QuakerBlast.com

Built for Performance, Efficiency, Durability, and Reliability

Industrial Hot Water Fully Electric
OWNER'S MANUAL

OWNER'S MANUAL

1-877-461-3500 • sales@quakerblast.com • www.quakerblast.com

BEFORE YOU BEGIN!

HIGH-PRESSURE WASH EQUIPMENT AND THE SPRAYS THAT THEY GENERATE CAN CAUSE SERIOUS INJURY.
THINK SAFETY FIRST!

The forces generated by high-pressure sprays can penetrate clothing or skin and cause severe personal injury. Additionally, the high-pressure spray and material dislodged by it may be deflected back toward you and / or persons or objects nearby. Water or water combined with cleaning agents or soap can make floors and other surfaces slippery, creating the possibility of persons or objects falling. Power cords and high-pressure hoses create a further hazard and should always be stored neatly when not in use. During any cleaning operation, hoses and power cords should be laid flat on the ground and away from areas where they may become entangled in objects or cause tripping of persons passing by. Always consider the surrounding environment and conditions before beginning any cleaning operation.

- **Eye protection, safety footwear and protective clothing should always be worn when using this equipment.**
- **Never place any part of your body in front of the high-pressure nozzle.**
- **Never direct the high-pressure spray at yourself or any other person.**
- **Never allow children to operate the pressure washer.**
- **Hold the trigger gun/wand assembly securely with both hands when operating the pressure washer.**
- **Never direct the high-pressure spray at any electrical device or the pressure washer itself.**
- **Never operate electrically powered pressure washers where they will be exposed to rain or other forms of precipitation or spray.**
- **Never operate the pressure washer with damaged parts or components.**
- **Never allow the machine or accessories to freeze.**
- **Do not drive over or crush high-pressure hoses or allow them to come in contact with sharp objects.**
- **Do not operate electrically heated system without first supplying water to the heat exchanger tank. Fill the water tank with clean water to safe levels of operation.**
- **Do not attempt to move or pull the machine (portable equipment) by the high-pressure hose or electrical cord.**
- **When not in use, turn the machine OFF and depress the trigger gun to remove residual system pressure**
- **Do not operate the system without a water supply.**
- **Do not allow the machine to operate (by-pass) for extended periods with the trigger gun closed or without discharging water.**
- **Avoid rapid triggering and releasing of the gun. Smooth triggering will extend the life expectancy of the system components.**

High-pressure wash system components are sensitive to solid matter and debris that may be present in the fluid moving through them. Additionally, material allowed to enter hoses and various connections when the equipment is improperly moved or stored can increase the potential for failure. To avoid component fouling, poor system performance and costly downtime, always ensure that a clean water supply and when possible, a clean environment is provided to the machine

QuakerBlast Pressure Cleaning Systems

1-877-461-3500

This manual contains operational information that is specific for The Industrial Hot Water Fully Electric Models

Read the following instructions carefully before attempting to assemble, install, operate or service this pressure washer. Failure to comply with these instructions could result in personal injury and/or property damage.

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PROTECTING THE SYSTEM FROM FREEZING

If the equipment will be used or stored in areas where it will be exposed to temperatures below 0° Celsius (32° Fahrenheit) for any period of time, precautions must be taken to prevent damage due to freezing. **Draining the system does not offer adequate protection.** Use of a high quality plumbing antifreeze or automotive windshield washer antifreeze is recommended. Glycol based antifreeze may be used, but be sure to follow the manufacturer's directions for correct mixture and for proper disposal after use. The following method may be used to protect the system when not in use.

1. Disconnect the power supply to the machine and turn off all control switches (Turn off engine on gas powered machines)

2. Turn off the water supply.

3. Relieve any trapped pressure in the system by squeezing the trigger gun but leave high pressure hose(s) attached to the discharge.

4. Remove supply hose.

5. Fill a clean container of sufficient size to supply the machine with enough antifreeze solution for approximately two minutes operation (i.e. 8 gallons for a 4 GPM system).

6. Connect a short hose to the inlet of the system and submerge the open end in the antifreeze close to the bottom of the container.

7. Restore power to the machine and turn control switch to MANUAL position. (Start engine on gas powered machines)

8. Open and hold trigger gun until antifreeze is discharged from nozzle. (Most antifreeze compounds will foam slightly when discharged from system). Discharged antifreeze may be directed back into container for reuse or proper disposal.

9. Close the trigger gun momentarily to force solution through by-pass loop.

10. Repeat steps 1, 3, and 4

If desired, compressed air may be connected to the inlet connection of the system to force the remaining antifreeze solution from the system; however, air pressure should be regulated to no more than 80 PSI.

EQUIPMENT PREVENTATIVE MAINTENANCE

Regular inspection and maintenance of your system is the best defense against equipment failure and costly downtime. Additionally, the high-pressure wash systems can create safety hazards. Simple checks, performed by the operator of the equipment or maintenance personnel on a regular basis, will help to ensure safe operation and that the system's maximum performance and life cycle is achieved. The guidelines below pertain to the basic system and components only. Further consideration should be given to optional accessories when included.

Daily Maintenance should include the following:

- Check that all water supply and high pressure discharge hoses as well as all power cords do not create an obstruction that may cause anyone to trip or fall.
- Check that all controls, switches and disconnects are readily accessible and can be reached quickly in case of emergency.
- Check inlet water supply valves and hoses for signs of leakage and correct where needed.
- Check inlet water supply hose for kinks or other forms of restriction that can interrupt proper flow in to the system.
- Check that all electrical cords and wires are properly secured/connected and do not pose a potential hazard for electrocution. **All electrical supply and motor connections must include a ground wire.**
- Check that the area around the unit is clear and dry.
- Check that all moving parts such as belts, pulleys, motor fans etc., are clear of debris that could become entangled or otherwise come in contact with them.
- Check the pump oil sight glass or dipstick for the correct oil level and signs of contaminants (water or metallic particles).
- Untangle the high presser hose if needed.
- Check the hose for nicks, cuts and abrasions that can lead to leaks.
- Check that the nozzle is clear of debris and operates correctly.
- Check for adequate water to the unit.
- Check that the chemical tank is full
- Check that the Chemical tube is clear and in the tank.

