SPRAYWAND
A PRODUCT OF PEM CORPORATION

OWNER'S MANUAL

SPRAYWAND E-300

PRETREATMENT APPLICATION SYSTEM

PEM

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Introduction

The PEM E-300 SprayWand™ Pretreatment Application System is designed to meet the demands of high production environments. The heavy-duty system and precision fixed-ration chemical injectors ensure consistent outputs and results.

The PEM system features chemical injection systems that are heated for many different chemical applications.

 **Warning:** To prevent injury and equipment damage, thoroughly read and understand the contents of this manual before operating the E-300.

General specifications

Model:	E-300
HP:	7.5
Electrical:	460 V, 3 phase – 90 A
Connection:	4-wire through junction box
GPM:	5
Pressure	
- Phosphatize:	1500 PSI
- Rinse:	1500 PSI
Stack size:	No stack
Water connection:	Standard garden hose, female swivel
Dimensions (L,W,H):	36” x 30” x 48”
Weight:	500 lbs.
Nozzles:	1-15085 x ¼ NPT Chemical
	1-40100 x ¼”NPT Rinse

Note: The manufacturer reserves the right to make improvements in design and/or changes in specifications at any time without incurring any obligation to install them on units previously sold. Some photos and/or illustrations may not be exact representations of your particular machine; however, the technical information will apply.

Limited warranty

PEM Corporation warrants each machine sold by us to be free from manufacturing defects in normal service for 90 days commencing with the delivery of the machine to the original owner.

If the machine is used with approved products, the warranty is extended to two full years or 2000 hours, whichever occurs first.

Two (2) Years Parts

- Frames
- Pump Drive Assemblies

One (1) Year Parts

- Electric Motor
- Pulleys
- Heating Elements

Ninety (90) Days Parts

- Lights
- Wand
- Trigger gun
- Unloaders

Our obligation under this warranty is expressly limited at our option to the replacement or repair by our company approval, or a service facility designated by us¸ of such part or parts as inspection shall disclose have been defective. This warranty does not apply to defects caused by damage or unreasonable use (including failure to provide reasonable and necessary maintenance) while in the possession of the consumer.
This warranty does not apply to nozzles, V-belts, hoses, pump wear parts, filters or 0-rings or damage to the wand or gun due to mishandling.

PEM Corporation shall not be liable for consequential damage of anything, including but not limited to the consequential labor costs or transportation charges in connection with the replacement or repair of the defective parts.

PEM Corporation makes no warranty with the respect to trade accessories. They are subject to the warranties of their manufacturers.

Any implied or statutory warranties, including any warranty of merchantability or fitness for a particular purpose are expressly limited to the duration of this written warranty. We make no other express warranty, nor is anyone authorized to make any on our behalf of PEM Corporation.

Safety

 This safety alert symbol indicts important messages in this manual. When you see this symbol, carefully read the message that follows, and be alert to the possibility of personal injury or death if you do not adhere to the requirements of the safety message. Also be review and follow the safety decals on the machine.

Note: PEM Corporation encourages the use of environmentally friendly chemicals and waste storage and disposal practices. Always store and/or dispose of chemicals in a manner that complies with local, state and federal regulations. Furthermore, always read and follow the directions printed on product labels when using chemicals**.**

Safety Rules

PEM Corporation cannot anticipate every possible circumstance that might involve a potential hazard. The warnings and cautions in this manual are therefore not all inclusive. If you use an operating procedure, installation or work method not specifically recommended, you must satisfy yourself that it is safe for you and for other persons. You must also ensure that the product will not be damaged or made unsafe by the procedure that you use.

 **Warning:** Fluids under pressure spray can be nearly invisible and can penetrate the skin and cause extremely serious injury. Avoid contact with high pressure spray. Specifically:

- Never point the spray gun at any part of your body or at any other persons.
- Never put your hands or fingers over the spray tip while the machine is in operation.
- Never use your hands to stop or detect leaks.
- Always shut of the machine and trigger the pressure gun to relieve system pressure before removing the spray tip or servicing the machine.
- Always wear full eye protection (preferably a face shield), protective clothing and rubber boots when operating the machine to protect you from burns caused by hot spray, fluid injection or debris dislodged by high-pressure spray.
- If any fluid appears to have penetrated the skin, get emergency medical care at once. Do not treat as a simple cut. Tell the doctor exactly what was injected. For treatment instructions, have your doctor call the **National Poison Control Network at 412-681-6669**.

 **Warning:** Operate and maintain the machine in a manner that prevents injury to you and others and damage to equipment. Specifically:

- Never alter or modify the equipment.
- Never exceed the factory pressure or temperature rating of the system. Be sure all accessory equipment and system components used will withstand the pressure developed.
- Never let the pump run without water supply flowing through the unit.
- Never allow children or any unauthorized or untrained persons to operate, adjust or repair this machine.
- Always keep other persons at a safe distance when using this machine.
- Never attempt to clean or wash down the machine using its own spray gun. Cleaning the machine in this manner will increase the hazard of electrical shock and/or damage to the machine. The machine is water resistant but not water proof.
- Never leave an operating machine unattended. Always shut off the machine and relieve pressure before leaving the machine.
- Never spray inflammable or toxic liquids or chemicals such as insecticides or weed killer.
- Never operate the machine when combustible fumes or dust may be present.

- Never use detergents that are not compatible with the discharge hose. Read and follow instructions provided by the detergent manufacturer. Also follow directions on the container regarding contact with the eyes, nose or skin.
- Always connect the machine to the correct electrical supply outlet. Comply with all federal, state and local codes and ordinances regarding electrical requirements.
- Never allow electrical extension cord connections to fall or lay in water. Use only extension cords rated for use with this machine.
- Always respect and be alert for the potential hazards of electrical equipment, hot burners, moving parts, high-pressure spray and steam.
- Always be certain that the machine safety decals are kept clean and legible. Replace any decals that become damaged, lost or painted over.
- Always disconnect the electrical plug before performing any repairs or service on machine.
- Never attempt repairs or modifications that you do not understand. Contact your service dealer or contractor.
- Always keep protective guards covers and shields in place. Replace any that were removed for service or that were damaged before operating the machine.
- Never exceed the 210° F temperature setting for hot water, high- pressure cleaning. Be sure the correct nozzle is used.

