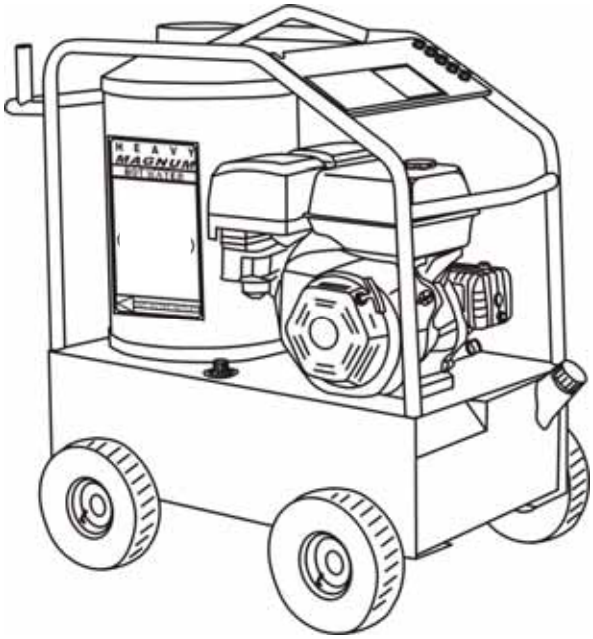
PDHW4500
HOT WATER PRESSURE WASHER
Owner's Manual



SAVE THIS MANUAL FOR FUTURE REFERENCE

This manual provides information regarding the operation and maintenance of these products. We have made every effort to ensure the accuracy of the information in this manual. We reserve the right to change this product at any time without prior notice.

Please keep this manual available to all users during the entire life of the **HOT WATER PRESSURE WASHER.**

TABLE OF CONTENTS

IMPORTANT

Please make certain that the person who is to use this equipment carefully reads and understands these instructions before operating.

PRESSURE PUMP TECHNICAL PARAMETER AND PERFORMANCE

Model	PDHW4500
Revolution	3600rpm
Max pressure	4500PSI
Capacity	4.0GPM(15L/min)
Max. Water Temperature	190℉(88℃)
Power require	16HP(11.7KW)

This manual contains information that will be specific for your pressure washer, as well as similar models. The table of contents will allow you to identify the sections that apply to your equipment. **Carefully review any additional manuals that have been included with your system and follow ALL ADDITIONAL OPERATING INSTRUCTIONS. They are specific for the quality components that have been used to manufacture our machine and are an integral part of the operating and maintenance procedures.**

If you have any questions please do not hesitate to contact us.

SAFETY GUIDELINES - DEFINITIONS

This manual contains information that is important for you to know and understand. This information relates to protecting **YOUR SAFETY** and **PREVENTING EQUIPMENT PROBLEMS**. To help you recognize this information, we use the symbols below. Please read the manual and pay attention to these symbols.

⚠DANGER Indicates an imminently hazardous situation which, if not avoided, **will** result in **death or serious injury.**	**⚠CAUTION** Indicates a potentially hazardous situation which, if not avoided, **may** result in **minor or moderate injury.**
⚠WARNING Indicates a potentially hazardous situation which, if not avoided, **could** result in **death or serious injury.**	**CAUTION** Used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, **may** result in **property damage**.

CONSUMER SAFETY INFORMATION

⚠WARNING This product may not be equipped with a spark arresting muffler. If the product is not equipped and will be used around flammable materials, or on land covered with materials such as agricultural crops, forest, brush, grass, or other similar items, then an approved spark arrester must be installed and is legally required in the state of California. It is a violation of California statutes section 130050 and/or sections 4442 and 4443 of the California Public Resources Code, unless the engine is equipped with a spark arrester, as defined in section 4442, and maintained in effective working order. Spark arresters are also required on some U.S. Forest Service land and may also be legally required under other statutes and ordinances.

⚠WARNING Engine exhaust contains chemicals known, in certain quantities, to cause cancer, birth defects or other reproductive harm.

IMPORTANT SAFETY INSTRUCTIONS

⚠WARNING Do not operate this unit until you have read and understand this Operators Manual and the Engine Owners Manual for Safety, Operation, and Maintenance Instructions.

READ AND SAVE THESE INSTRUCTIONS

HAZARD

⚠DANGER RISK OF EXPLOSION OR FIRE

WHAT CAN HAPPEN	HOW TO PREVENT IT
• Spilled gasoline and it's vapors can become ignited from cigarette sparks, electrical arcing, exhaust gases, and hot engine components such as the muffler.	• Shut off engine and allow it to cool before adding fuel to the tank. • Use care in filling tank to avoid spilling fuel. Move pressure washer away from fueling area before starting engine.
• Heat will expand fuel in the tank which could result in spillage and possible fire explosion.	• Keep maximum fuel level ½" below top of tank to allow for expansion.
• Operating the pressure washer in an explosive environment could result in a fire.	• *Operate and fuel equipment in well ventilated areas free from obstructions. Equip areas with fire extinguisher suitable for gasoline fires.*

HAZARD

⚠DANGER **RISK OF EXPLOSION OR FIRE (continued)**

WHAT CAN HAPPEN	HOW TO PREVENT IT
• Materials placed against or near the pressure washer can interfere with its proper ventilation features causing overheating and possible ignition of the materials.	• Never operate pressure washer in an area containing dry brush or weeds.
• Muffler exhaust heat can damage painted surfaces, melt any material sensitive to heat (such as siding, plastic, rubber, or vinyl), and damage live plants.	• Always keep pressure washer a minimum of four feet away from surfaces (such as houses, automobiles, or live plants) that could be damaged from muffler exhaust heat.
• Improperly stored fuel could lead to accidental ignition. Fuel improperly secured could get into the hands of children or other unqualified persons.	• Store fuel in an OSHA approved container, in a secure location away from work area.
• Use of acids, toxic or corrosive chemicals, poisons, insecticides, or any kind of flammable solvent with this product could result in serious injury or death.	• Do not spray flammable liquids.

HAZARD

⚠DANGER **RISK TO BREATHING**

WHAT CAN HAPPEN	HOW TO PREVENT IT
• Breathing exhaust fumes will cause serious injury or death! Engine exhaust contains carbon monoxide, an odorless and deadly gas.	• Operate pressure washer in a well ventilated area. Avoid enclosed areas such as garages, basements, etc. • Never operate unit in a location occupied by humans or animals.
• Some cleaning fluids contain substances which could cause injury to skin, eyes, or lungs.	• Use only cleaning fluids specifically recommended for high pressure washers. Follow manufacturers recommendations. Do not use chlorine bleach or any other corrosive compound.