Weekly Maintenance should include the following:

- Check and clean inlet filters and screens
- Check and clean the chemical filter/screen
- Check for signs of water and / or oil leaking around the pump

Monthly Maintenance should include the following:

- Update your record of inspections, problems or any potential problems
- Check for any oil leaks at the crankcase, crankshaft or piston seals
- Check controls are working within specifications

Quarterly Maintenance should include the following:

- Change the pump oil every 3 months or 500 hours of use, whichever occurs first
- Check the inlet and discharge valve assemblies and O-rings should be checked or changed every 3 months

ELECTRIC HEAT EXCHANGER

Functional Description

The function of our heat exchangers is to enhance an existing high pressure cold water wash system by enabling it to create hot water downstream of the height pressure pump. It also allows the system to operate automatically, virtually eliminating the problems that are often associated with "hands-on" controls. High pressure cold water is circulated through a tubular coil which is submerged in hot water in an unpressurized tank. The cold water is then heated by the surrounding hot water.

Motor controls as well as other system controls and safety features are provided with the heat exchanger, and are enclosed within the unit eliminating the need for separate pump control.

Our heat exchangers have been designed with the maximum efficiency in mind. There is no need for messy and potentially dangerous fuel storage and no need for venting. The unit may be located in any convenient location. High pressure hot water is only the squeeze of a trigger away, and our heat exchangers deliver it to you instantaneously; **NO WARM UP PERIOD.**

Cold Inlet Water Connection

Inlet connection to the heat exchanger is made by connecting a high pressure discharge hose (optional) from the discharge port of the high pressure pump unit to one of the fittings provided on top of the heat exchanger. **DO NOT EXCEED MAXIMUM SYSTEM PRESSURE** (See specifications on the third page).

Hot Discharge Water Connection

Discharge connection is made from the fitting opposite the inlet to the hose/gun/lance assembly, or to plumbing for remote station(s) operation.

Automatic Controls

Automatic controls include water temperature control, low heat exchanger water level shut off, and pump motor control circuit complete with time delay stop. Motor circuit fusing and overload protection are also provided. In addition all heat exchanger control circuits have provisions for connecting a flow switch and optional pump thermal protector.

The thermostat maintains tank water temperature at approximately 180 degrees F (82 degrees C). A level switch in the tank will open if, the water level should drop to a point where operation of the unit is affected

Electrical Supply Hookup

Electrical service for the system is run to the terminal block on the electrical panel labeled L1, L2, L3. A ground lug is also provided. This unit must be properly grounded to prevent electrical shock. A fused disconnect is to be provided according to local codes. Refer to ID plate for voltage and total connected load.

ALL ELECTRICAL WORK TO BE PERFORMED BY A QUALIFIED ELECTRICIAN.

WARNING: This controller must be provided with suitable overload and overcurrent protection in accordance with the Canadian Electrical Code part 1.

UNIT TO BE CONNECTED TO A (GFCI) OR TWIST LOCK PLUG OR PERMANENT CONNECTION

Motor/Motor Control Connection

The high pressure pump motor is to be connected to the motor contactor overload connections labeled T4, T5, T6. Be sure that the motor current (see FLA rating on motor plate) is within the current rating of the motor overload, and that the overload is set to the proper current level. A ground lug is also provided for the motor circuit. Electrical leads from a flow switch (optional) are to be connected to the terminal strip labeled FLOW SWITCH CONNECT, at terminals 7 & 8. An optional thermo probe may be connected at terminals 9 & 10. The purpose of this probe is to protect the high pressure pump from overheating. A thermally activated switch within the probe will open when the pump temperature is too high, stopping the unit. The system will start again only when the temperature has been restored. On units that are not equipped with this feature, a jumper wire (installed at the factory), must connect terminals 9 & 10 and it is suggested that another type of thermal protector be used.

Startup and Adjustment Procedures:

Installation

Install the Electrically Heated System in accordance with pumping package and heat exchanger directions. See pump and heat exchanger directions. This equipment should be installed and serviced by qualified personnel.

Turning Power On

Do not turn power on until the heat exchanger is filled with water as severe damage may occur if water is not above heater elements. To fill heat exchanger, remove 1 ¼" pipe plug from the elbow fill pipe located on the heat exchanger. Insert water hose and fill. Heater tank will require approximately 70 gallons (265 litters) of water on initial fill. After a water level has reached the fill elbow the power may now be turned on. It will take 15 to 20 minutes for the heat exchanger to reach operating temperature. **WATER WILL EXIT THE FILL PIPE WHILE THE HEATER TEMPERATURE IS RISING.** This is due to the heat expansion of the cold water just added. This will stop after the heater has reached its operating temperature. Replace and hand tighten the 1 ¼" fill pipe plug. After initial heating of the tank leave the main power on to the equipment. This will ensure hot cleaning solution instantly on pump start up.

Turning Water On

Turn the inlet water supply on after the pumping package has been installed. See pumping package section for details.

CAUTION!

Before pumping package is started for the first time, or after maintenance has been performed on any supply or discharge water lines, all air must be purged from the system. Failure to do so may result in system damage.

System Operation

Caution: Pressure cleaning gun must be HELD ONTO SECURELY when the pump is turned on as serious personal injury may be inflicted if spray wand is allowed to move freely. High pressure spray can cause **SERIOUS BODILY HARM- HANDLE WITH CARE- NEVER POINT SPRAY AT ANY PART OF THE BODY.** Proper protective equipment should be worn if corrosive chemicals are used. With pumping unit off pull the gun trigger to ensure that the water is running through the nozzle. Check the supply line to ensure there are no kinks in the hose. Release the gun trigger. Place the operators switch located on the heat exchanger in the "A" automatic position. You are now ready to clean.

Pressure Regulation
This unit has been adjusted at the factory and preset at the designed specifications. DO NOT READJUST IN AN ATTEMPT TO INCREASE PUMP PRESSURE. This will only increase the regulation pressure which will cause internal pump damage or motor overload.

MAINTENANCE

Daily
To ensure a problem free- system simple visual checks can be performed. Check for leaks in inlet supply, pumping system, pump to heater hose, gun(s) and high pressure hose. Check and refill chemical concentrate. Check pump oil level/ condition. Check nozzle condition. If badly worn or leaking conditions are found, qualified personnel should repair or place components with new original or equivalent manufacturers parts.

Check equipment for proper operation. Nozzle spray should be uniform in flow, angle, and pressure. Clean if nozzle is plugged and replace if worn. If a heavy pulsation is the hose or spray is observed, repair of the pumping system is required.

Weekly
After the first week of operation it is recommended 1litre of motor oil be added to be beat exchanger tank through the 1 ¼ fill pipe. This oil creates a vapor barrier and slows evaporation of water in the tank.