 **Danger:** Chemicals used for cleaning are dangerous. Keep all chemicals out of reach of children and untrained adults. Take proper safety precautions before handing any chemicals. Read and follow all directions and instructions on the product label as well as the safety data sheets before using the chemical. Wear eye protection and rubber gloves when handling or using chemicals. Always have a clean supply of water available to wash off any contact with the skin or eyes. Should any chemical contact the eyes, immediately flood the eyes with clean water and seek medical attention at once. If skin contact occurs, flood the affected area with plenty of water for 15 minutes. If irritation persists, seek medical attention. If chemicals are swallowed, follow the product label directions and get immediate medical attention.

 **Warning:** Do not start the machine unless you have the trigger gun or wand assembly completely under your control. Left loose, the gun or wand could recoil and damage property or cause injury.

 **Warning:** The discharge hose supplied with the machine is designed for use on steam and high-pressure cleaners. Special care, handling, and maintenance are required to provide proper and safe operation. Follow the guidelines to ensure safe operation and maximum hose service life:

- Never exceed rated machine pressure or temperature.
- Do not route the hose in a manner that will cause sharp bending, kinking, cutting, abrasion or exterior damage.
- Do not pull on the hose to move the machine, untangle knots or pull excessively or cause stress on the hose.
- Do not use the hose if cuts, leaks, abrasions, bulges or coupling damage is evident.
- Do not use the hose if any reinforcement is exposed.
- Do not attempt field repairs through an unauthorized hydraulic hose repair shop. Special couplings and crimping specifications are required for steam and high-pressure washer discharge hose. Contact a qualified pressure washer service representative for repair of damaged hose. If you have any doubt about the hose condition, replace it immediately.
- Always examine hose couplings and the quick disconnect (if provided) before each operation. If leaking is evident, do not use the hose. Contact a qualified pressure washer service representative.
- Never leave the discharge hose lying on the floor or ground to be driven over by vehicles or damaged by falling objects. Always coil and hang the hose immediately after use.

 **Danger:** To prevent unexpected energizing, startup or release of energy that could cause injury to people working on the machine follow the steps of the OSHA Lockout/Tagout Rule below to ensure that power to the machine will be under control:

1. Turn of the equipment.
2. Dissipate or release all residual energy in the machine.
3. Shut of the main power cord near the machine, and tag the switch.
4. Check all previous steps, and then try to operate the machine to ensure that it won't work.

Installation

Machine delivery and inspection

Before unpacking, check the machine for any damage that may have occurred during shipment. Note any damage and immediately contact the carrier to make a damage or shortage claim.

Machine identification

The machine model number, serial number and specifications are stamped on an identification plate that is permanently attached inside the pump compartment. See Figure 1.

For future reference, record the information from this plate in Table 1.

Figure 1: Identification plate location on the inside of the SprayWand.

Model_____

Output_____Gpm_____Psi____

Elec._____Ph_____Volts_____Amps_

Serial Number_____

Table 1: Machine identification from the plate.

Machine location

The pressure cleaners are designed specifically for use as stationary unit. Position the machine for easy and safe access to controls, power, and water. Also consider the best possible location for access to the machine for routine maintenance or service.

If the machine must be located out of sight of the operator, special equipment or controls may be required to provide proper operation and ensure operator safety. Contact your dealer or qualified service representative before installing or using the machine from a remote location.

Avoid locating the machine in direct spray; the SprayBay is not an appropriate location for this equipment.

Avoid locating the machine on slippery surface areas or where water may accumulate.

Machine setup

Exact machine setup may vary somewhat between machine models; however, the following information will be a general guideline. Contact your dealer or authorized service representative for special installation or setup requirements.
Note: In order to avoid unnecessary expense of complying with or correcting the violation of a regulation, investigate all applicable state and local codes before attempting to install the machine.

Electrical service

Caution: Do not attempt to operate this machine on less than 90% of rated system voltage. Overheating, poor performance or component damage could occur. Contact a qualified electrical technician to check for proper system voltage.

Note: The pump is designed to operate in either direction; rotation direction is not an issue.

Refer to the machine date plate to determine the exact electrical supply requirements for your machine. Be sure all machine control switches are turned off before connecting the electrical supply.

To further ensure machine grounding, a separate external grounding lug has been provided. It is located below the nameplate. In certain areas, it is either recommended or required that a separate ground wire be attached to this lug and to an available ground source, such as a metal water line or ground rod. (See Figure 2).

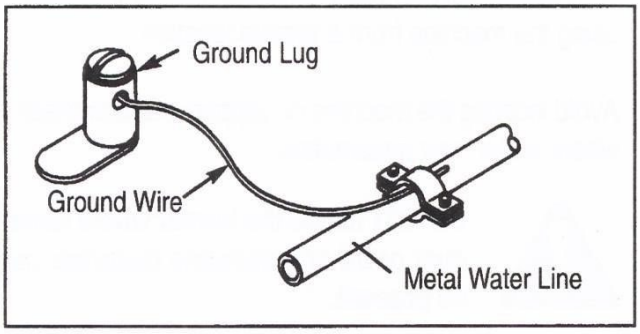


Figure 2: Ground

The electrical supply must be connected directly to the electrical service supply box on the machine. Electrical connection and supply for these machines must be made by a licensed electrician and must conform to all federal, state and local codes and ordnances regarding three-phase electrical requirements.

Water supply

Connect the machine to a cold-water supply tap in the back of the machine (see Figure 6). The water supply must equal to at least 1.5 times the gallon per minute (gpm) output of the machine. If wide variations in water pressure occur, install a pressure regulator in the supply line. Use at least a ¾-inch ID supply hose.

Figure 6: Water connection in the back of the machine

Caution: To prevent machine damage, use only perfectly clean water. If the water supply exceeds 6 grains of hardness (100 ppm), the coil conditioner will extend the coil life and maintain machine efficiency.

Coil conditioner

The chemical supplier sets the coil conditioner flow rate by adjusting the conditioner pump (see Figure 7) located under the top cover. Coil conditioner is pumped into the float tank. The float tank is located on the back side of the E-300 SprayWand (see Figure 8).

Figure 7: Conditioner and Neutralizer Pumps

Figure 8: Float Tank

Neutralizer

The chemical supplier sets the neutralizer flow rate by adjusting the neutralizer pump, which is located next to the conditioner pump (see Figure 7). Place the neutralizer discharge tube into or near the drain of the wash bay where the machine is used.

Wand and Hose

Caution: The chemical injector is sensitive to pressure. If the nozzles are damaged or are the wrong size, the injector may not work. If the hose is damaged or kinked (e.g., ran over by a forklift), it may also cause the injector to malfunction. Non-standard piping or the addition of valves and elbows may also cause injection problems.