HAZARD

⚠DANGER **RISK TO FLUID INJECTION**

WHAT CAN HAPPEN	HOW TO PREVENT IT
• Your washer operates at fluid pressures and velocities high enough to penetrate human and animal flesh, which could result in amputation or other serious injury. Leaks caused by loose fittings or worn or damaged hoses can result in injection injuries. DO NOT TREAT FLUID INJECTION AS A SIMPLE CUT! See a physician immediately!	• Never place hands in front of nozzle. • Direct spray away from self and others. • Make sure hose and fittings are tightened and in good condition. Never hold onto the hose or fittings during operation. • Do not allow hose to contact muffler. • Never attach or remove wand or hose fittings while system is pressurized.
• Injuries can result if system pressure is not reduced before attempting maintenance or disassembly.	• To relieve system pressure, shut off engine, turn off water supply, and pull gun trigger until water stops flowing. • Use only hoses and accessories rated for pressure higher than your pressure washer's PSI.

HAZARD

⚠WARNING RISK OF CHEMICAL BURN

WHAT CAN HAPPEN	HOW TO PREVENT IT
• Use of acids, toxic or corrosive chemicals, poisons, insecticides, or any kind of flammable solvent with this product could result in serious injury or death.	• Do not use acids, gasoline, kerosene, or any other flammable materials in this product. Use only household detergents, cleaners and degreasers recommended for use in pressure washers. • Wear protective clothing to protect eyes and skin from contact with sprayed materials.

HAZARD

⚠WARNING RISK OF ELECTRICAL SHOCK

WHAT CAN HAPPEN	HOW TO PREVENT IT
• Spray directed at electrical outlets or switches, or objects connected to an electrical circuit, could result in a fatal electrical shock.	• Unplug any electrically operated product before attempting to clean it. Direct spray away from electric outlets and switches.

HAZARD

⚠WARNING RISK OF ELECTRICAL SHOCKRISK OF ELECTRICAL SHOCKRISK OF HOT SURFACES

WHAT CAN HAPPEN	HOW TO PREVENT IT
• Contact with hot surfaces, such as engines exhaust components, could result in serious burn.	• During operation, touch only the control surfaces of the pressure washer. Keep children away from the pressure washer at all times. They may not be able to recognize the hazards of this product.

HAZARD

⚠DANGER RISK OF INJURY OR PROPERTY DAMAGE WHEN TRANSPORTING OR STORING

WHAT CAN HAPPEN	HOW TO PREVENT IT
• Fuel or oil can leak or spill and could result in fire or breathing hazard, serious injury or death can result. Fuel or oil leaks will damage carpet, paint or other surfaces in vehicles or trailers.	• If pressure washer is equipped with a fuel shut-off valve, turn the valve to the off position before transporting to avoid fuel leaks. If pressure washer is not equipped with a fuel shut-off valve, drain the fuel from tank before transporting. Only transport fuel in an OSHA approved container. Always place pressure washer on a protective mat when transporting to protect against damage to vehicle from leaks. Remove pressure washer from vehicle immediately upon arrival at your destination.

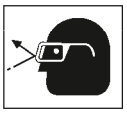
HAZARD

⚠DANGER **RISK OF UNSAFE OPERATION**

WHAT CAN HAPPEN	HOW TO PREVENT IT
• Unsafe operation of your pressure washer could lead to serious injury or death to you or others.	• Do not use chlorine bleach or any other corrosive compound. • Become familiar with the operation and controls of the pressure washer. • Keep operating area clear of all persons, pets, and obstacles. • Do not operate the product when fatigued or under the influence of alcohol or drugs. Stay alert at all times. • Never defeat the safety features of this product. • Do not operate machine with missing, broken, or unauthorized parts. • Never leave wand unattended while unit is running.
• **If proper starting procedure is not followed, engine can kickback causing serious hand and arm injury.**	• **If engine does not start after two pulls, squeeze trigger of gun to relieve pump pressure. Pull starter cord slowly until resistance is felt. Then pull cord rapidly to avoid kickback and prevent hand or arm injury.**
• The spray gun/wand is a powerful cleaning tool that could look like a toy to a child.	• Keep children away from the pressure washer at all times.
• Reactive force of spray will cause gun/wand to kickback, and could cause the operator to slip or fall, or misdirect the spray. Improper control of gun/wand can result in injuries to self and others.	• Do not overreach or stand on an unstable support. • Do not use pressure washer while standing on a ladder. • Grip gun/wand firmly with both hands. Expect the gun to kickback when triggered.

HAZARD

⚠WARNING **RISK OF INJURY FROM SPRAY**



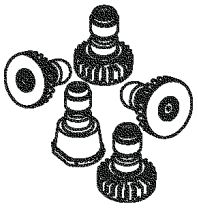
WHAT CAN HAPPEN	HOW TO PREVENT IT
• High velocity fluid spray can cause objects to break, propelling particles at high speed. • Light or unsecured objects can become hazardous projectiles.	• Always wear ANSI approved Z87 safety glasses.Wear protective clothing to protect against accidental spraying. • Never point wand at, or spray people or animals. • Always secure trigger lock when wand is not in service to prevent accidental operation. • Never permanently secure trigger in pull back (open) position.

CARTON CONTENTS

English Operation Manual

Chemical Hose

Nozzle Cleaning Tool

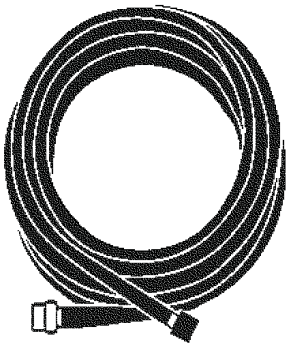


Quick Connect Nozzles

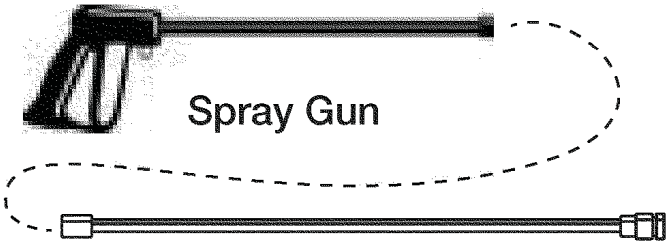
Engine Manual

Registration card

Bagged Parts



High Pressure Hose



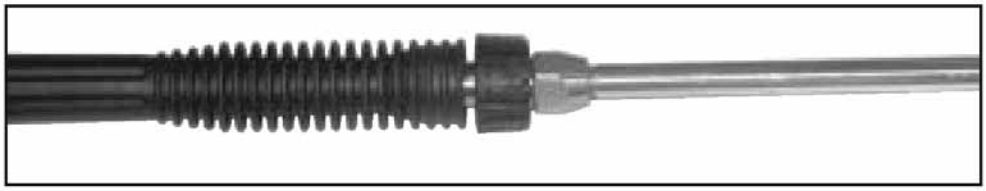
Quick Connect Spray Wand

ASSEMBLY INSTRUCTIONS

1. Slide a wheel (with the inflation valve facing out) and a flat washer over the axle, then fix the wheel tightly with nuts (M16).

