicing pump or removing any component.*

ROUTINE

Pump should be checked routinely for proper operation. Replace or clean all filters and line strainers on a regular basis.

DRAINING

This pump cannot be completely drained because of internal design. Most of the liquid can be drained by tilting the discharge forward after removing discharge casting; or, the liquid can be drained through the inlet port. Store in heated areas.

CLEANING

If used for spraying insecticides, pump should be thoroughly flushed with clean water after using.

LUBRICATION

The motor has prelubricated bearings. No lubrication is required.

SERVICING THREE-PHASE UNITS

Loctite (thread sealer) is used on the threads between the motor shaft and the pump shaft coupling. When reassembling, reapply thread sealer.

PUMP DISASSEMBLY

To disassemble the pump, refer to the exploded parts view and Figures 16, 17 & 18

Tools Required:

- Block of wood (2" x 4" x 12")
  Piece of 3/4" pipe (12" to 24" long)
- Pipe wrench
- Strap wrench
- 1/4" Dowel rod (about 24" long)
- 9/16" Open end wrench
- 3/8" Open end wrench

1. To stabilize pump during disassembly, place block of wood underneath pump barrel.
2. Thread pipe into pump inlet port. This acts as a handle.
3. Using the pipe wrench, remove the discharge head, turning CCW (counter clockwise).
4. With the strap wrench, loosen the barrel, turning CCW (counter clockwise). DO NOT use pipe wrench on pump barrel.
5. Holding the impeller stack in place, position pump in upright position, standing unit on the motor end cover. 6. Use the 1/4" dowel rod to hold the stages down and in place on the pump shaft. Remove pump barrel.
7. Slide the stages off the pump shaft onto the 1/4" dowel rod. Leave stages on rod and carefully set aside.

NOTE: There may be some small .010" shim washers located next to the pump shaft coupling. Keep these shims for re-assembly.

8. Through the side opening of the mounting frame, hold the motor shaft with 9/16" wrench. Remove the shaft and coupling from the motor using the 3/8" wrench on the hex shaped pump shaft.

NOTE: If the hex shaft comes free, leaving the coupling attached to the motor, use vise grips to free the coupling.

MECHANICAL SEAL REPLACEMENT

1. Follow instructions under "Pump Disassembly".
2. Remove the mechanical seal assembly.
   a. The rotary portion of the seal assembly (carbon ring, Buna-N gasket and spring will slide easily off the end of shaft).
   b. Using two (2) screwdrivers, pry the ceramic seal and rubber gasket from the recess of the mounting ring (See Figure 16).

⚠CAUTION *The precision lapped faces of the mechanical seal are easily damaged. Handle the replacement seal carefully. Short seal life will result if seal faces (ceramic & carbon) are nicked, scratched or dirty.*

3. Clean the seal cavity of the mounting ring and the motor thoroughly.
4. Wet outer edge of rubber cup on ceramic seat with liquid soap solution. Use sparingly (one drop only).

NOTE: Liquid soap solution - one drop of liquid soap combined with one teaspoonful of water.

5. With thumb pressure, press ceramic seal half firmly and squarely into seal cavity. Polished face of ceramic seat is up. If seal will not seat correctly, remove, placing seal face up on bench. Reclean cavity. Seal should now seat correctly (See Figure 17).
6. If seal does not seat correctly after recleaning cavity, place a cardboard washer over polished seal face and carefully press into place using a piece of standard clean 3/4" pipe as a press (See Figure 18).

Maintenance (Continued)

IMPORTANT: Do not scratch seal face.

7. Dispose of cardboard washer and recheck seal face to be sure it is free of dirt, foreign particles, scratches and grease.
8. Inspect shaft to be sure it is free of nicks and scratches.
9. Apply liquid soap solution sparingly (one drop is sufficient) to inside diameter of rubber rotating member.
10. Slide rotating seal member (carbon face down toward ceramic face) and spring over the shaft.

IMPORTANT: Do not nick or scratch carbon face of seal when handling.

MOTOR REPLACEMENT

The motor can be replaced with any standard Nema 56J jet pump motor (of proper HP for each pump) by referring to the following instructions.

1. Follow steps as outlined under Rotary Seal Replacement and Pump Disassembly.
2. Remove cap screws that connect the motor to the mounting ring and pull motor away.
3. Replace motor with standard Nema 56J jet pump motor by positioning motor against the mounting frame and assembling with four (4) cap screws.

IMPORTANT: Because damage to the shaft seal can occur in disassembly, a new seal will be necessary.