Consult a PEM representative before purchasing additional or replacement wands as the color representation varies.

Initial start-up

Control panel

 **Warning:** To assure safe operation, familiarize yourself with the machine controls and indicator lights before starting or operating the machine. See Figure 8.

Switches

Pump switch – This switch will start the pump operation. Turn on this switch to start the pump motor. Turn off this switch to shut down the entire machine, including the burner.

Burner switch – This switch will prepare the unit to heat when the trigger is pulled. Once the burner switch is on, you can set the temperature controller to the desired temperature. Then pull the trigger and the heat should start shortly.

Indicator lights

Pump motor overload indicator light – This light will glow orange if the pump motor overload protector switch has tripped because the machine has drawn too many amps. This may indicate the wiring to the motor or the motor itself is faulty. If the indicator light turns on, turn off the pump switch and let the machine cool down. Turn the pump switch on again. If the pump motor continues to shut down, call PEM.

Temp indicator light – This light will glow red during normal operation and indicates the thermostat-controlled circuit through the temperature control switch is complete. The light will go out during normal operation whenever the water temperature reaches its preset limit setting (when the thermostat shuts off the circuit).

Heat indicator light – This light will glow red during normal operation and indicates the circuit to the heater elements is complete. It will stay on whenever the burner rocker switch, which controls the burner, is on (when the wand trigger is pulled).

Temperature control

Located to the right of the burner switch, this knob (Figure 9) is turned to set the water temperature (210° F Max). The burner will cycle on and off to maintain the selected water temperature.

Caution: Left loose, the gun or wand assembly could damage and cause injury to personal or property damage. Do not start the machine without having the trigger gun or wand completely under your control.

Caution: Never run the E-300 unit dry. Costly damage to the pump will result. Always be sure the water supply is completely turned on before operating the machine.

Figure 9: Control panel.

Initial startup procedure

1. Inspect connections for any leaks and tighten if necessary.
2. With the nozzle removed from the wand, turn on the Pump switch to start the pump.
3. Run the machine for 1 minute. Operate the trigger once or twice.
4. Shut off the machine and install the nozzle.
5. Check for high pressure leaks, and tighten connections if necessary.
6. Operate the trigger mechanism to make sure the unloader valve that operates the system is full of water.
7. Set temp controller for desired temperature.
8. Turn on the burner switch. Once the trigger is pulled, the pressure switch and flow switch should satisfy. The burner switch will illuminate and power will be sent to the timers.
   One timer will kick in the heater element after 15 seconds. The second timer should kick in 15 seconds after that.
9. The heater contactors will stay energized until desired temperature has been reached or the trigger is released.
10. After pulling the wand trigger for 2 minutes to operate the burner, test the flow switch by releasing the wand trigger. The heat light should go out and heater elements should no longer be energized.

Adjusting chemical concentration

To apply chemistry, a downstream injector is used, which is specifically designed for the system. The injector itself is precision calibrated and non-adjustable. However, the ratio of chemical-to-water is easily adjusted using the color-coded metering orifices that can be threaded into the chemical pick-up. An assortment of various sized metering orifices is included with the machine in the instruction packet. See Table 3. The injector will draw approximately 2.5% chemical by volume with no metering tips. The metering tips can be used to reduce this percentage in 0.2% increments down to approximately 0.8%. These metering tips thread into the chemical barb on the injector.
Install them as follows:

1. Slip the vinyl pick-up tube off the barb
2. Thread the selected metering tip into the injector barb.
3. Replace the vinyl tube.

Purple	2.00%
Black	1.60%
Yellow	1.40%
Blue	1.20%
Green	1.00%
White	0.80%

Table 3: Metering orifices

*Superflow Injectors are also available. These injectors can produce higher chemical concentrations up to 4%.

 **Caution:** Chemicals not compatible with the system materials will cause damage to the components down the line from the chemical injector. Ensure the chemicals will not damage stainless steel, Burna-N, and Viton.

 **Warning:** High-pressure spray, detergents, fluid injector or debris dislodged by the high-pressure spray can cause burns or other types of injuries. To protect yourself, always wear full eye protection (preferably a face shield), protective clothing, rubber gloves, and boots when operating the machine**.**

 **Danger:** High pressure spray can damage the machine and cause electrical shock. Never attempt to clean or wash down the machine using its own spray gun. The machine is water protected but not water proof.

Daily Operation

Starting the machine

1. Ensure the neutralizer line is in the wash bay drain and the coil conditioners line is in the float tank, if used (see Figure 8).
2. Turn on the pump switch.
3. Turn on the burner switch.

Note: The pump is designed to operate in either direction; rotation direction is not an issue.

Caution: To prevent damage to the machine, follow the steps in the Maintenance section**.**

Caution: Do not let the pump run dry. Serious damage to the machine will occur. Always ensure continuous water flow to the machine.

Caution: Never adjust or modify the unloader valve, which is located next to the pump and is used to bypass the coil when the wand is not in use. Adjusting the unloader valve will not increase performance of the unit and will void the manufacturer's warranty.

Caution: Do not drag the hose over an abrasive surface such as concrete. This will cause excessive wear and shorter hose life. Lift the hose up instead of dragging it.

Caution: To prevent injury when removing and installing nozzles, use only spray tips that are matched to the unit. Keep the nozzle and the tube pointed away from you and others.

Shutting down the machine

1. Turn off the burner switch, and let the heating elements cool down for 2-5 minutes while spraying.
2. Turn off the pump switch.

Winterizing the machine

 **Caution:** Do not store the machine where it will be subject to freezing temperatures, otherwise severe damage will occur. If it must be stored where the temperature is below 32° F/0° C, winterize the machine as follows:

1. Prepare 10 gallons of 50/50 antifreeze and water.
2. Remove the nozzle from the wand, and lay out the hose and wand flat on the floor.
3. Drain the float tank, and refill it with the antifreeze solution.
4. Hold open the trigger gun while keeping the float tank full of the antifreeze solution.
5. Turn the Pump switch on. When antifreeze solution appears at the end of the gun, release the trigger once or twice, and then turn the Pump switch off.
6. When preparing to operate the machine the next time, have an antifreeze container handy. Reconnect the water supply. Turn the Pump switch on, and direct the flow of antifreeze into the container, taking care not to dilute it when water starts flowing through. Antifreeze left undiluted can be reused.

Predictive maintenance

Warning: To prevent damage to the machine and injury of personnel, make daily inspections of the machine for anything that could cause damage, fire or any other safety problem.