Check heat exchanger water level. The level must be up to the filler pipe neck. Add water if necessary. If cold water has been added, heating may cause the expanding water to escape through the filler plug. This will stop after operating temperature has been reached.

Monthly
Check system for operation. Automatic start/stop, hot high pressure water, and smooth operation should be noted. Check tank water level; refill if necessary. Should the tank ever be completely emptied, 450 g of perafilm P must be added to the tank. This prevents corrosion.

Change oil in pump crankcase. Note the condition of the oil when drained. If found to be creamy, the water seals in pump may have to removed and replaced. Fallow the pump manual directions.

FAILURE TO MAINTAIN YOUR PRESSURE WASHER/EQUIPMENT, INCLUDING REGULAR MAINTENANCE OF PUMP AND SYSTEM COMPONENTS, WILL VOID MANUFACTURER'S WARRANTY.

Symptom	Possible Cause	Solution
Pulsation	Excessive pressure and/or temperature of fluid being pump.	Check pressures and/or temperature. Reduce to acceptable level. Reduce pressure.
	Unloader/regulator set too high of pressure. Running pump dry.	Reduce Pressure
	Faulty Pulsation Dampener.	DO not run pump without water. Check pre-charge, if low, re-charge it or install a new one.

GENERAL INFORMATION

Introduction

The electrical Single heater consists of a, single coil heat exchanger, control components, thermo probe, float switch, high pressure hose(s) connections.

THIS MACHINE SHOULD BE PROTECTED FROM FREEZING AT ALL TIMES. (SEE MAINTENANCE)

Installation Location

Place system in any suitable location. Adjusting the leg bolts levels the unit. It is recommended to provide ample room and support for installation, maintenance, and operation of elevated systems. Drainage should be provided near the unit.
The pumping unit is designed to be located on top of the heat exchanger although it may be located beside it.

System Functions

In every Electrically Heated System the following standard features can be found:
1. Automatic start circuit complete with manual override

2. Automatic time delay stop circuit

3. Automatic temperature controlled heat exchanger

4. Thermal safety shutdown on pumping system to protect pump components

5. Low water shutdown circuit to protect heating elements from lack of water in the heat exchanger

6. Corrosion resistant incoloy heating elements (tube type)

7. Fifty feet of 3/8" steel braided hose

8. High pressure trigger gun

9. Lance complete with chemical valve

10. Chemical injection system

11. Complete motor fusing and overload protections

Note: Some of this features may not applied to your build. Check with serial and model number for features that come with your pressure washer.

HEAT EXCHANGER DIAGRAM

The design feature of our Heat Exchanger allows high pressure cold water to be heated in an unpressurized tank. Cold water entering the heat exchanger passes through a coil submerged in heated water. Electrical controls for the exchanger and pumping package are mounted on the outside of the tank. The protective outer wrap and front panel enclose the controls.

After filling the water tank to the level indicated in Fig3, turn the heat exchanger switch to the "ON" position. Once the heater has reached the set temperature, water may drip through a small hole in the 90 deg. to prevent pressure from building up which can naturally occur when water is heated to high temperature.