2 . Attach high pressure hose to gun. Tighten securely.

3. Connect wand to gun. Tighten securely.



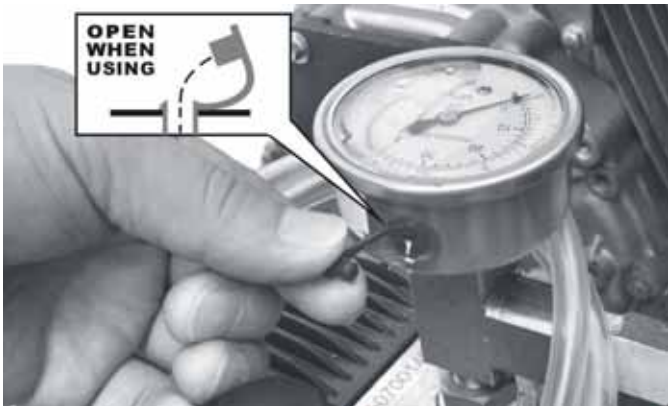
4. Place the nozzle holder the panel (located on the handle assembly) and push each no holder into place.

5. Remove five colored quick connect nozzles from plastic bag and insert them into correct grommet on the nozzle holder.

NOTE: Nozzles e color coded to match colored nozzles on panel.

NOTE: The high pressure pump was filled with oil at the factory. There is no need to add oil at this time, Maintenance section of this manual for Maintenance information.

WARNING: The shipping plug must be removed and replaced with the dipstick/oil plug before operating pressure washer.



6. Using a 7/8" wrench, remove shipping plug from pump by turning it counterclockwise. Discard plug.

7 Remove dipstick/oil plug from plastic bag and install into pump, tighten securely.

OPERATING INSTRUCTIONS

ALL MACHINES WITH BURNERS MUST BE INSTALLED ON A NON-COMBUSTIBLE FLOOR, WITH ADEQUATE AIR CIRCULATION.

Perform pre-start check maintenance inspection on all ***applicable operation systems*** prior to operating the machine. This is essential for the safe, effective and efficient operation. You will get optimum performance from you system ONLY if these instructions and inspections are followed. Any indication that the pressure washing system was not operated and maintained according to these instructions may cancel the manufacturers warranty.

Carefully review any additional manuals that have been included with your system and follow **ALL ADDITIONAL OPERATING INSTRUCTIONS**. They are specific for the quality components that have been used to manufacture your machine and are an integral part of the operating and maintenance procedures.

Compare the illustrations with your unit to familiarize yourself with the location of various controls and adjustments. Save this manual for future reference.

BASIC ELEMENTS OF A PRESSURE WASHER

High Pressure Pump: Increases the pressure of the water supply. The pump moves the water through the system and delivers it to the pressure wand assembly.

Engine: Drives the high-pressure pump.

High Pressure Hose: Carries the pressurized water from the pump to the gun and spray wand.

Spray Gun: Connects with spray wand to control water flow rate, direction, and pressure.

Quick Connect Spray Wand: Allows the user to quickly change out high- pressure nozzles. See How To Use Spray Wand instructions in this section.

Pressure Wand Assembly – This refers to the gun, wand, and nozzle.

Unloader Valve – Is a valve located at the head of the pump for unloading water back into the bypass when the trigger gun is shut off. It releases water when the trigger on the gun is pressed. The un-loader valve is preset at the factory and should not be adjusted.

Burner – The burner heats the water in hot water pressure washers. It is located in the coil and may be powered by propane, gas, or oil.

Chemical Hose: Feed cleaning agents into the pump to mix with the water. See How To Apply Chemicals/Cleaning Solvents instructions in this section.

Burner Boiler: High-pressure water is heated by heat energy from when burner is working.

Fuel Tank (Diesel): Supply fuel for burner, using only diesel.

BASIC ELEMENTS OF ENGINE

Refer to the engine manual for location and operation of engine controls.

Choke Control: Opens and closes carburetor choke valve.

Starter Grip: Pulling starter grip operates recoil starter to crank engine.

Fuel Valve Lever: Opens/close connection between fuel tank carburetor.

Engine Switch: Enables and disables ignition system.

PRESSURE WASHER TERMINOLOGY

PSI: Pounds per Square Inch. The unit of measure for water pressure. Also used for air pressure, hydraulic pressure, etc.

GPM: Gallons Per Minute. The unit of measure for the flow rate of water.

CU: Cleaning Units. GPM multiplied by PSI. GPM x PSI=CU

Bypass Mode: Allows water to re-circulate within pump when gun trigger is not pulled.

CAUTION: Allowing the unit to run for more than two minutes without the gun trigger pulled could cause overheating and damage to the pump.

Chemical Injection System: Mixes cleaners or cleaning solvents with the water to improve cleaning effectiveness.

Water Supply: All pressure washers must have a source of water. The minimum requirements for a water supply are 20 PSI and 5 gallons per minute.

BURNER TERMINOLOGY

Oil Fired Burner-Oil Tank Levels- Diesel fuel is recommended fuel for Oil Fired Hot Water Pressure Washers.

Electrical Burner systems –**The burner get the power from engine charging coil via 12V diode-automatic manostat.**

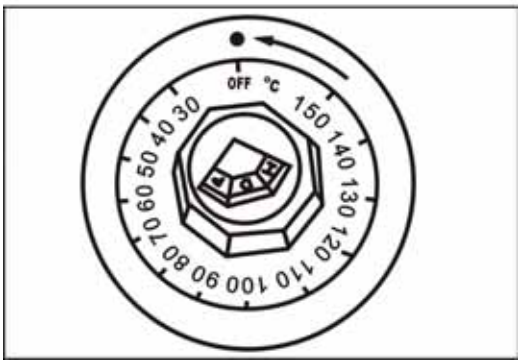
IF YOU REQUIRE UPGRADES OR MODIFICATIONS TO YOUR EXISTING ELECTRICAL SYSTEM IN ORDER TO OPERATE YOU PRESSURE WASHER, THEY MUST BE PERFORMED BY A LICENSED ELECTRICIAN AND BE COMPLETED IN ACCORDANCE TO ALL APPLICABLE CODES IN YOUR AREA OF OPERATION.

Visually inspect all electrical components to assure they are in good condition, showing no signs of exposure, breakage or splicing.

Visually inspect all hoses, nozzles and guns to assure they are in good condition. If replacements are necessary they must be rated to withstand the machines operating pressure and temperatures.

Visually inspect the pressure gauge, the glass must be intact and the pressure at zero.

Turn the burner thermostat knob control to "**OFF**".



All controls turned to the off position.