PUMP REASSEMBLY

Before reassembling the pump, carefully inspect the component parts of the cartridge (stage) assembly, looking for damage, wear or heat distortion. Pay careful attention to spacing direction of components, and location of shims. Refer to Figure 19 for proper facing and parts arrangement.

If damage to Stage components is evident, a complete cartridge assembly or individual stage assemblies are available for replacement (See Replacement Parts List).

1. Reassembly should follow the reverse order of the disassembly procedure with special care given to replacement of the rotary seal.
2. Check top and bottom of o-rings for damage. It is recommended that new o-rings be used.
3. Do not use pipe compound of Teflon tape on barrel threads. The o-rings will prevent pump from leaking.
4. After pump is reassembled, tighten the discharge head to a torque of 45-50 ft/lbs. If torque wrench is not available, tighten firmly but avoid distortion or damage to plastic internal parts.
5. After reassembly, apply power momentarily to unit (15 to 30 seconds). The pump and motor should rotate freely or with a light rubbing.

Figure 16 - Remove Mechanical Seal

Figure 17 - Press In Seal

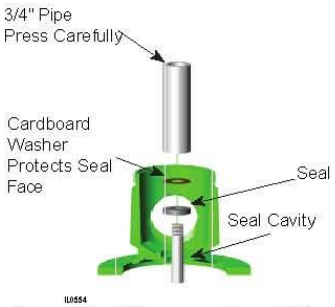
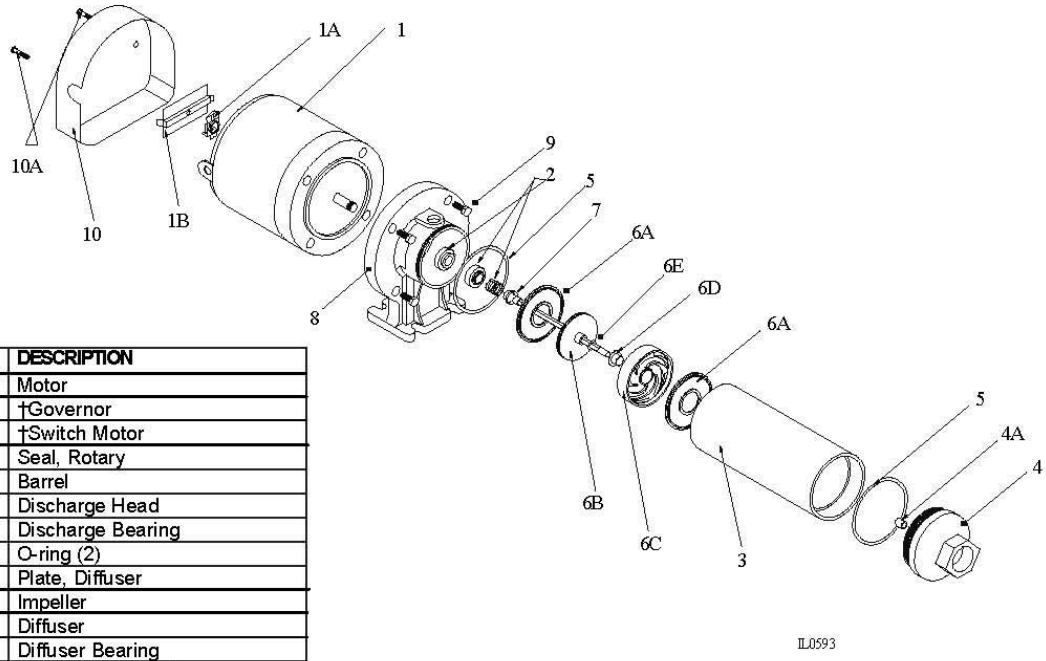