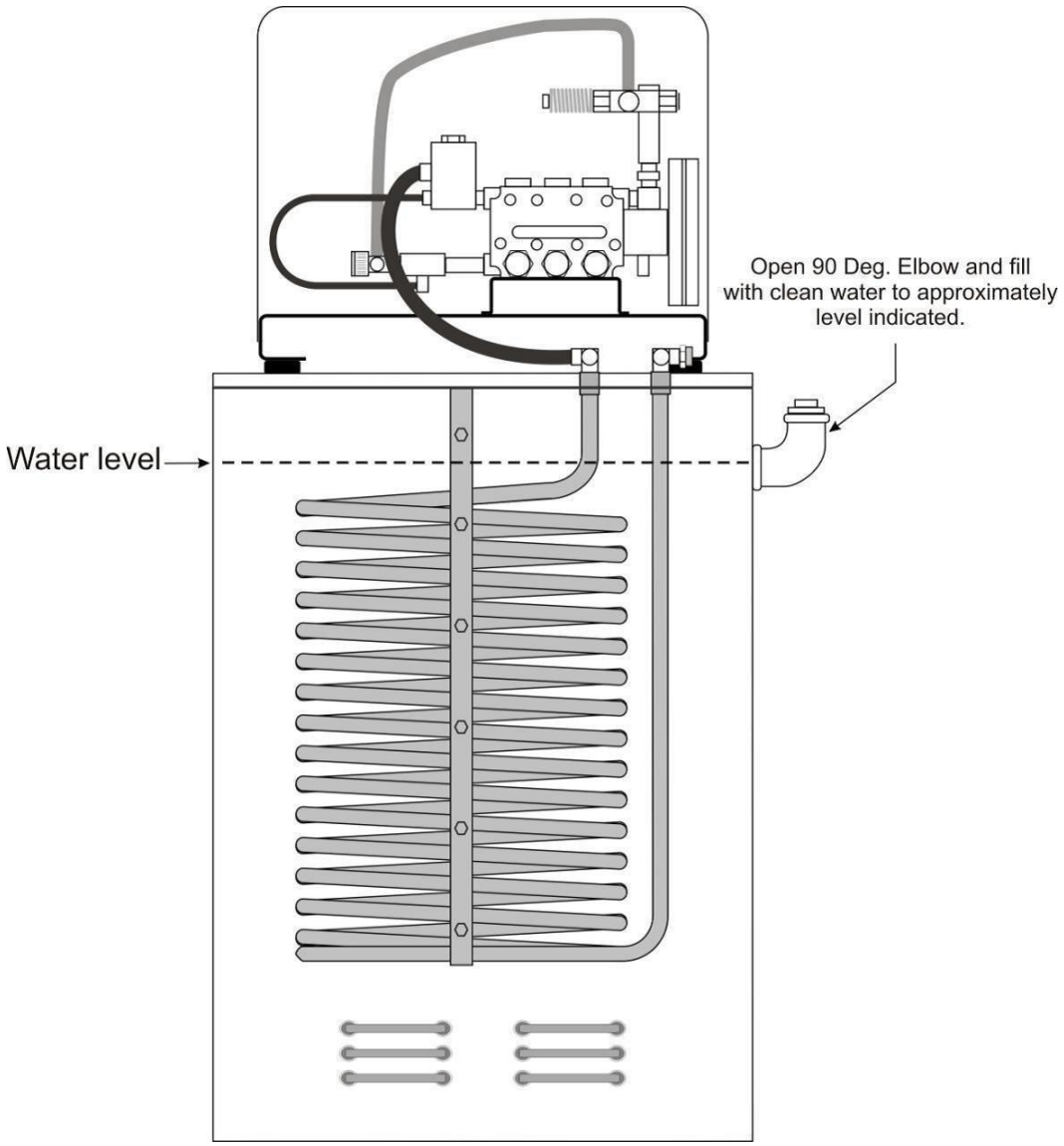
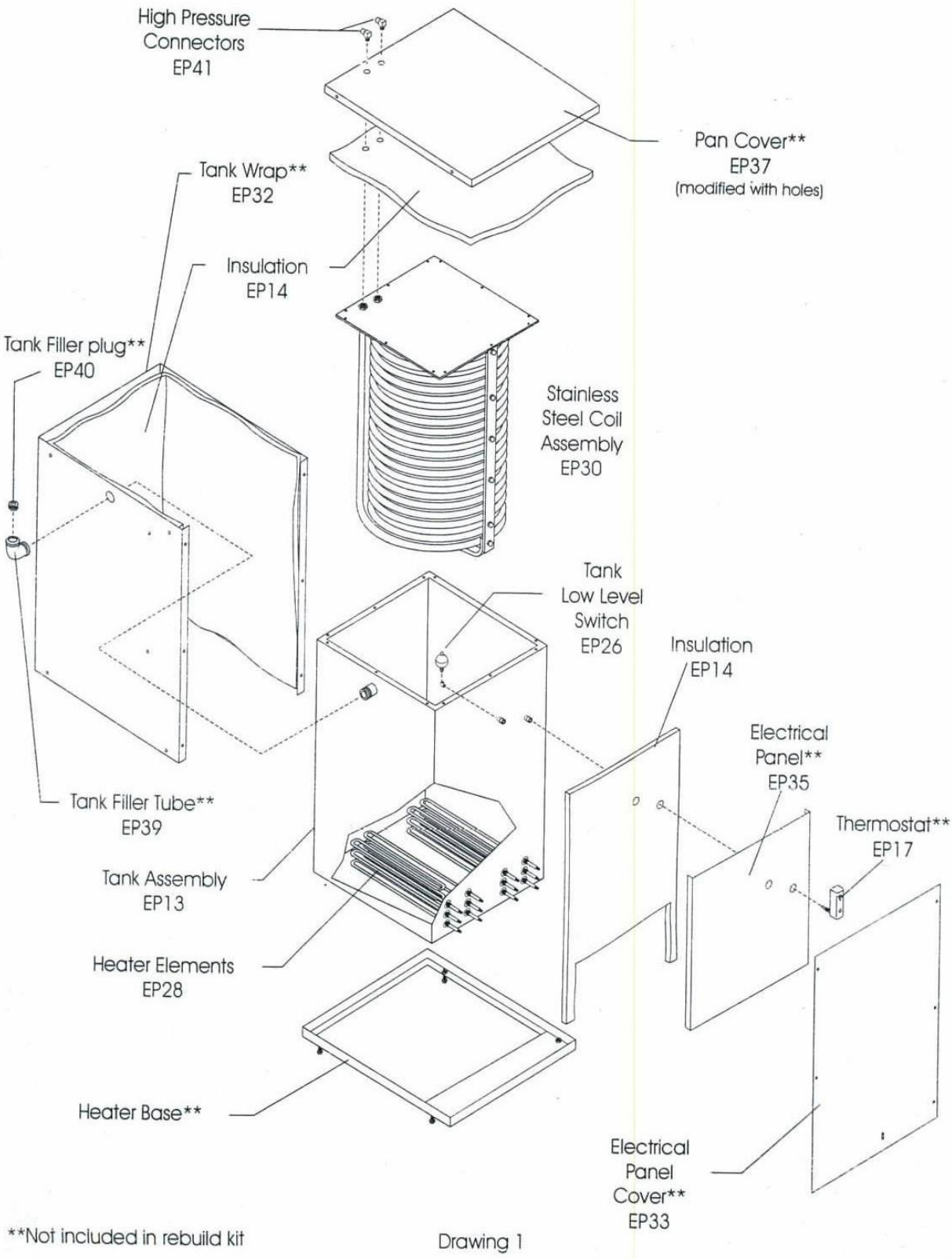