READ AND UNDERSTAND ALL WARNINGS BEFORE STARTING UNIT

DANGER: <u>When using the high pressure setting.</u> <u>DO NOT</u> allow the high pressure spray to come in contact with unprotected skin, eyes, or with any pets or animals. Serious injury can occur.

Your washer operates at fluid pressures and velocities high enough to penetrate human and animal flesh, which could result in amputation or other serious injury. Leaks caused by loose fittings or worn or damaged hoses can result in injection injuries. **<u>DO NOT TREAT FLUID INJECTION AS A SIMPLE CUT! See a physician immediately!</u>**

WARNING: <u>NEVER</u> fill fuel tank when engine is running or hot. Do not smoke when filling fuel tank.

<u>NEVER</u> fill fuel tank completely. Fill tank to 1/2" below bottom of filler neck to provide space for fuel expansion. Wipe any fuel spillage from engine and equipment before starting engine.

<u>NEVER</u> run engine indoors or in enclosed, poorly ventilated areas. Engine exhaust contains carbon monoxide, an odorless and deadly gas.

<u>DO NOT</u> let hoses come in contact with very hot engine muffler during or immediately after use of you pressure washer. Damage to hoses from contact with hot engine surfaces will NOT be covered by warranty.

CAUTION: <u>NEVER</u> pull water supply hose to pressure washer. This could damage hose and/or pump inlet.

<u>DO NOT</u> use hot water, use cold water only.

<u>NEVER</u> turn water supply off while pressure washer engine is running or damage to

pump will result.

DO NOT stop spraying water fore than two minutes at a time. Pump in bypass mode when spray gun trigger is not pressed. If pump is left in bypass mode for me than two minutes internal components of the pump can be damaged.

If you do not understand these precautions, please contact to a service representative for further instructions.

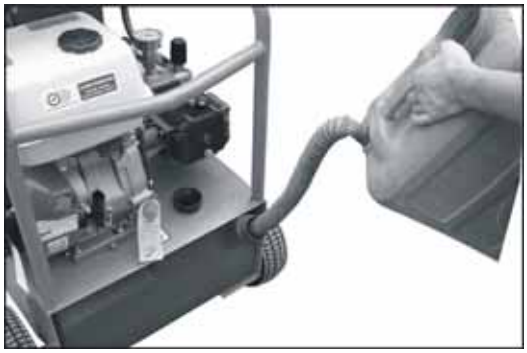
STARTING USING

Prior to starting refer to your engine manual for proper starting procedure.

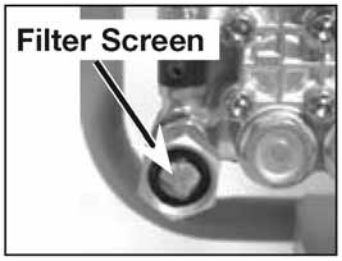
1. In a well ventilated outdoor area add fresh, high quality, unleaded gasoline with a pump octane rating of 86 or higher. Do not overfill. Wipe up spilled fuel before starting the engine. The engine is a 4 cycle and uses regular octane, unleaded fuel. **DO NOT USE MIXED FUEL.** Refer to Engine Owners Manual for correct procedure.

2. Check engine oil level. See Engine Owners Manual for correct procedure.

3. Adding 0# diesel into fuel tank of burner (1# , 2#, or kerosene is optional), Do not overfill. Wipe up spilled fuel before starting the engine.



5. Verify the filter screen is in water inlet of pump. **NOTE:** Cone side faces out.



6. Water source at 20 PSI. Attach the water source to the water inlet located on the pump. Turn on the water source. The water source may be attached with a good quality standard garden type hose, 3/4″ is recommended.

Connect the male fitting into the female pump inlet swivel fitting making sure that the inlet screen is intact and fitted correctly.

NOTE: Water must be in sufficient supply (must provide a minimum of 5 gallons per minute) and pressure must be between 20-60 PSI to ensure proper and safe operation. Do not attach a hose that is smaller in size than the inlet of the pump.

7. Attach the high-pressure hose to the outlet coupling on the boiler or pump. Ensure that quick disconnect connections are tightly locked together.

8. **If applying a chemical or cleaning solution,** see How to Apply Chemicals/Cleaning Solvents instructions in this section.

9. Turn water source on. **NOTE:** Failure to do so could cause damage to the pump.

10. Start engine. See Engine Owners Manual for correct procedure. **MAKE SURE THAT THE ENGINE EXHAUST IS NOT FACING ANY FLAMMABLE MATERIALS.**

NOTE: When engine rope is pulled, pressure starts building in the gun. If the engine does not start after two pulls, pull the gun trigger to relieve this pressure.

CAUTION: MAKE SURE THAT THE ENGINE EXHAUST IS NOT FACING ANY FLAMMABLE MATERIALS.

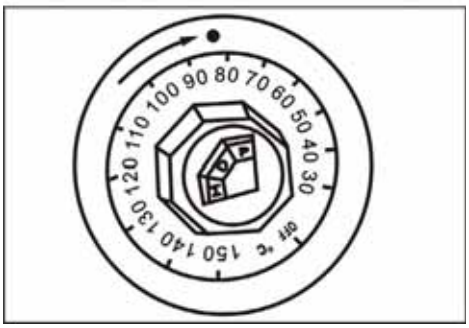
11. Depress trigger on gun start water flow.

NOTE: Stand on a stable surface and grip gun/spray wand firmly with both hands. Expect the gun to kick when triggered.

12. Release trigger to stop water flow.

13. **Burner operation：**

Adjust the burner thermostat knob control to the desired temperature. The burner start automatically, when trigger is pulled



NOTE: The machine must be operating with water source prior to turning on the burner. **IF YOU EXPERIENCE IGNITION FAILURE, DO NOT ATTEMPT TO RESTART BURNER! EXCESS FUEL AND VAPORS MAY HAVE ACCUMULATED AND THE CHAMBER MAY BE HOT. THE UNIT MUST COOL DOWN BEFORE RESTART CAN BE ATTEMPTED.** If the burner does not restart contact our service department or your local oil burner service technician.

14. Pull trigger on the pressure wand assembly to start cleaning. To stop the pressurized water, release the trigger. Do not leave unit running when not in use.

WARNING: If unit is left running while not in use, pump damage may occur. Do not leave unit running while not in use!

WARNING: DON'T TOUCH THE BARE METAL OF PRESSURE WAND ASSEMBLY AND HIGH PRESSURE HOSE WHEN USING THE HOT WATER. OTHERWISE WILL BE SCALD.

15. Adjust spray for the task being performed by changing quick connect nozzle. See How Use Spray Wand instructions in this section.

PRESSURE WASHER OPERATING FEATURES PRESSURE ADJUSTMENTS

The pressure setting is preset at the factory to achieve optimum pressure and cleaning. If you need to lower the pressure, it can be accomplished by these methods.