Figure 18 - If Necessary, Press With Cardboard And Pipe

Troubleshooting Chart

Symptom	Possible Cause(s)	Corrective Action
Pump won't start or run at full speed	1. Blown fuse or open circuit breaker	1. Replace fuse or close circuit breaker. See wire size chart for proper break/fuse size
	2. Power supply in OFF position	2. Turn power on
	3. Incorrect voltage at motor (check voltage with motor running)	3. Low voltage a. Voltage must be within ± 10% of motor rated voltage. Check incoming voltage. Contact power company b. Make certain that voltage of motor matches voltage of power supply. See motor name plate and motor wiring diagrams c. Check wire size from main switch to pump. See wire size chart for correct wire size
	4. Loose, broken or incorrect wiring	4. Rewire any incorrect circuits. Tighten connections, replace defective wires
	5. Defective motor	5. Replace motor
	6. Pump hydraulic components clogged/ worn/damaged	6. Replace worn parts or entire pump. Clean parts if required
Pump operates, but delivers little or no water	1. Manual or solenoid valves plumbed into system restricting flow	1. a Check all valves on pump inlet and discharge sides of system to be sure they are opened properly to allow flow to and from the pump b. Bleed trapped air in pump which keeps water from reaching the pump. (Normally due to closed valve in discharge plumbing)
	2. In-line filter restricting flow	2. Check all in-line filters to be sure they are not plugged or restricted
	3. Low line voltage	3. See low line voltage corrective action (above)
	4. Inadequate water supply to booster pump	4. Check pressure on inlet side of booster to be sure positive pressure is maintained to the booster pump
	5. Undersized piping	5. Replace undersized piping
	6. Leak on inlet side of system	6. Make sure connections are tight. Repair leaks as necessary
	7. Inadequate, defective or plugged foot valve and/or strainer	7. Clean, repair or replace as needed
	8. Worn or defective pump parts or pump.	8. Replace worn parts or entire plugged impeller Clean parts if
	9. Suction lift too great	9. Pump should be operated under flooded suction only
	10. Pump not primed	10. Prime pump - Make certain inlet pipe is drawn up tight and pump and pipe are full of water
	11. Incorrect rotation, motor running backwards	11. Reverse motor rotation can occur on three phase units. To correct, interchange any two incoming power leads.
Excessive noise while pump in	1. Pump not secured to firm foundation	1. Secure properly
	2. Piping not supported	2. Make necessary adjustments
	3. Restricted inlet line	3. Clean or correct
	4. Cavitation (noise like marbles in pump)	4. a. Reduce speed on direct drive b. Increase inlet pipe size c. Too viscous (material being pumped too thick
	5. Worn motor bearings	5. Replace bearings or motor
Pump leaks	1. Worn mechanical seal (leaks at shaft)	1. Replace shaft (rotary) seal
	2. Worn o-ring seals	2. Replace o-ring seals, located inside both ends of the stainless steel shell

Booster Pump Parts Drawing



ITEM NO.	DESCRIPTION
1	Motor
1A	†Governor
1B	†Switch Motor
2	Seal, Rotary
3	Barrel
4	Discharge Head
4A	Discharge Bearing
5	O-ring (2)
6A	Plate, Diffuser
6B	Impeller
6C	Diffuser
6D	Diffuser Bearing
6E	Shim as Required
7	Shaft and Coupling Assembly
8	Mounting Ring
9	Hex Head Bolts (4)
10	†MotorAccess Cover
10A	†Screws, Access Cover (2)

*See note below parts included in cartridge assembly.
†ODP Motor Only

Figure 19

Internal Parts Detail

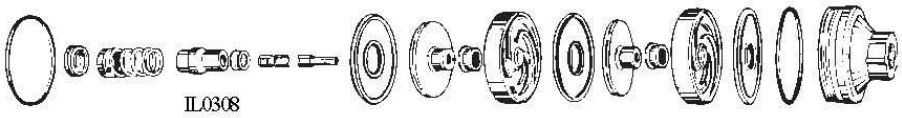


Figure 20 - Cartridge Assembly Includes Discharge Bearing, Shaft & Coupling Assembly, Diffuser Plate, Impellers, Diffuser Bearings, Diffusers and O-rings

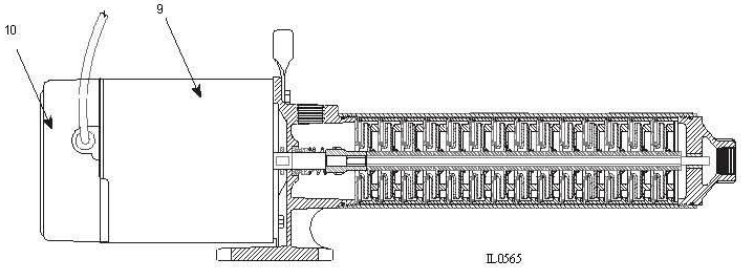
NOTE: Illustration shows only two stages. Pump has multiple stages. Individual parts are not available separately.