Warning: To prevent injury from electric shock or accidental machine startups, disconnect the electrical power supply before servicing any part of the machine. Follow lock-out, tag-out procedures to prevent accidental startup.

Pressure hose

Inspect the hose for wear or damage (see Figure 10). If there is damage, replace the hose. Do NOT repair it.

Wrap up the hose as soon as you turn off the machine, and store it on the hose hooks or other safe location.

Hose Reels will greatly increase the life of the hoses. Feel free to contact PEM about hose management options available.

Caution: Avoid extending the hose across high traffic areas, which can damage the hose. Never leave the hose where it can be run over by any type of vehicles.

Caution: Never pull the hose around a sharp corner or force it into a small lip. The wire braid has a minimum bend of 5 inches. A smaller bend will damage the braid.

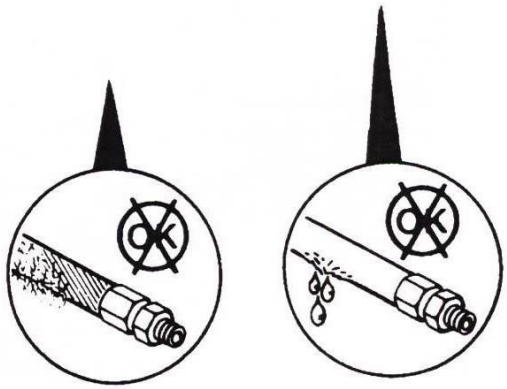


Figure 10: Examples of a damaged hose

Water inlet tank filter screen

The stainless-steel screen located in the float tank (see Figure 9) prevents foreign material from entering the pump. Check the screen frequently to ensure that it does not clog.

Caution: To prevent damage, never operate the machine with the filter screen removed. Be sure to put the filter in place after cleaning it**.**

Pump

Pump lubrication

The pump (see Figure 11) is pre-lubed at the factory. However, check the pump oil level frequently as follows:

1. Locate the site glass on the back side of the CAT pump. The site glass is a clear circle with a red dot in the middle: the oil level should be at the red dot. If the oil is low, remove the fill plug and add oil.
2. Fill the crankcase to the red dot on the site glass with **SAE 30 weight oil, preferably with no detergent**. Do not overfill.
3. Replace the fill plug.

Change the oil after the initial 50 hours of operation and then after every three months or 500 hours of operation, whichever occurs first. Change the oil as follows:

1. Drain the oil by 1) removing the plug located at the rear of the pump crankcase or 2) removing the fill plug (Figure 12) and suctioning the oil out with a suction gun that has a flexible tub.
2. Fill the crankcase to the red dot on the site glass with **SAE 30-weight oil**, **preferably with no detergent**. Do not overfill.
3. Replace the check/fill plug.

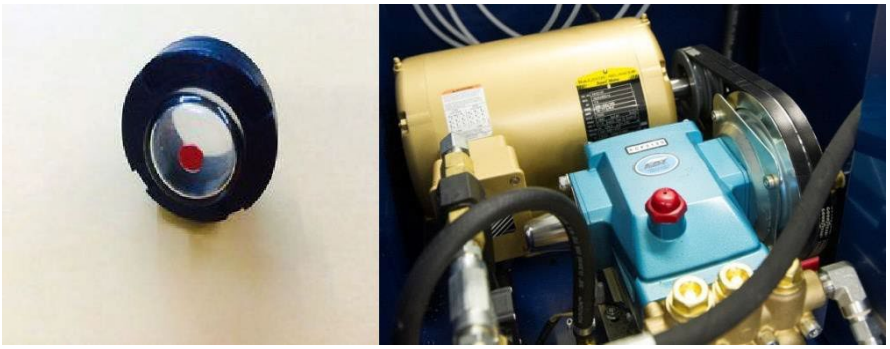


Figure 11: Pump

Figure 12: Pump oil check/fill plug

Pump belt

New belts will loosen after a short amount of use, and the tension must be readjusted

1. Measure belt defection at the longest span of belt, midway between the pulleys. With a 25-lb vertical force applied, ensure the deflection is no more than 1/2” to 5/8” (see Figure 13).
2. If you are using a belt tension gauge, ensure that 100 to 110 lbs. is registered on the spring scale when the pump is secured in the operating position.
3. To adjust the belt tension, loosen the four-pump main frame attaching bolt nuts one half to one turn. Turn the tension bolt nut clockwise to tighten the belt or counterclockwise to loosen it.
4. Tighten the mount-bolt nuts.
5. Using a straight edge, verify the pump drive pulley alignment. If it is off, adjust the position of the pump by loosening the pump mounting nuts, adjusting the pump position and re-tightening the nuts.

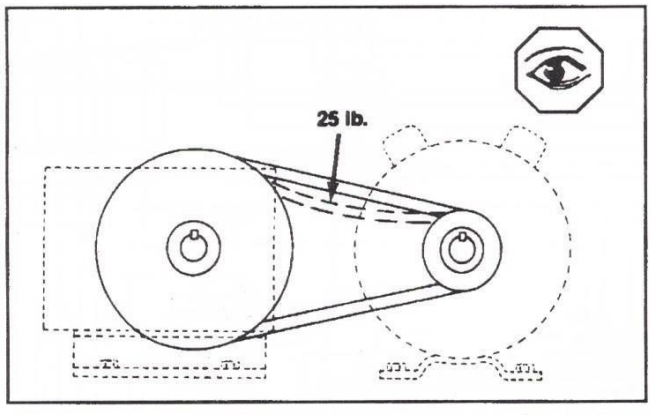


Figure 13: Measuring pump belt deflection

Inspect the belt for excessive wear, fraying and cracking at least once a month or after every 100 hours of operation, whichever comes first. Replace damaged or worn belts.

Note: Install dual pump belts in matched sets. When belt replacement is necessary, never replace a single belt in a set as the new belt will carry all the load and fail rapidly.