1. Back away from the surface to be cleaned.

The further away you are, the less the pressure will be on the surface to be cleaned.

2. Change to the 40 ° nozzle. (White)

This nozzle delivers a less powerful stream of water and a wider spray pattern.

CAUTION: DO NOT attempt to increase pump pressure. A higher-pressure setting than the factory set pressure may damage pump.

3. Adjust the pressure regulator on the pump. Turn the pressure regulator knob counterclockwise to lower pressure. Refer to the illustrations to identify your pressure regulator. Once you have finished using your pressure washer, return the pressure regulator to its original position by turning it clockwise.

This machine has been adjusted to operate at a specifically rated **PSI** and Volume, as per the machine specifications. Always monitor the pressure gauge when adjusting pressure.

CAUTION: DO NOT try to turn pressure regulator knob past the built-in stop or damage to pump will result.

TO USE SPRAY WAND

The nozzles for the spray wand are stored in nozzle holder on the panel assembly. Colors on the panel identify nozzle location and spray pattern. See chart to choose the correct nozzle for

the job to be performed.

Nozzle Color	Red	Yellow	Green	White	Black
Spray Pattern	0°	15°	25°	40°	low pressure
Uses	powerful pinpoint for very intense cleaning	intense cleaning of small areas	intense cleaning of larger areas	covers wide areas of cleaning	applies cleaning solutions
Surfaces *	Metal or concrete DO NOT use on wood	metal, concrete, or wood	metal, concrete, or wood	metal, concrete, wood, or vinyl	metal, concrete, wood, or vinyl

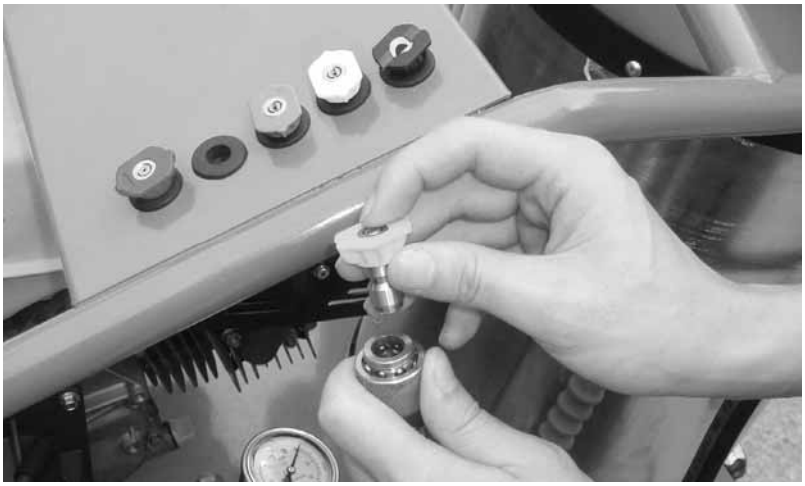
CAUTION: The high pressure spray from your pressure is washer capable of causing damage to surfaces such as wood, glass, automobile paint, auto striping and trim, and delicate objects such as flowers and shrubs. Before spraying, check the item to be cleaned to assure yourself that it is strong enough resist damage from the force of the spray.

CHANGING NOZZLES ON SPRAY WAND

WARNING: Risk of Flying Object could cause risk of serious in. DO NOT attempt to change nozzles while pressure washer is running. Turn engine off before changing nozzles.

1. Pull quick connect coupler back and insert nozzle.

2. Release quick connect couple and twist nozzle to make sure it is see in coupler.



WARNING: Risk of Flying Object could cause risk of serious in. Ensure nozzle is completely inserted QC socket, and QC snap ring is fully engaged (forward) before squeezing gun trigger.

WARNING: Risk of injection or injury to person. Do not direct discharge stream toward persons, unprotected skin, eyes, or any pets or animals. Serious injury can occur.

SHUTTING DOWN

1. After each used if you have applied chemicals, place chemical hose into container of clean water and draw clean water through chemical injection system to rinse system thoroughly.

NOTE: Failure to do so could cause damage to the pump.

2. **To stop Burner operation:**
Turn the thermostat knob control to “OFF”, allow burner unit to cool for 2 minutes. Release trigger on the pressure wand assembly.

3. Turn engine off. See Engine Owner’s Manual. NOTE: NEVER turn the water off with the engine running. Release the trigger for the second time in order to relieve the pump system of pressure.

4. Turn water source off.

5. Pull trigger on spray gun to relieve any water pressure in hose or spray gun.

6. See Storage section in this manual for proper storage procedures.

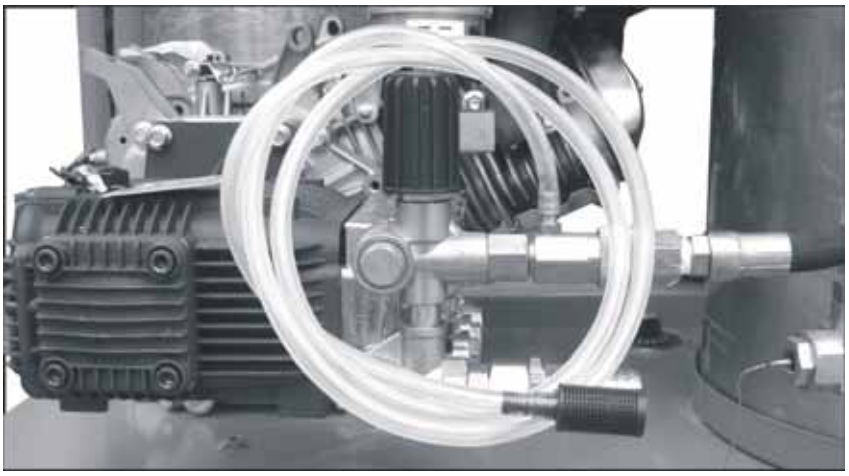
HOW TO APPLY CHEMICAL AND CLEANING SOLVENTS

Applying chemicals or cleaning solvents is a low pressure operation.

NOTE: Use only soaps and chemicals designed for pressure washer use. Do not use bleach.

To Apply chemical:

1. Press chemical hose onto barbed fitting located near high pressure hose connection of pump as shown.



2. Place other end of chemical hose with filter on it into container holding chemical/cleaning solution. NOTE: For every 7 gallons of water pumped 1 gallons of chemical/cleaning solution will be used.

3. Install low pressure (black) nozzle into quick connect fitting of spray wand, see How To Use Spray Wand paragraph in this section.

4. After use of chemicals, place chemical hose into container of clean water and clean water tough chemical injection system to rinse system thoroughly. If chemical remain in the pump it could damaged. Pumps damaged due to chemicals will not be covered under warranty.