Figure 3
Heat Exchanger

48 kW Heat Exchanger



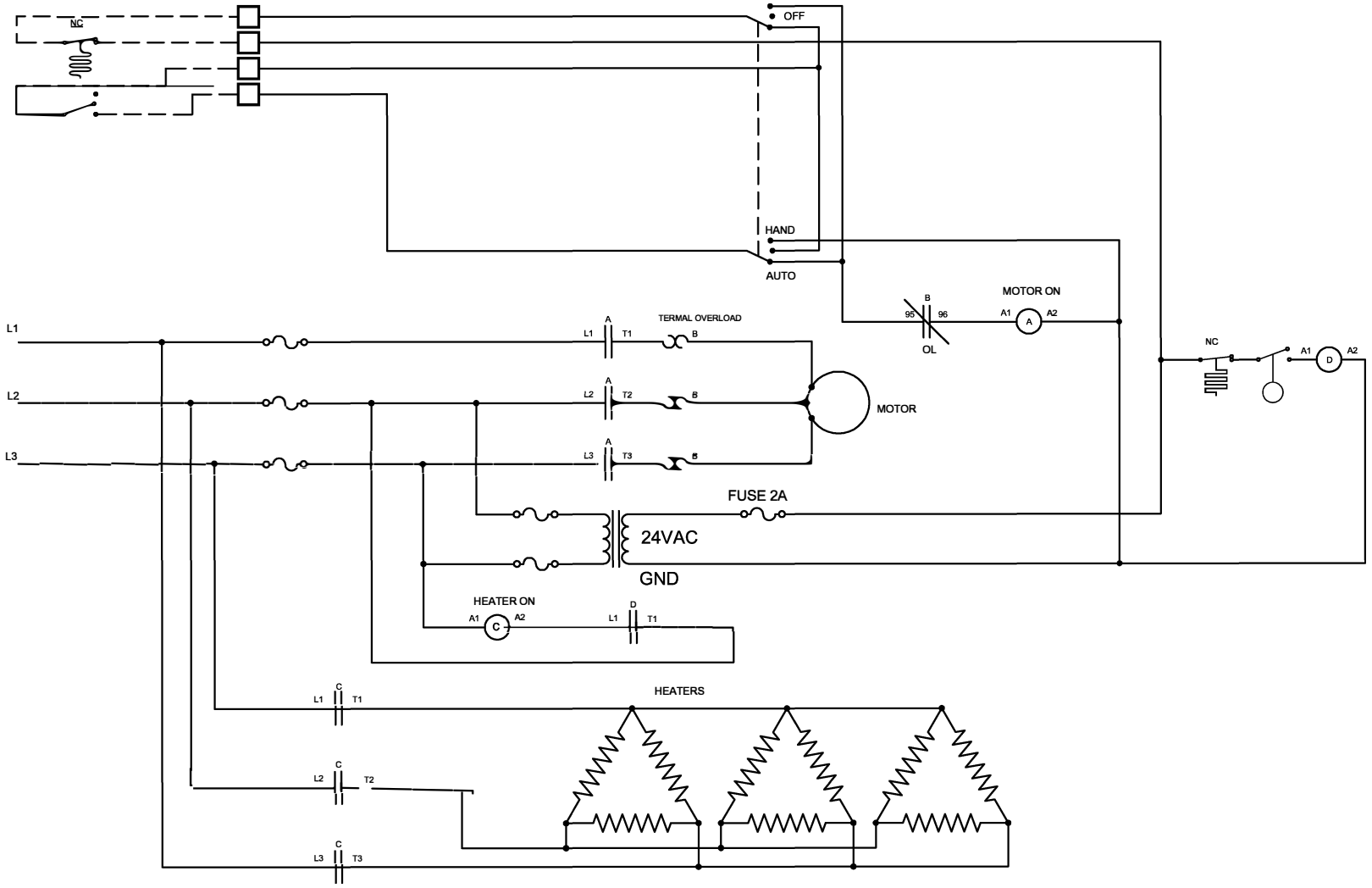
**Not included in rebuild kit

Drawing 1

QUAKER BLAST

CIRCUIT DIAGRAM

FULL ELECTRICALY HEATED SYSTEM



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SERVICE MANUAL

QUAKERBLAST PRESSURE CLEANING SYSTEMS

This manual is intended for technical personnel to assist in the diagnosis and repair of issues with pressure washers.

This manual is not intended for use by non-technical personnel.

It is advised to always refer to competent technical personnel for repairs to avoid equipment damage or potential injury.

If you have any technical questions please do not hesitate to call us at 1-877-461-3500.

Built for Performance, Efficiency, Durability, and Reliability

MANUFACTURER'S WARRANTY

Thank you for your purchase of an QuakerBlast pressure cleaning system. All original equipment are warrantied for a specific period and on the conditions set forth, that the product is free from defects in materials and workmanship as follows:

Pump: Crankshaft, Manifold, Crankcase, Bearings, Connecting Rods	7 Years Parts 1 Year Labor
Heating Coils	1 Year over 5100 PSI, Lifetime Limited under 5100 PSI, 1 Year Labor
Honda Engine *Kohler Engine * Others	2 Years or as otherwise stated by the engine manufacturing policy
Electric Motor/Generators	2 Years/1 Year Warranty from individual manufacturer of component
Frame and Body Materials	Lifetime Limited Warranty
Burners: fuel pumps, ignitor, fuel solenoid coil, burner motor, gas valve	1 Year Parts 1 Year Labor
Electric Components: switches, GFCI, therm-ostats, transformers, flow & pressure switch	90 day, Manufacturing Defect
Accessories: Unloader, Safety Valves, Pulleys, Thermometers	90 day, Manufacturing Defect
Wear Items: trigger guns, wands, water strainers and filters; seals, lights, gaskets; belts, check valves; nozzles; o-rings; quick couplers, packings and seals on wet-end of pump, high pressure discharge hose; chemical injectors and fuel filters; fittings	90 day, Manufacturing Defect

NOTE* **Due to original equipment manufacturer's requirements, QuakerBlast is not permitted to perform warranty repairs or claims for electrical motors, gas, or diesel engines. Please contact QuakerBlast service department for a local warranty representative.**

LIMITATIONS OF LIABILITY

QuakerBlast's liability for special, incidental, or consequential damages is expressly disclaimed. In no event shall QuakerBlast's liability exceed the purchase price of the product in question. QuakerBlast makes every effort to ensure that all illustrations and specifications are correct, however, these do not imply a warranty that the product is merchantable or fit for a particular purpose, or that the product will actually conform to the illustrations or specifications. Our obligation under this warranty is expressly limited at our option to the replacement or repair at our manufacturer location, is such part or parts at inspection shall disclose to have been defective. QuakerBlast does not authorize any other party, to make any representation or promise on behalf of QuakerBlast or to modify the terms, conditions, or limitations in any way. It is the buyer's responsibility to ensure that the installation and use of QuakerBlast products conform to local codes. While QuakerBlast attempts to ensure that its products meet national codes, it cannot be responsible for how the customer chooses to use or install the product. THE WARRANTY CONTAINED HEREIN IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY.

QuakerBlast reserves the right to make any changes to an QuakerBlast product at any time without incurring any obligation with respect to any product previously ordered, sold, or shipped.

WARRANTY REPAIRS

Warranty claims must first contact QuakerBlast's Service Department to be issued a pre-authorized repair number (PARN). You will need a copy of your invoice and the equipment serial number.
If new parts are needed, they will be invoiced to you as normal. Defective parts are to be sent to us PREPAID for warranty and consideration. If a part is found to be defective, a credit will be issued to cover the costs of parts and shipping. All work is to be performed at the manufacturers' place of business when returned PREPAID. This warranty will not cover labor if warranty work is conducted at the customer's place of business. Road service will be charged at the normal rate in these situations.