PRESSURE BOOSTER PUMP REPAIR PARTS

(For Pricing Refer To Repair Parts Price List)

Replacement Motors

FORM NO. FW0045
0208
SUPERSEDES 0907
PAGE 4-7A REPAIR PARTS



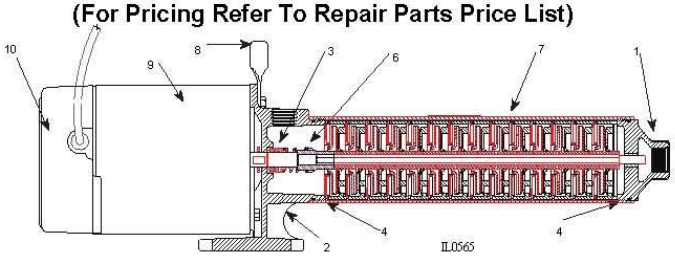
ITEM	REPLACEMENT MOTORS	QTY	CAST IRON	POWDER COATED	STAINLESS STEEL	CAST IRON	POWDER COATED	STAINLESS STEEL
			SINGLE PHASE 60 HZ			THREE PHASE 60 HZ		
9	ODP NEMA J 1/3 HP	1	98J103	98J103	98S103			
	ODP NEMA J 1/2 HP		98J105	98J105	98S105	98J305	98J305	98S305
	ODP NEMA J 3/4 HP		98J107	98J107	98S107	98J307	98J307	98S307
	ODP NEMA J 1 HP		98J110	98J110	98S110	98J310	98J310	98S310
	ODP NEMA J 1-1/2 HP		98J115	98J115	98S115	98J315	98J315	98S315
	ODP NEMA J 2 HP		98J120	98J120	98S120	98J320	98J320	98S320
	ODP NEMA J 3 HP		98J630	98J630	98S630	98J330	98J330	98S330
10	Motor Cover w/Screws	1	136132R	136132R	136132R	136132R	136132R	136132R
*	Screws, Motor Cover	2	136133	136133	136133	136133	136133	136133
			SINGLE PHASE 50 HZ			THREE PHASE 60/50 HZ		
9	ODP NEMA J 1/3 HP	1	98J003	98J003	98S003			
	ODP NEMA J 1/2 HP		98J005	98J005	98S005	98J305	98J305	98S305
	ODP NEMA J 3/4 HP		98J007	98J007	98S007	98J307	98J307	98S307
	ODP NEMA J 1 HP		98J010	98J010	98S010	98J310	98J310	98S310
	ODP NEMA J 1-1/2 HP		98J015	98J015	98S015	98J315	98J315	98S315
	ODP NEMA J 2 HP		98J820	98J820	98S820	98J320	98J320	98S320
10	Motor Cover w/Screws	1	136132R	136132R	136132R	136132R	136132R	136132R
*	Screws, Motor Cover	2	136133	136133	136133	136133	136133	136133
			SINGLE PHASE 60/50 HZ			THREE PHASE 60/50 HZ		
9	TEFC NEMA J 1/2 HP	1		020691	020691		021011	021011
	TEFC NEMA J 3/4 HP			021008	021008		021012	021012
	TEFC NEMA J 1 HP			021009	021009		020688	020688
	TEFC NEMA J 1-1/2 HP			020692	020692		020647	020647
	TEFC NEMA J 2 HP			020693	020693		020689	020689
	TEFC NEMA J 3 HP			021010	021010		020690	020690

* Not Shown

FORM NO. FW0046
0509
SUPERSEDES 0907
PAGE 4-8A REPAIR PARTS

PRESSURE BOOSTER PUMP REPAIR PARTS

(For Pricing Refer To Repair Parts Price List)



	ITEM	DESCRIPTION	QTY	CAST IRON	POWDER COATED	STAINLESS STEEL	
5 - 7 - 10 - 19 GPM, 60 HZ & 50 HZ	1	Discharge Head 3/4" NPT	1	132000	136905	136640	
	2	Mounting Ring 3/4" NPT	1	132002	136904	136639	
27 - 35 GPM, 60 HZ & 50 HZ	1	Discharge Head 1" NPT	1	136635	137796	139166	
	2	Mounting Ring 1" NPT	1	136634	137794	139100	
55 - 85 GPM, 60 HZ & 50 HZ	1	Discharge Head 2" NPT	1	021585	-	-	
	2	Mounting Ring 2" NPT	1	021584	-	-	
ALL SERIES 60 HZ & 50 HZ	3	Seal, Rotary w/Spring	1	131100 †	131100 †	136682 ‡	
	4	O-Ring	2	131925 ■	131925 ■	136607 ▲	
	*	Hex Head Cap Screws 3/8" x 3/4"	4	121106	121106	121106	

See replacement motors. ITEMS 9 & 10

(†) Buna N - Carbon/Silicon Carbide (‡) Viton - Carbon/Silicon Carbide (■) Buna N (▲) Viton (*) Not Shown
(8) 132079 Handle available as an option