NOTE: Chemicals and soaps will not siphon when spray wand is in the high pressure setting.

MAINTENANCE

WARNING: When performing maintenance, you may be exposed to hot surfaces, water pressure, or moving parts that can cause serious injury or death!

Before performing any maintenance or repair, disconnect spark plug wire, let engine cool release all water pressure. The engine contains flammable fuel. DO NOT smoke or work near open flames while performing maintenance. To ensue efficient operation a longer life of your pressure washer, a routine maintenance schedule should be prepared and followed. If the pressure washer is used in unusual conditions, such as high-temperatures or dusty conditions, more frequent maintenance checks will be required.

ENGINE

Consult the Engine Owners Manual for the manufacturer's recommendations for any and all maintenance. Consult the Engine Owners Manual for the manufacturer's recommendations for any and all maintenance. **NOTE:** The frame is equipped with an oil drain hole to help make changing the engine oil easier.

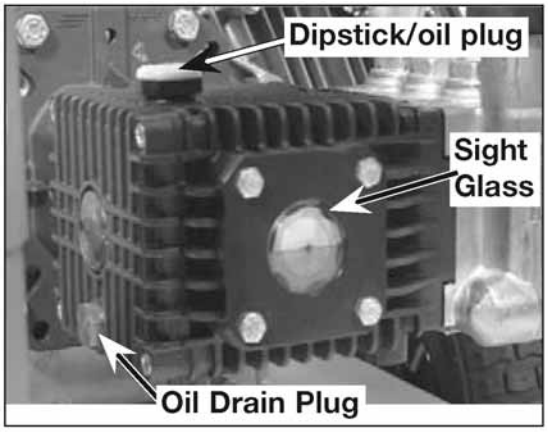
PUMP

NOTE: The pump was filled with oil at the factor.

1. Change pump oil after the first ten (10) hours of operation and every fifty (50) hours thereafter.

To Check Oil:

1. The oil level should come to the dot in the middle of the sight glass.



How to Change Pump Oil

1. Loosen dipstick/oil plug.

2. Place a container under the oil drain plug.

3. Remove oil drain plug.

4. After oil is drained place oil drain plug. Tighten securely.

5. Remove dipstick/oil plug and fill with 19 oz(526ml) of EXA70 pump oil, if EXA70 is not available use 30W non detergent oil.

6. Replace dipstick/oil plug and tighten securely.

NOZZLE CLEANING

If the nozzle becomes clogged with foreign materials, such as dirt, excessive pressure may

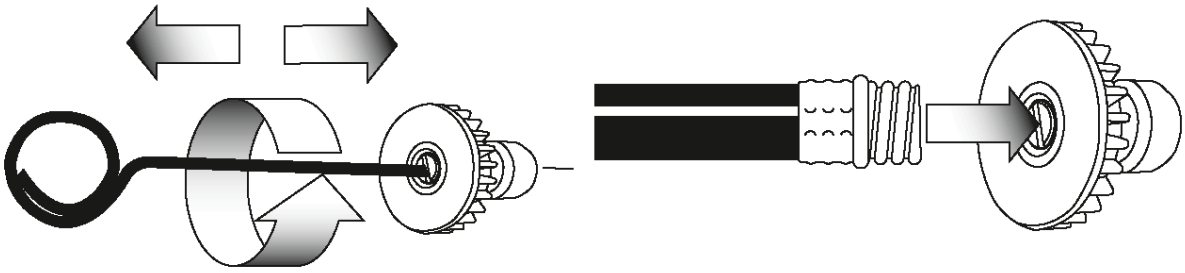
develop. If the nozzle becomes partially clogged or restricted, the pump pressure will pulsate. Clean the nozzle immediately using the nozzle kit supplied and the following instructions:

1. Shut of the pressure washer and turn off the water supply.

2. Pull trigger on gun handle to relieve any water pressure.

3. Disconnect the spray wand from the gun.

4. Remove the high-pressure nozzle from the spray wand. Remove any obstructions with the nozzle cleaning tool provided and back flush with clean water.



5. Direct water supply into spray wand to back flush loosened particles for 30 seconds.

6. Reassemble the nozzle to the wand.

7. Reconnect spray wand to gun and turn on water supply.

8. Start pressure washer and place spray wand into high pressure setting to test.

HOW TO CLEAN THE WATER INLET FITER

This screen filter should be checked periodically and cleaned if necessary.

1. Remove filter by grasping end and removing it from water inlet of pump as shown.

2. Clean filter by flushing it with water on both sides.

3. Re-insert filter into water inlet of pump. **NOTE:** Cone side faces out.

NOTE: Do not operate pressure washer without filter properly installed.

BURNER

If the machine is found to be thermal and firepower keep decreasing or the efficiency decreases or the temperature is slow to reach the required level quickly after it has been in use for 6 months, it may need the following maintenance:

1. Remove any sediment and clean the fuel tank.
2. Disassemble the filter, take out the central part of filter and remove any grease or dirt by compressed air and wash it in fresh diesel then re-install it. (Do NOT use petrol, water or banana oil)
3. Disassemble the central part of filter on the oil pump and clean it with compressed air and diesel then re-install it. (Do NOT use petrol water and banana oil)
4. Take out the oil nozzle with the oil nozzle spanner and clean it by compressed air and diesel then re-install it.

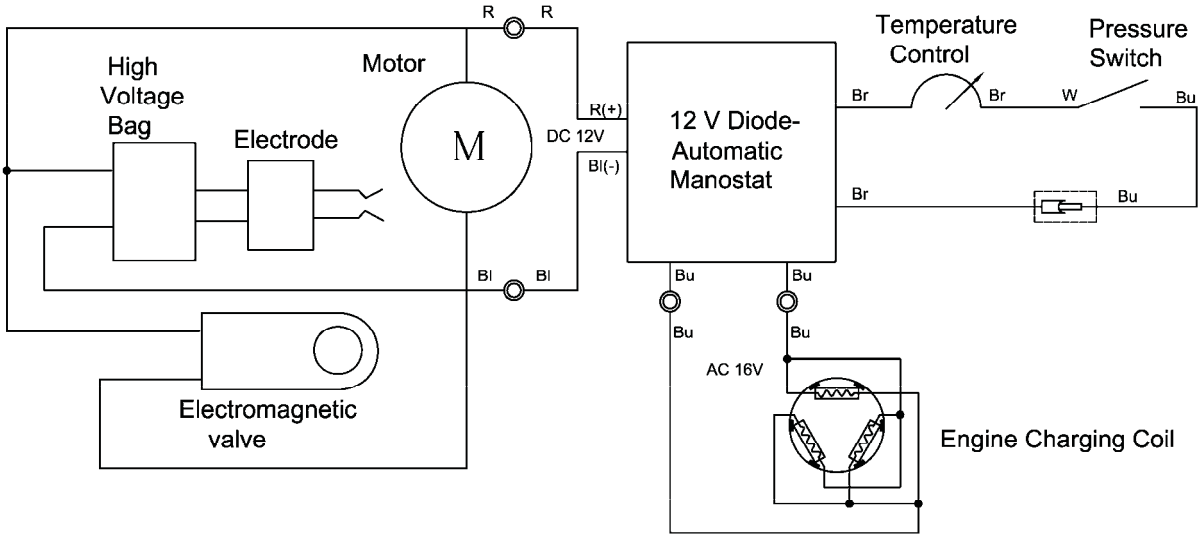
Remove any carbide deposits on the ignition electrode. There must be a gap of 4mm distance between the two electrodes otherwise it will be difficult to ignite.