Repair

Pump

Servicing the pumping section

The three inlet and three discharge valves are identical and can be serviced without disrupting the inlet or discharge piping using a valve kit available from the manufacturer. Two kits will be needed to repair all the valves in the pump. The kit includes new O-rings and a valve assemblies (valve seat, poppet, spring and retainer all preassembled). Service the valves using the kit as follows:

1. Remove each valve plug using a 24 mm socket (see Figure 16).

Figure 16: Removing valve plugs

2. Examine the O-ring gaskets, and replace if needed (see Figure 17).

Figure 17: Examining the O-ring gaskets

3. Using a needle-nose pliers, remove the valve assembly from the cavity (see Figure 18).

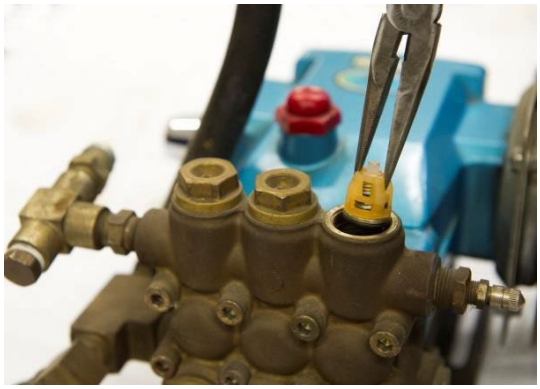


Figure 18: Removing the valve assemblies

4. Remove the O-ring from the cavity.
5. Install the new O-ring in the valve cavity.
6. Insert the new valve assembly into the valve cavity.
7. Replace the valve cap and torque it to 70-75 foot-pounds.

Servicing the ceramic plungers and V-packings

Removing the pump manifold head

1. Using a 6 mm hex-key wrench, remove the eight cap bolts from the manifold head (see Figure 19).

Figure 19: Removing the cap bolts

2. Separate the head form the crankcase. It may be necessary to tap the head with a rawhide mallet in order to loosen it (see Figure 20).

Figure 20: Removing the manifold head

Caution: When sliding the head from the crankcase, be careful not to damage the plungers.

3. The V-packing assemblies may come off with the head. If not, slide them off and examine the ceramic plungers. Their surface should be smooth and not scored or pitted. Clean them if necessary, and replace them if they are damaged as follows:

Replacing plungers

1. Using a 10-mm socket, remove the ceramic plunger and plunger retainer from the piston rod (see Figure 21).

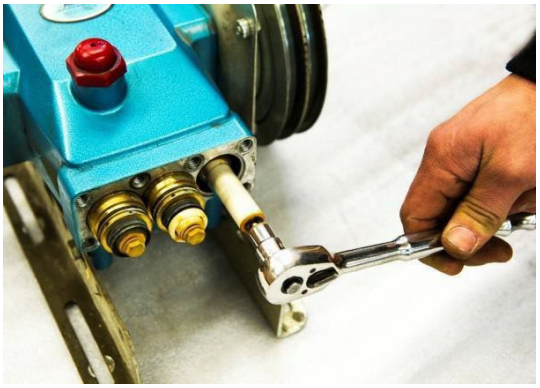


Figure 21: Removing plunger

2. If the barrier slinger or keyhole washer comes off with the plunger, replace them before installing a new plunger.
3. Separate the plunger retainer from the plunger.
4. Install a new seal washer on the plunger retainer. Use a small dab of grease on the outside of the seal washer to ensure better installation.
5. Carefully press the plunger retainer into the new plunger.
6. Slide the new plunger over the piston rod, and torque it to 5 foot-pounds.

Replacing V-packings

1. From the crankcase side of the manifold head, use a reverse pliers to remove the low-pressure seal from the seal case.
2. Using the reverse pliers, remove the press-in seal case from the manifold.
3. Remove the front male adapter and the V-packing.
4. Examine the adapters and v-packing for wear, and replace as needed. Examine the seal case O-ring.
5. Install the new head ring.
6. Coat the front V-packing with a thin film of grease, and insert it in the cavity. Repeat with the second V-packing. Lubricate the seal case O-ring.
7. Firmly press the seal cases into the V-packing
8. Press the low-pressure seal into the seal case with the garter spring down.

9. Replace the seal retainer with tabs facing down and holes away from the crankcase.
10. Coat each plunger with a thin film of grease.

Reinstalling the manifold head

1. Carefully slide the manifold head into the crankcase.
2. Install the eight cap bolts as follows:
    a. Install all eight cap bolts finger tight.
    b. Torque all cap bolts to 5 foot-pounds in the sequence shown in Figure 22.
    c. Torque all cap bolts to 10 foot-pounds in the sequence shown in Figure 22.