60 HZ MODELS									
	MATERIAL	CAST IRON	CI	PB0508AXXX	PB0512AXXX	PB0516AXXX	PB0712AXXX	PB1014AXXX	PB1016AXXX
		POWDER COATED	PC	PB0508CXXX	PB0512CXXX	PB0516CXXX	PB0712AXXX	PB1014CXXX	PB1016CXXX
		STAINLESS STEEL	SS	PB0508SXXX	PB0512SXXX	PB0516SXXX	PB0712SXXX	PB1014SXXX	PB1016SXXX
	ITEM	DESCRIPTION	MATERIAL	PART NUMBER					
	5	Cartridge Assembly ‡	CI & PC	135163	132939	138447	134097	134998	135814
			SS		136683	138450	136684	136685	136686
	6	Shaft & Coupling Assembly	CI & PC	135161	133336	138446	133336	134996	135813
			SS	138938	136636	138449	136636	136637	136638
	7	Barrel/Shell	CI, PC & SS	135162	132003	138448	132003	134997	135815
	MATERIAL	CAST IRON	CI	PB1914AXXX	PB2711AXXX	PB2714AXXX	PB3506AXXX	PB3508AXXX	
		POWDER COATED	PC	PB1914CXXX	PB2711CXXX	PB2714CXXX	PB3506CXXX	PB3508CXXX	
		STAINLESS STEEL	SS	PB1914SXXX	PB2711SXXX	PB2714SXXX	PB3506SXXX	PB3508SXXX	
	ITEM	DESCRIPTION	MATERIAL	PART NUMBER					
	5	Cartridge Assembly ‡	CI & PC	137222	135627	136629	136626	136632	
			SS	139162	139163	138946	139164	139165	
	6	Shaft & Coupling Assembly	CI & PC	137221	136624	136628	136625	136631	
			SS	139159	139157	137535	139156	139158	
	7	Barrel/Shell	CI, PC & SS	137223	135628	136630	136627	136633	
	MATERIAL	CAST IRON	CI	PB5504XX	PB5506XX	PB8504XX	PB8505XX		
	ITEM	DESCRIPTION	MATERIAL	PART NUMBER					
	5	Cartridge Assembly ‡	CI	022293	022294	022295	022296		
	6	Shaft & Coupling Assembly	CI	022289	022287	022288	022287 7		
		Barrel/Shell	CI, PC & SS	022291	022292	138151	022290		

50 HZ MODELS									
	MATERIAL	CAST IRON	CI	PB0508XXXX	PB0514XXXX	PB0714XXXX	PB1020XXXX	PB1022XXXX	PB1023XXXX
		POWDER COATED	PC	PB0508ZXXX	PB0514ZXXX	PB0714ZXXX	PB1020ZXXX	PB1022ZXXX	PB1023ZXXX
		STAINLESS STEEL	SS	PB0508YXXX	PB0514YXXX	PB0714YXXX	PB1020YXXX	PB1022YXXX	PB1023YXXX
	ITEM	DESCRIPTION	MATERIAL	PART NUMBER					
	5	Cartridge Assembly ‡	CI & PC	135163	138150	021032	135907		135911
			SS		138682	021033	138683	020280	138684
	6	Shaft & Coupling Assembly	CI & PC	135161	138149	138149	135906	020278	135910
			SS	138938	138444	138444	138154	020278	137103
	7	Barrel	CI, PC & SS	135162	138151	138151	135098	020094	135912
	MATERIAL	CAST IRON	CI	PB1920XXXX	PB2717XXXX	PB3508XXXX	PB3514XXXXT		
		POWDER COATED	PC	PB1920ZXXX	PB2717ZXXX	PB3508ZXXX	PB3514ZXXXT	PB1922ZXXX	
		STAINLESS STEEL	SS	PB1920YXXX	PB2717YXXX	PB3508YXXX	PB3514YXXXT		
	ITEM	DESCRIPTION	MATERIAL	PART NUMBER					
	5	Cartridge Assembly ‡	CI & PC	020982	020980	136632	021017	139435	
			SS	020095	138949	139165	021026	*	
	6	Shaft & Coupling Assembly	CI & PC	020971	020916	136631	021015	139434	
			SS	020093	138948	139158	021020	021425	
	7	Barrel	CI, PC & SS	020094	138947	136633	021016	139436	

(‡) Cartridge assembly includes: impellers, diffusers and shaft & coupling assembly. Components not available individually. Sold as assembly only.