WARRANTY DOES NOT COVER:

- **Abnormal wear-and-tear: Our warranty covers material and manufacturing defects only**
- **Components or other devices not manufactured by QuakerBlast including, but not limited to gasoline, diesel engines, electric motors, generators, pumps, etc.**
- **Pickup and/or delivery of the equipment**
- **Rental or replacement equipment during the repair period**
- **Overtime labor charges**
- **Freight charges for replacement parts (customer responsibility)**
- **Travel time or mileage**
- **Service calls**
- **Transportation of equipment for service**
- **Consequential Damage or Liability that occurs as a result of original defect**

WARRANTY DOES NOT COVER DEFECTS CAUSED BY:

- **Improper or negligent operation or installation, accident, abuse, misuse, neglect, unauthorized modifications**
- **Improper repairs**
- **Neglected recommended maintenance/incorrect operation (specified in the Owner/ Operator's Manual**
- **Unapproved devices or attachments**
- **Water sediments, rust corrosion, thermal expansion, scale deposits or a contaminated water supply or use of chemicals not approved or recommended by QuakerBlast Pressure Systems Ltd.**
- **Improper voltage, sudden voltage spikes or power transients in the electrical supply**
- **Usage which is contrary to the intended purpose of the equipment**
- **Natural calamities or disasters including, but not limited to: floods, fires, wind, freezing*, earthquakes, tornados, hurricanes and lightning strikes**

  ***Includes damage done to components that come in contact with water as a result of freezing in a non-winterized machine.**

service@quakerblast.com **1-877-461-3500** **www.quakerblast.com**

FLUID SYSTEM DIAGNOSTICS - Flow and Pressure

PROBLEM	POSSIBLE CAUSE	SOLUTION
No Flow	No power	Make sure pump is operating. Check drive belts and couplings, make necessary adjustments.
	Trigger gun valve	Check trigger gun, repair or replace.
	No water source	Ensure water supply is not restricted and hoses are in good repair and not kinked.
	Clogged spray nozzle	Check spray nozzle, repair or replace.
	Clogged inlet filter	Check inlet filter, repair or replace.
	Float Valve stuck(optional)	Float valves can become stuck in the "UP" position. Manually dislodge and inspect for problems.
	Faultyunloader valve	Remove and check for proper action, repair or replace.
Low pressure, adequate flow	Incorrect or no spray nozzle	Nozzle should be properly sized for the system. Low pressure indicates that the nozzle in use is too large.
	Worn spray nozzle	Replace nozzle when it shows signs of internal erosion.
	Debris in valves	Clean valves and check o-rings for pits and cracks.
	Lance on low pressure	Adjust pressure so the water flows through properly.
	Unloader is not adjustedcorrectly	Adjust unloader to proper level.
	Pressure gauge inaccurate	Use a new pressure gauge on a quick connect at outlet to check system pressure and replace if gauge isfaulty.
	Pump packings bad	If low pressure persists, pump packings may need replaced.
Low pressure, lowflow	Volume Improperlyadjusted	If unit has volume adjustment, it may need readjustment
	Discharge leaks	Look for leaks on the discharge side of system.
	Downstream chemical injector (Dema)	Remove the injector and retest system. If the flow is restored, replace the injector.
	Loose drive belts	If belts do not have proper deflection, replace them.
	Pump not running at rated speed	Check engine throttle and see that the motor is rated for the same speed as the pump.
	Stripped pump drive coupling	Inspect coupling and repair or replace.
	Defective easy startvalve (optional)	Check the start or throttle-back valve for proper operation.
	Malfunctioningmotor or gear	Ensure that the motor or engine is working properly
	Unloader stuck in bypass	Piston assembly may be stuck or fouled
Low pressure, low flow - Bogs	Outlet restriction	Build up can restrict flow. If water is not flowing freely, flush with garden hose to isolate the clog or restriction.
	Clogged nozzle	Distorted spray pattern can indicate a clogged nozzle.
	Nozzle too small	Ensure nozzle is proper size for the system.
	Hose restriction	Correct any kinks or restrictions. Replace crushed hoses.
	Debris in the system	Debris can lodge in the discharge side of the system (valves, fittings, injectors, filters) Flushing with water may correct it.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Excessive pressure	Small spray nozzle	Nozzle must be properly sized for the rated flow and pressure. Reset unloader or pressure relief if nozzle size is changed.
	Faulty pressure gauge	Check the pressure gauge using a properly calibrated pressure gauge on quick connects at the equipment outlet.
	Improperlyadjusted unloader	Adjust to the proper pressure using pressure gauge.
	Faulty unloader	Check the unloader action. If it is not working properly, it may need repaired or replaced.
Pump chatters, caviataion, vibration	Air in system	Inspect places where air can enter the system. i.e. fittings, hose, connections etc.
	Chemical line not submerged	If the chemical valve is on, ensure that the chemical line is fully submerged in the chemical
	Inlet line restricted	All inlet connections should be snug and not kinked to reduce the chances of pump starvation.
	Inadequate water supply	Water supply to the system must meet or exceed the rated flow (GPM) on the serial number plate. Faucet must be completely opened or water above the tank outlet in a gravity fed system.
	Float valve stuck(optional)	If float valve is stuck in the up position, water can not enter the float tank. Unstick valve if possible of replace if necessary.
	Turbulence in float tank (optional)	Excessive turbulence allows the pump to draw air into the system. Correct excessive turbulence.
	Inlet or inlet strainer clogged	Regularly clean the inlet and inlet strainer to keep debris from entering the float tank
	Water supply to hot	Inlet temperature should not exceed 140F - 160F range.
Inlet line vibrates	Air in system	Inspect places where air can enter the system, i.e.; fittings, hose, connections etc.
	Debris in inlet check valves	If there is no float tank and the outlet line does no vibrate, the inlet check valve may be clogged. Remove debris. Check o-rings under valves.
Outlet line vibrates	Air in system	Inspect places where air can enter the system, i.e.; fittings, hose, connections etc.
	Debris in inlet check valves	If there is no float tank and the outlet line does no vibrate, the inlet check valve may be clogged. Remove debris.
	Pump packing bad	If they show signs of ware or damage, replace them.
Inlet and outlet lines vibrate	Inlet and outlet check valves fouled	Look for the source of debris in the inlet and discharge check valves and remove.