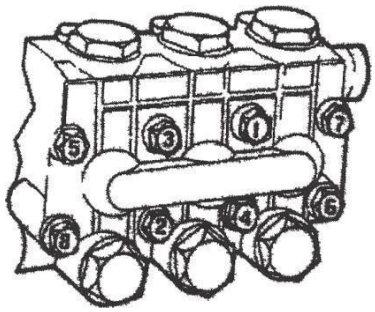


Figure 22: Manifold head torque sequence

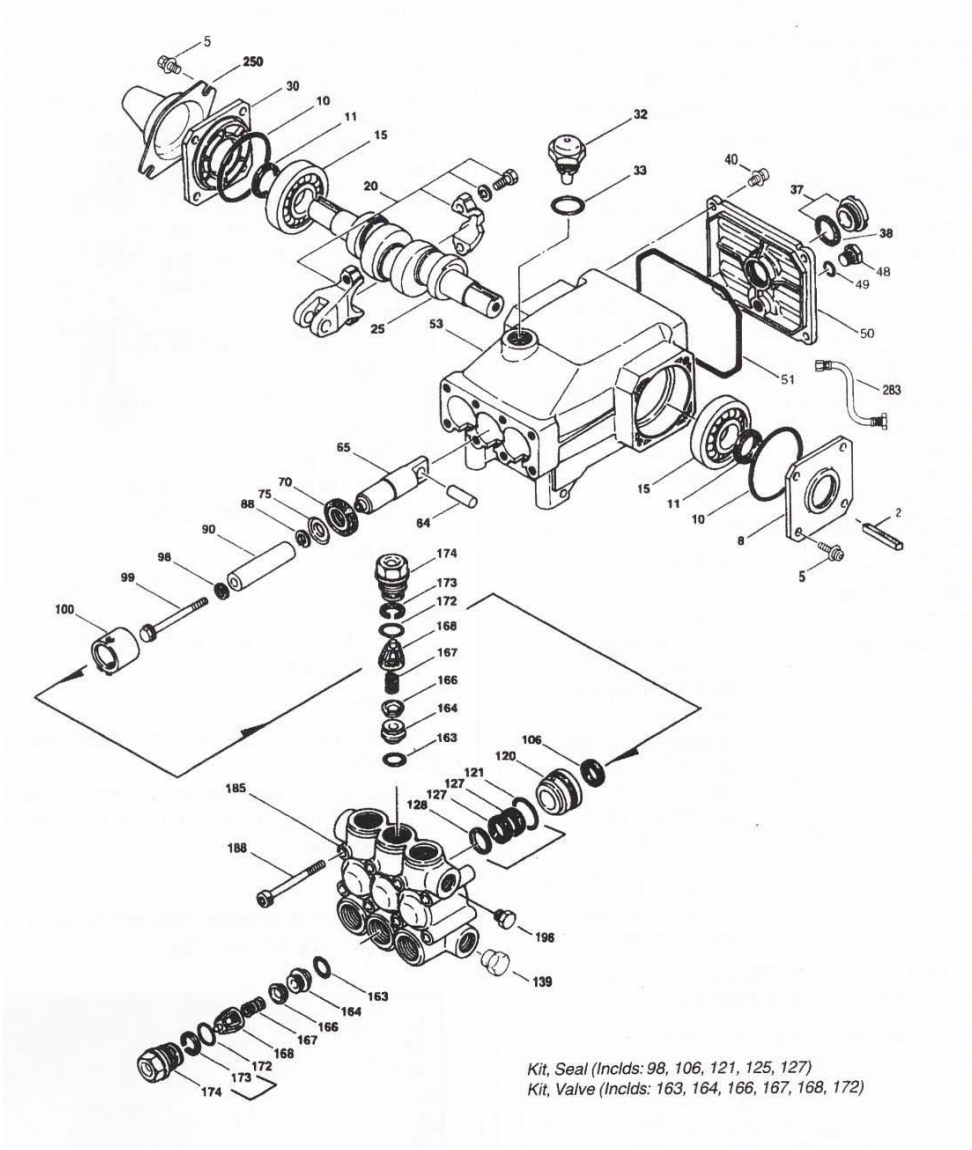


Figure 23: Pump exploded view

Pump parts list (5CP310, 5CP3120G1, 5CP3130G1)

Item	Part number	Material	Description	Quantity
2	30057	STL	Key (M6x6x25)	1
5	96031	STZP	Screw, Sems (M8x16)	8
8	46910	AL	Cover, Bearing	2/1
10	14028	NBR	O-ring, Bearing Cover -70D	2
11	43222	NBR	Seal, Oil, Crankshaft	2
15	14480	STL	Bearing, Ball	2
20	†48658	HS	Rod, Connecting Assembly [2/00]	3
25	46928	FCM	Crankshaft, Duel End – 3120, 5120, 6120, 6120G1	1
	48233	FCM	Crankshaft, Single End – 31201G1	1
	48368	FCM	Crankshaft, Single End – 31201G1, 5150G1	1
30	48224	AL	Cover, Bearing Blind	1
32	46798		Cap, Oil Filler, Domed	1
33	14179	NBR	O-Ring, Bubble 2/Gasket – 80 D	1
37	92241		Gauge, Oil Bubble w/Gasket – 80 D	1
38	44428	NBR	Gasket, Flat, Oil Gauge – 80 D	1
40	92519	STZP	Screw, Sems (M6x16)	4
48	25625	STCP	Plug, Draign (1/4" x 19BSP)	1
49	23170	NBR	O-Ring, Drain Plug – 70D	1
50	46940	AL	Cover, Rear	1
51	14044	NBR	O-Ring, Rear Cover	1
53	48617	AL	Crankcase	1
64	46746	CM	Pin, Crosshead	3
65	48458	BBNP	Rod, Plunger	3
70	46838	NBR	Seal, Oil, Crankcase – 70D	3
75	43900	S	Slinger, Barrier	3
88	45697	S	Washer, Keyhole (M18)	3
90	46884	CC	Plunger (M16x50)	3
98	46730	NBR	Washer, Seal	3
	48394	FPM	Washer, Seal	3
99	48201	SS	Retainer, Plunger w/Stud (M6)	3

100	46749	PVDF	Retainer, Seal	3
106	43316	NBR	Seal, LPS w/S Spg	3
	106660	FPM	Seal, LPS w/S Spg	3
120	46888	BB	Case, Seal (Press-in-Style)	3
121	13978	NBR	O-Ring, Seal Case – 70D	3
	14329	FPM	O-Ring, Seal Case	3
125	-		Seal, HPS w/s	3
	-		Seal, HPS w/SS	3
127	43319	PTFE	V-Packing	6
	46287	HT	V-Packing	6
	-		V-Packing	6
128	46618	NY	Adapter, Male	3
139	22179	BBCP	Plug, Inlet (1/2" NPT)	1
162	-		Back-up-Ring, Seat	6
163	17457	NBR	O-Ring, Seat	6
	11685	FPM	O-Ring, Seat	6
164	46658	S	Seat	6
166	46429	S	Valve	6
167	43750	S	Spring	6
168	44565	PVDF	Retainer, Spring	6
172	17549	NBR	O-Ring, Valve Plug	6
	26996	FPM	O-Ring, Valve Plug	6
173	48365	D	Baku-up-Ring, Valve Plug	6
174	45900	BB	Plug, Valve	6
185	46886	FBB	Manifold, Head	1
188	87872	STZP	Screw, HSH (M8x70)	8
196	22187	BBCP	Plug, Discharge (3/8" NPT)	1
250	118672	STCP	Protector, Shaft	1

Troubleshooting

 **Warning:** To prevent serious or fatal injury, ensure the machine is shutoff and disconnected from the electrical supply before attempting any repairs or maintenance. Use lockout-tagout procedures.

Troubleshooting is an organized study of the problem and a planted method of investigation and correction. The following troubleshooting guide includes some of the problems that you may encounter during service of the machine. It does not give all the possible methods to correct the problems listed, but is meant to stimulate a train of thought and indicate a work procedure directed toward finding the source of the problem.

Most problems are simple and easily corrected. To save time and trouble, always check the easiest and obvious thing first.

Study the problem thoroughly, and ask yourself these questions:

- What was the warning signs preceding the trouble?
- What previous repair and maintenance work has been done?
- Has a similar problem occurred before?
- If the machine still runs, is it safe to continue operation to make further checks?