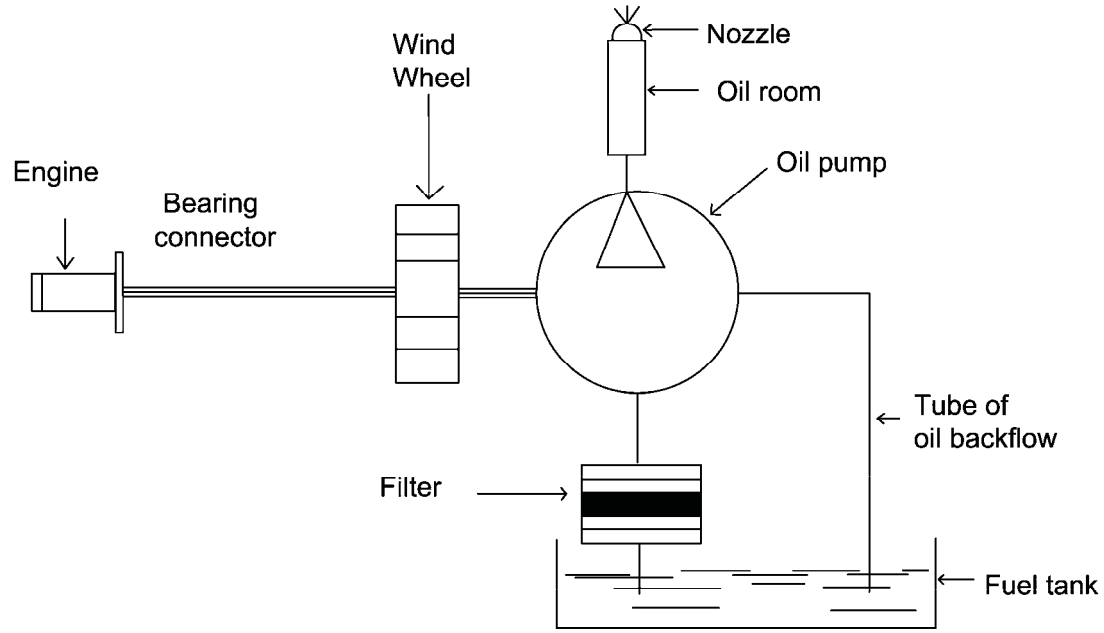
BURNER REPAIR AND MAINTENANCE

1. Check each connector and socket to see if there are any loose contacts and tighten them if necessary..

2. Check if the engine is running or not, and to check to see if the temperature of the engine exceeds 80 centigrade. If it exceeds 80 C then the machine will start the high temperature protection condition, it will return to the normal state after engine cools. If there is no high temperature then check the capacitance to see whether it is disconnected or not and if water has entered the engine and caused the rotor to become rusty and engine burn out
3. Check if the electrode ignites or not. It will appear as an electric arc in normal conditions. If there is no electric arc please switch off the main power and check whether the electrode is carbonized or not. If everything is normal please check the high voltage bag to see if it has a loose contact or not and tighten if necessary. If not then please change the high voltage bag.
4. Check to see if the oil access is obstructed. Pull the plug of high voltage bag power supply wire, connect to a power source to observe if the nozzle will spurt oil or not. If it does not spurt oil then check whether the oil pump is running using the rubber stick.. Check if the electromagnetic valve has voltage or not, if not it has it been burn out and should be replaced with a new oil pump.

BURNER ELECTRIC CIRCUIT BLUEPRINT AND OIL ACCESS BLUEPRINT





STORAGE

ENGINE

Consult the Engine Owners Manual for the manufacturer's recommendations for storage.

PUMP

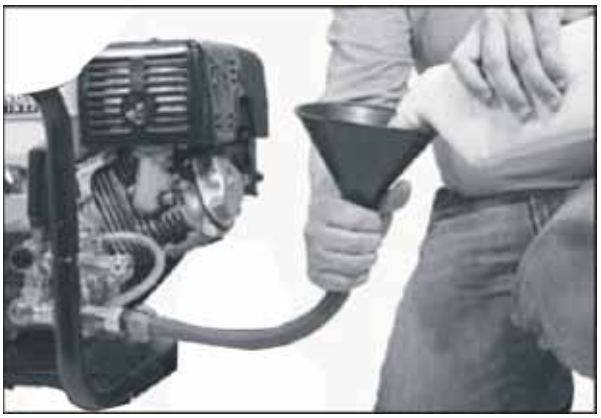
The manufacturer recommends using a pump protector/winterize, such as EXA80, when storing the unit for more than 30 days and/or when freezing temperatures (below 0℃/32℉) are expected. If a pump protector/winterize is not available, *RV antifreeze needs to be run through the pump as outlined in the steps below.

NOTE: Using a pump protector/winterize or*RV antifreeze is to provide proper lubrication to the internal seals of the pump regardless of temperature or environment.

1. Obtain a funnel, six ounces of *RV antifreeze, and 16-36 inches of garden hose with a male hose connector attached to one end.

CAUTION: Use only RV antifreeze or vehicle windshield washing fluid (RATED FOR MINIMUM -40℃). Any other antifreeze is corrosive and can damage pump.

2. Disconnect engine spark plug wire.
3. Connect length of garden hose to water inlet of pump.
4. Add *RV antifreeze (or vehicle windshield washing fluid) to hose as shown.



5. Pull engine starter rope slowly several times until antifreeze (or vehicle windshield washing fluid) comes out of high pressure hose connection of pump.
6. Remove garden hose from water inlet of pump.
7. Reconnect engine spark plug wire.
8. Your machine is now prepared for storage.

***Windshield washer fluid may also be used.**

HOT WATER PRESSURE WASHER

1. Drain all water from burner boiler high, pressure hose, coil it, and store it in cradle of the pressure washer handle.

2. Drain all water from burner boiler high, and install the quick connector back ensure that quick disconnect connections are tightly locked together.

3. Drain all water from spray gun and wand by holding spray gun in a vertical position with nozzle end pointing down and squeezing trigger. Store in gun holder.