FLUID SYSTEM DIAGNOSTICS - Unloader

PROBLEM	POSSIBLE CAUSE	SOLUTION
Very low or noflow	Unloader stuck in bypass	Isolate the flow problem. If it occurs before the unloader discharge point, check the piston assembly to see if it is fouled or stuck in bypass mode.
Unloader will not unload	Debris in unloader	Take bottom nut off unloader, identify ball, spring and seat. Clean out any debris and
	Sever leak on the outlet of unit	Check for leaks and repair.
Unloader (flow) cycles with system under pressure	Improper flow	Any variation in flow form what the orifice is sized can cause cycling. System must produce the rated flowconstantly.
	Nozzle to small	A nozzle that is too small can cause the flow to be reduced.
	Nozzle clogged	A distorted spray pattern indicates a clogged nozzle.
	Improper unloader orifice	The systems rated output should indicate the proper sized orifice for your system.
	Unloader orifice clogged	Check the orifice for clogs and clear out any debris.
	Injector orifice clogged	If the system has a Venturi injector downstream of the unloader, check the orifice for clogs.
	Other downstream restriction	Scale buildup can restrict flow. Check; controls, valves, switches, trigger gun, and lance. Descale as necessary and begin preventive maintenance program for scale prevention.
	Pump not delivering the rated pressure	See low pressure or low flow diagnostics.
	High water supplypressure	Check inlet water supply for excessive pressure.
Unloader (flow) cycles with system in bypass	No restrictions on the unloader	Check unloader bypass port to see if a flow restrictor is properly installed. Install one if none is present.
	Downstream leakage(excessive)	Causes the unloader to since a continuing flow and divert it to the closed gun. Repair or replace.
	Accumulatordownstream (option)	Remove the accumulatorfrom the system.
Unloader (pressure) produces smooth flow & low volume	Unloader adjustedtoo low	Adjust the unloader using the pressure gauge for the correct pressure.
	Spray nozzle clogged	A distorted spray pattern indicates a clogged nozzle.
	Spraynozzle too small	A small nozzle causes a reduced flow and cycling may result.
	Injector orifice blocked	If the system has a Venturi injector downstream of the unloader, check the orifice for clogs.
	System not delivering rated flow	See flow diagnostics.
Unloader (flow) produces smooth flow & low volume	Unloader adjustedtoo low	Adjust unloader and regulator until proper pressure is achieved.
	Unloader valve stuck in bypass	If unloader is sticking, repair or replace as necessary.
	Restriction insystem	Downstream restrictions can cause a reduction in flow. Check; controls, valves, switches, trigger gun, and lance. Descale as necessary and begin preventive maintenance program for scale prevention.

Unloader (pressure) produces low flowand normal pressure	Unloader adjustedtoo low	If the unloader is diverting flow to bypass it may be adjusted too low, readjust as necessary.
	Spray nozzle to large	Ensure the proper nozzle is installed on system.
	Internal nozzle erosion	The number of hours of usage can give you a clue to the extent of the ware. If in doubt, change
	Insufficient pump pressure	Check pump seals and packings and tighten drive belts.
Unloader (flow) produces low flow & normal pressure	Unloader adjustedtoo low	If unloader is diverting flow to bypass, readjust using the pressure gauge.
	Nozzle too large	Ensure the proper sized nozzle is being used.
Unloader (pressure) leaks from main spring or adjusting bolt	Shaft O-ring in valve body warn	Check O-rings for ware or damage and replace as necessary.
Unloader (flow) pressure increases when trigger released	Unloader piston stuck or frozen	Check unloader shaft for proper action. Unstick piston and shaft or replace unloader.
	Bypass port clogged or restricted	Ensure that unloader bypass port is not clogged
	Excessive tension on main spring	If tension is incorrect, adjust or replace as necessary.
Unloader (flow) leaks water around adjusting bolt	Sleeve O-ring worn	Check O-rings for ware or damage and replace as necessary.

FLUID SYSTEM DIAGNOSTICS -Leaking

ANY LEAKS SHOULD BE REPAIRED ASAP TO PREVENT DAMAGE TO THE SYSTEM.

PROBLEM	POSSIBLE CAUSE	SOLUTION
From inlet	Garden hose washer	Ensure the washer is present and in good condition.
From low pressure (inlet) line fittings	Loose clamps or connections	Low pressure line should be properly sealed on barb and tightly clamped.
From float tank(option)	Float tank full of water or stuck	If float is not floating above water, check the float to see if it has filled up with water. If necessary, drain and seal.
From pressure fittings	Fittings not tightened or taped, or cracked	Usually metal to metal fittings should be taped with Teflon tape or lock tight to provide a tight seal. (unless
From quick connects	Bad o-rings	If quick connect o-ring shows wear or damage, replace it.
From pump	Bad packing	If the seal leak is detected under the pump manifold, packing may be worn and in need of replacement.
From trigger gun	Bad rod o-ring	If o-rings show wear or damage, they may need replaced.
	Stripped connectors	Physical damage may not be apparent, but unseen warping from freezing or extreme pressure can still cause leakage.
From nozzle	Weep gun (optional)	If a weep gun has been installed, check the gun valve seat to ensure it is functioning properly.
	Damage gun valve ball or seat	Inspect trigger gun valve assembly for damage or ware to ball or seat. Lodged debris can stop valve from closing. Repair with kit or replace.
From unloader	Bad o-rings or seals	If quick connect o-ring shows wear, damage or improper seating.
From variable pressure Lance(option)	Bad o-rings at adjustingknob	Inspect o-rings for ware or damage and replace as necessary.
Unloader will not unload	Debris in unloader	Take bottom nut off unloader, identify ball, spring and seat. Clean out any debris and reassemble.
	Sever leak on the outlet of unit	Check for leaks and repair.
From pressure relief valve	System over pressure	See pressure and flow diagnostics to find the cause of the excessive pressure and correct it.
	Clogged nozzle	Spray pattern will be distorted if nozzle is clogged, clean out.
	Trigger gun valve not working	If trigger gun valve action is not correct, repair or replace.
	Excessive pressure spike	If water spurts from valve when trigger is released, check unloader adjustment. Pressure spike should be below the level where pressure relief valve is activated.
	Wear or damage to ball or seal	Inspect ball and seal for damage and adjust as necessary.
	Improper relief valve adjustment	Adjust valve properly.