Heating malfunction

Problem	Probable cause	Solution
SprayWand heat fails to turn on and off with operation of wand trigger	1. Flow switch faulty 2. Pressure switch faulty 3. Timer faulty 4. Heating elements faulty 5. Burner switch faulty	Contact PEM for assistance
Low temperature output	1. 1 or more heater elements burned out 2. Thermostat set to low	1. Contact PEM for assistance 2. Increase the thermostat setting
Excessive temperature output	1. Temperature set too high 2. Faulty thermostat 3. Flow switch malfunction	1. Decrease thermostat setting 2. Replace thermostat 3. Replace bad flow switch

Pump malfunction and pressure delivery problems

Problem	Probable cause	Solution
Low pressure	1. Worn or oversize spray nozzle 2. Clogged water inlet strainer 3. Out of detergent (pump sucking air through detergent line) 4. Air leak in inlet plumbing 5. Belt slipping 6. Dirt or foreign particles in the valve assembly 7. Worn or damaged inlet or discharge valve. 8. Faulty unloader	1. Replace worn nozzle 2. Clean or replace fouled strainers (in float tank) 3. Restore detergent supply or close detergent shut-off valve 4. Locate air leak. Reseal connection or replace damaged part 5. Tighten or replace if damaged 6. Remove any dirt or particles 7. Replace worn valves 8. Replace unloader assembly

Rough operation with loss of pressure	1. Restricted inlet plumbing or air leak in inlet plumbing 2. Damaged pump part 3. Float tank running empty	1. Ensure adequate water supply and supply hose. Repair clogged inlet fittings 2. Replace any damaged pump parts clean out any foreign particles 3. Check incoming water supply, replace float assembly if water not keeping up to demand
Water leakage in intake manifold or crankcase	Worn manifold seals or condensation inside the crankcase	Replace seals. Change the oil on a regular basis
Noisy operation, knocking	1. Inadequate water supply to the pump, creating a "vacuum knock" 2. Loose pulley 3. Worn or broken bearing(s) 4. Faulty pump shaft	1. Check for restricted inlet and adequate tap water supply 2. Check key and tighten set screw 3. Replace bearing(s) 4. Replace pump
Oil leaks	Worn crank seals, crankcase cover and seal or drain plug	Replace seals
Excessive pump shaft play	Worn and loose bearings	Replace bearings. Check bearing seals, spacers and retainers, replacing any worn parts
Irregular spray pattern	Worn or partly clogged spray nozzle	Clean or replace nozzle

General malfunctions

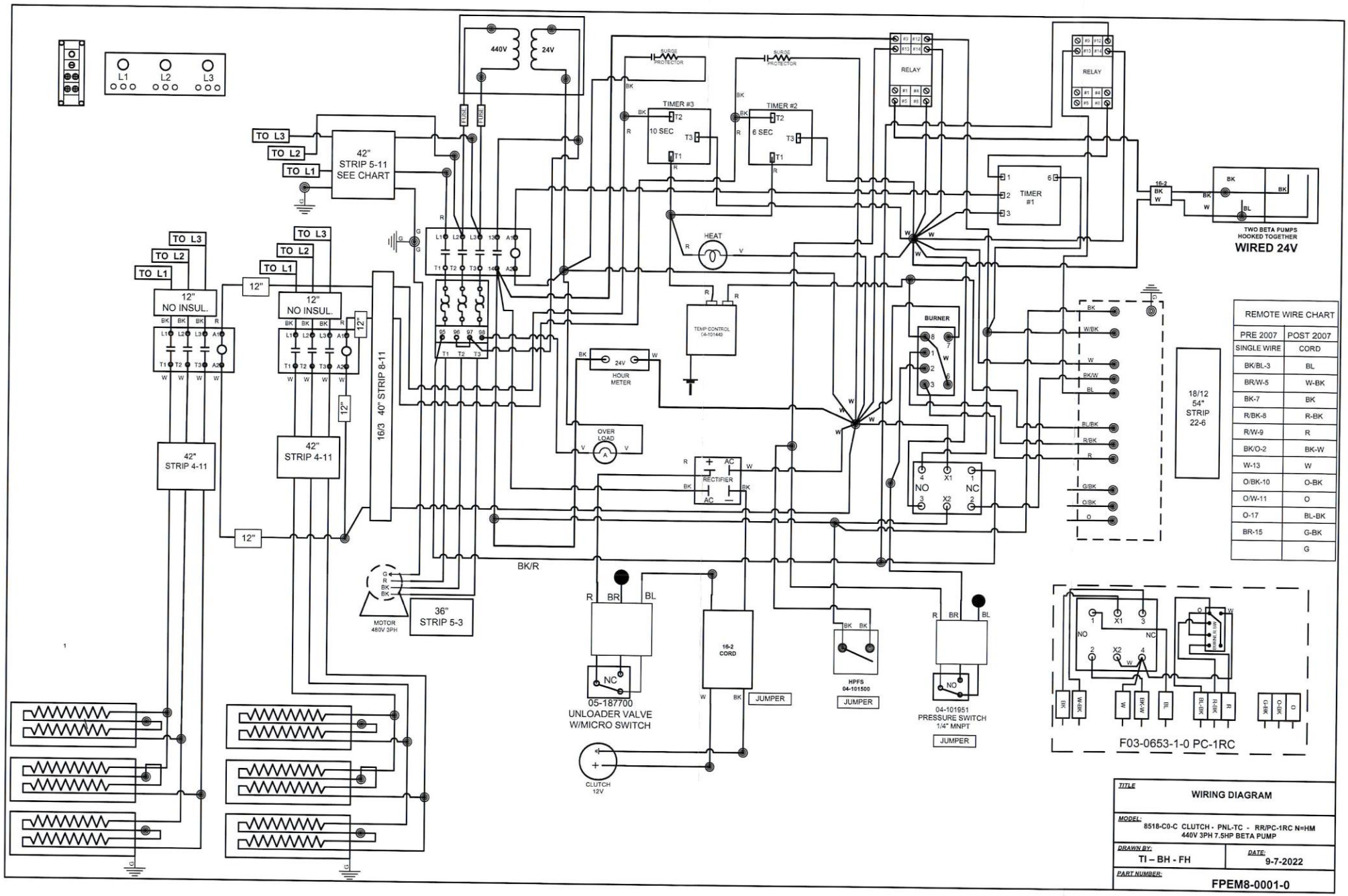
Problem	Probable cause	Solution
Machine cycles	1. Chemical injector clogged 2. Nozzle clogged 3. Air leak 4. Clutch engaging when trigger not pulled	1. Replace the chemical injector 2. Remove the nozzle and clean 3. Locate air leak and repair 4. Check for leaks in plumbing. Repair leak if found, if no leaks found, replace unloader valve.
Machine pulsates two to three times per second	Broken valve in the pump	Remove and replace pump valve (see the Repair section)

Chemical system malfunction

Problem	Probable cause	Solution
Injector(s) won't draw	1. Plugged wand nozzle 2. Damaged wand nozzle 3. Chemical pick-up filter clogged 4. Injector clogged 5. Hose damaged 6. Not adequate flow/ pressure 7. Temperature too high	1. Clean or replace nozzle 2. Replace nozzle 3. Check – clean or replace 4. Remove and clean injector 5. Replace hose 6. See low pressure section 7. Turn thermostat down
Injectors fade in and out	Water temperature too high	Turn down temp dial to 150 degrees or less. If nothing changes, replace bad temp controller

Electrical malfunction

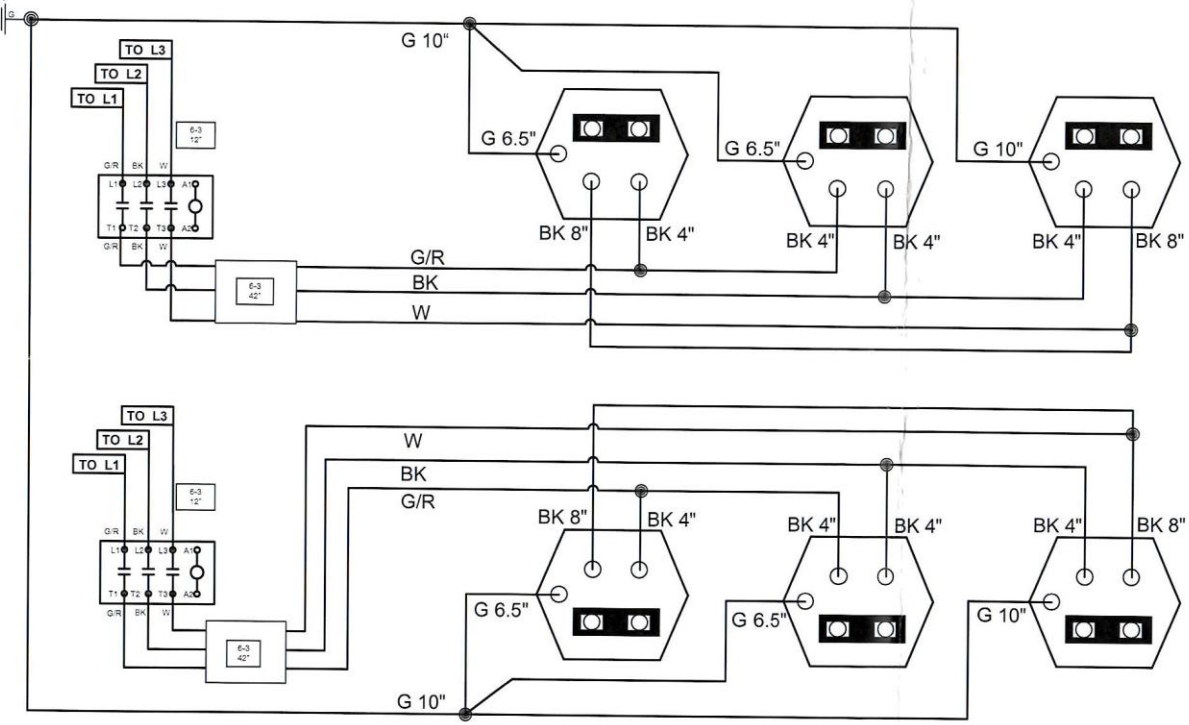
Problem	Probable cause	Solution
SprayWand electrically dead	1. No power to machine 2. Defective Pump switch 3. Faulty or loose wiring	1. Check the circuit breaker. Check for a defective electrical outlet 2. Test the switch, and replace if it is defective 3. Contact qualified service technician
Power supply circuit breaker trips often, will not stay on	1. Short circuit in the washer or elsewhere on the circuit 2. Undersized circuit used, or too much total load on the circuit. 3. Supply voltage is too low	1. Check washer (and other loads on the same circuit) for faulty or loose wiring 2. Put the washer on a larger circuit, or remove the loads from the existing circuit 3. Have certified electrician check the incoming voltage
Thermal overload protector in main pump motor trips often	1. Partially or totally clogged spray nozzle overburdens the motor 2. Undersized spray nozzle in use 3. Restriction in plumbing of the machine 4. High ambient temperature 5. Supply voltage is low	1. Remove and clean out the nozzle. Make sure the strainers on the inlet and chemical suction tube are present ad in good, clean condition 2. Make sure the nozzle size is as given in the Specifications section 3. Locate restriction and repair 4. Install better ventilation, or move to a cooler location 5. Check the line voltage and ensure proper voltage
Electrical shock from cabinet and spray wand	Electrical leakage exists, and the machine is not properly grounded	 **Danger:** To prevent injury or death, do not use the machine. Find the problem or contact a qualified electrician. Ensure the machine is completely grounded at all times. This means a solid ground connection inside the cabinet.



REMOTE WIRE CHART	
PRE 2007	POST 2007
SINGLE WIRE	CORD
BK/BL-3	BL
BR/W-5	W-BK
BK-7	BK
R/BK-8	R-BK
R/W-9	R
BK/O-2	BK-W
W-13	W
O/BK-10	O-BK
O/W-11	O
O-17	BL-BK
BR-15	G-BK
	G

TITLE	WIRING DIAGRAM
MODEL:	8518-C0-C CLUTCH - PNL-TC - RR/PC-1RC N=HM 440V 3PH 7.5HP BETA PUMP
DRAWN BY:	TI – BH - FH
DATE:	9-7-2022
PART NUMBER:	FPEM8-0001-0

03-181204
EYELET



440V 3PH
ELEMENT WIRING

480V 3PH
ELEMENT WIRING

QTY-1 PER ELEMENT

ELEC JUMPER
SUPPLIED WITH
ELEMENTS

2180 WIRE: HIGH TEMP 12 GA.BLK
1 - 64"
4 - 8"
8 - 4"

2191 WIRE: HIGH TEMP 12 GA GRN
1 - 66"
4 - 6.5"
4 - 10"

1 – 03-181204 BATTERY EYELETS 1A079
18 – 03-181211 TERM. RING EYELETS NP 10GA TO 12GA

8 – 03-171200 SPLICE CAP INSUL LARGE
8 – 03-171210 SPLICE CAP COPPER LARGE

TITLE: SCHEMATIC	
MODEL: ELEMENT WIRING 6-ELEMENTS	
DRAWN BY: FH	DATE: 1-13-2021
PART NUMBER: F08-0125	

Service record

Type	Date

PEM Corporation
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sales@pemequip.com

PEMequip.com