FLUID SYSTEM DIAGNOSTICS - Trigger Gun/Spray Nozzle

PROBLEM	POSSIBLE CAUSE	SOLUTION
No nozzle flow from nozzle when trigger depressed.	Broken piston rod in trigger gun	If water flows through discharge hose without gun, check trigger gun valve piston rod and replace ifnecessary.
	Missing metal insert in trigger gun (European stylegun)	Inspect to assure insert is in place.
	Blockage in system pastgun	Check nozzle or spray accessory for blockage and clear it.
Excess pressure when trigger gun is released	Excessive pressure spikes	After unloader increases pressure to a maximum, further adjustment will only increase the pressure spikes.Re-adjust.
Flow not stopping when trigger gun released	Broken return spring on trigger gun	If trigger action is too loose, return spring may need replaced.
	Debris in gun valve	Debris in gun valve can stop piston return. Clear debris.
Trigger action sticks	Keeper plug tootight	It may be possible to loosen plug slightly without leakage but it will likely need replaced.
Trigger gun leaks	Worn or bad o-ring	Check trigger gun o-rings for ware or damage and replace.
	Stripped or loose connections	Physical damage may not be apparent but unseen warping from freezing or sever overpressure may still causeleaking.
No chemical	Chemical valve closed Black nozzle	Open chemical valve. If It chatters with no chemical delivery, air is being drawn from the upstream side of the pump. Check fittings, connections and ensure the inlet line is fully submerged into the chemical jug.
	Chemical dried up in the injector	inspect and clean as necessary.
	Chemical foot strainer clogged	May be a strainer or check valve. Ensure that the ball is not stuck or clogged.
	Chemical line kinked	Chemical line kinking or binding prevents chemical delivery.
	Chemical line toolong	An overly long chemical line can prevent the pump from drawing chemical into the system. Try installing a shorter line.
	Chemical too dilute	Verify chemical strength.
	No adjustment for low pressure	Downstream injectors only - Low pressure is required for most injectors to draw chemical. If no adjuster exists it may need low pressure spray nozzle installed on the lance.
	Incorrect injector orifice	If not properly sized for the systems rated output, chemical delivery problems will result. Check serial plate forspecs.
Excessive chemical	Valve improperly adjusted, check knob on injector	To properly adjust, a chemical flow meter may be used to precisely measure chemical flow.
	Chemical dilutionto strong	Verify chemical strength.
Spray pattern irregular	Clogged nozzle	Spray pattern will be distorted if nozzle is clogged.
Volume proper, pressure low	Nozzle to large	Ensure that the nozzle is sized properly sized for the system
	Internal nozzle wear	A loss of pressure may result form gradual nozzle wear. Replace a nozzle of correct size.
Pressure proper, volume low	Clogged nozzle	Spray pattern will be distorted if nozzle is clogged. Check nozzle for clogging if the unit has a pressure unloader.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Steadyfuel flow at bleed valve but none in combustion chamber	Solenoid valve not energizing	Remove the solenoid cover and place blade of an insulated screwdriver in the coil with the system operating in hot water mode. A good working solenoid will hold the screwdriver in the solenoid. If not it may need replaced.
		Oil pump may have debris, replace as necessary.
Boiler controls activating	Solenoid valve coil not energizing	If boiler controls work properly, the pressure or vacuum on the fuel pump may be misadjusted. Check solenoid coilagain.
Solenoid valve energizing	Debris in internal fuel pump valve	Check for clogging in the solenoid valve inside fuel pump.
	Fuel nozzle clogged	Check fuel nozzle for clogging and clear if necessary.
	Restriction in fuel outlet line	Check fuel line from pump to burner for any restriction.
	Fuel pump piston frozen closed	Check piston in fuel pump to see if it will travel. Free piston or replace fuel pump.
Air and fuel flow proper	No power reaching transformer	Ensure the proper voltage is reaching the ignition transformer with a volt meter.
	Ignition transformer bad	Using a volt meter, ensure that the transformer is supplying the proper voltage.
	Electrode gap improperly set	Check the gap and readjust if necessary, taking care that the proper distance is maintained from the fuel nozzle.
	Electrode caps cracked	Down fired, multi-pass boiler systems have a cap on the top of each electrode. Examine caps for cracks or carbon build-up and replace if there problems are evident.
	Electrode wires loose or damaged	Applies to down fired, multi-pass boiler systems - Check the wire to each electrode to ensure there is a goodconnection.
	Electrodes arcing to fuel lines	Electrodes should not be arcing to fuel lines or nozzle. Check electrode for cracking or carbon build-up.
	Transformer bus bars not lining up	Applies to gun type burners - Bus bars on the transformer should line up and connect properly with the electrodeterminals
Burner or electrode assembly fires when removed from housing	Improper air delivery	Check air delivery to combustion chamber. Down fired; check air damper and air bag. Gun type; Check air bands.
Ignites with air bandsclosed down	Excessive electrodegap	Ensure electrode gap is properly set.
Ignites with airbands opened up	Choked down	Open air bands to proper setting.

BOILER SYSTEM DIAGNOSTICS - Vacuum Switch - Optional

PROBLEM	POSSIBLE CAUSE	SOLUTION
Switch activated manually	Improper diaphragm movement	Replace switch if improper diaphragm movement is detected.
	Low water flow	Correct problems related to inadequate water flow.
	Air leak in or punctured diaphragm	Replace vacuum switch if diaphragm shows an air leak or hole.
Switch shows continuity when activated	Problem elsewhere in system	If vacuum switch works properly, continue with other boiler control diagnostics.
Switch does not shows continuitywhen activated	Switch contact bad	Replace switch with another one.

BOILER SYSTEM DIAGNOSTICS - Flow Switch - Optional

PROBLEM	POSSIBLE CAUSE	SOLUTION
Reed switchactivates when tested with external magnet	Magnet fouled and will not move	If magnet does not move freely within its housing, remove debris to unstick it.
	Reed switch misadjusted	To adjust it for the flow the system is producing, loosen the reed switch and move it in its
	Magnet is bad	If reed switch activated the boiler when tested with a hand held magnet, the internal magnet may
Reed switch does not activate when tested with external magnet	Reed switch is bad	If reed switch does not activated the boiler when tested with a hand held magnet, the reed switch mayneed replacement.
	Problem else where in system	See diagnostics listed above.

BOILER SYSTEM DIAGNOSTICS - Thermostat

PROBLEM	POSSIBLE CAUSE	SOLUTION
Thermostat set improperly	Thermostat set too low	Set thermostat properly and ensure connections are not loose or corroded.
Boiler fires when thermostat jumped, but will not fire with thermostat in circuit	Thermostat bad	Replace Thermostat.
Boiler will not firewhen thermostat jumped	Problem else where in system	Continue with boiler control diagnostics. If boiler still does not fire, the thermostat may need replaced.

BOILER SYSTEM DIAGNOSTICS - High Temperature Limit

PROBLEM	POSSIBLE CAUSE	SOLUTION
Electrical continuitythrough switch	Connections looseor corroded	Check connections to high temperature limit switch to ensure that they are not loose or corroded.
	Problem else where in system	If there is continuity through the switch but the boiler still does not fire, there is a problem elsewhere in the system. Continue with boiler control diagnostics.
No continuity through switch	Switch bad	Replace switch.