4. Store chemical hose so it is protected from damage.

TROUBLE SHOOTING GUIDE

POWER SYSTEM DIAGNOSTICS-Electric Motor Not Starting

PROBLEM	POSSIBLE CAUSE	SOLUTION
Electric motor starting	No power to machine	Inspect power supply and cords, correct any deficiencies
	Breaker tripped	Reset breaker. If problem reoccurs revaluate number of items drawing on the same system.
	Faulty power supply	Test voltage to the meter box.
	GFCI tripped (optional)	Reset GFCI. If problem reoccurs, test for proper ground.
	Loose connection	Check connections between switch and motor.

POWER SYSTEM DIAGNOSTICS-Gas Motor Not Starting

PROBLEM	POSSIBLE CAUSE	SOLUTION
Gas motor not starting	Fuel	Check to see if proper fuel levels are maintained
	No ignition	Check ignition by removing spark plug from cylinder. If electric start, try starting using the recoil starter.
	Electric Starter/Battery	Recharge or replace battery.
Spark Plug-strong gas smell	Flooded	Wait 5 minutes before attempting to restart.
	No ignition	Check ignition by removing spark plug from cylinder. If electric start, try staring using the recoil starter.
	Bad plug	Check spark plug and replace if necessary. Carbon deposits can indicate a fouled plug or too much fuel.
Plug does not fire	Poor connection	Inspect the ignition connection.
	Bad magneto	Check the source of spark plug for engine ignition.
Bad ignition system	Poor connection	Check the source of spark for the engine ignition.
Spark Plug-no gas smell	No fuel to cylinder	Check fuel delivery from carburetor to cylinder. Check carburetor float bowl for fuel.
	Fuel line restricted	Inspect fuel line to carburetor for restrictions or clogging. Flexible line may be kinked.
	Stuck carburetor float	Unstuck float.
	Clogged carburetor needle valve	Unclog needle valve.
	Bad fuel pump	Replace fuel pump.

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.
	Faulty unloaded valve	Remove and check for proper action, repair or replace.
Low pressure, adequate flow	Incorrect or on 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.
	Unloaded is no adjusted correctly	Adjust unloaded 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 is faulty.
	Pump pickings bad	If low pressure persists, pump pickings may need replaced.
Low pressure, low flow	Volume improperly adjusted	If unit has volume adjustment, it may need readjustment
	Discharge leaks	Look for leaks on the discharge side of system.
	Downstream chemical injector (Demas)	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 start valve (optional)	Check the start or throttle-back valve for proper operation.
	Malfunctioning motor or gear	Ensure that the motor or engine is working properly
	Unloaded 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 to small	Ensure nozzle is proper size for the system.
	Hose restriction	Correct any kinks or restrictions. Replace crushed hoses.
	Debris in the	Debris can lodge in the discharge side of the

	system	system(valves, fittings, injectors, filters) flushing With water may correct it.
Excessive pressure	Small spray nozzle	Nozzle must be properly sized for the rated flow and pressure. Reset unloaded 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.
	Improperly adjusted unloaded	Adjust to the proper pressure using pressure gauge.
	Faulty unloaded	Check the unloaded action. If it is not working properly, it may need repaired or replaced.
Pump chatters, cavitations, 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. Unstuck 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 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. Check o-rings under valves.
	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-Unloaded

PROBLEM	POSSIBLE CAUSE	SOLUTION
Very low or no flow	Unloaded stuck in bypass	Isolate the flow problem. If it occurs before the unloaded discharge point, check the piston assembly to see if it is fouled or stuck in bypass

		mode.
Unloaded will not unload	Debris in unloaded	Take bottom nut off unloaded, identify ball, spring and seat. Clean out any debris and
	Sever leak on the outlet of unit	Check for leads and repair.
Unloaded(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 flow constantly.
	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 unloaded orifice	The systems rated output should indicate the proper sized orifice for your system.
	Unloaded orifice clogged	Check the orifice for clogs and clear out any debris.
	Injector orifice clogged	If the system has a venture injector downstream of the unloaded, check the orifice for clogs.
	Other downstream restriction	Scale buildup can restrict flow. Check; controls, valves, switches, trigger gun, and lance. Rescale 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 supply pressure	Check inlet water supply for excessive pressure.
Unloaded (flow) cycles with system in bypass	No restrictions on the unloaded	Check unloaded bypass port to see if a flow restrictor is properly installed. Install one if none is present.
	Weep gun in system(option)	If a weep gun is installed, try replacing with a regular gun.
	Downstream leakage(excessive)	Causes the unloaded to since a continuing flow and divert it to the closed gun. Repair or replace.
	Accumulator downstream(option)	Remove the accumulator from the system.
Unloaded(pressure) produces smooth flow & low volume	Unloaded adjusted too low	Adjust the unloaded using the pressure gauge for the correct pressure.
	Spray nozzle clogged	A distorted spray pattern indicates a clogged nozzle.
	Spray nozzle too small	A small nozzle causes a reduced flow and cycling may result.
	Injector orifice blocked	If the system has a ventures injector downstream of the unloaded. Check the orifice for clogs.
	System not delivering rated flow	See flow diagnostics.
Unloaded (flow) produces smooth flow & low volume	Unloaded adjusted too low	Adjust unloaded and regulator until proper pressure is achieved.
	Unloaded valve stuck in bypass	If unloaded is sticking, repair or replace as necessary.
	Restriction in system	Downstream restrictions can cause a reduction in flow. Check; controls, valves, switches, trigger

		gun, and lance. Decaled as necessary and begin preventive maintenance program for scale preventions
Unloaded (pressure) produces low flow and normal pressure	Unloaded adjusted too low	If the unloaded 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 pickings and tighten drive belts.
Unloaded(flow)produces low flow & normal pressure	Unloaded adjusted too low	If unloaded is diverting flow to bypass, readjust using the pressure gauge.
	Nozzle too large	Ensure the proper sized nozzle is being used.
Unloaded (pressure) leaks Form main spring or adjusting bolt	Shaft o-ring in valve body warn	Check o-rings for ware or damage and replace as necessary.
Unloaded (flow) pressure increases when trigger released	Unloaded piston stuck or frozen	Check unloaded shaft for proper action. Unstuck piston and shaft or replace unloaded.
	Bypass port clogged or restricted	Ensure that unloaded bypass port is not clogged.
	Excessive tension on main spring	If tension is incorrect, adjust or replace as necessary.
Unloaded (flow) leaks water around adjusting blot	Sleeve o-ring worn	Check o-rings for ware or damage and replace as necessary.

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	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 to provide a tight seal.(unless fittings are provided with an o-ring or seal)
From quick connects	Bad o-rings	If quick connect o-ring shows wear or damage, replace it.
From pump	Bad pacing	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 seal. Lodged debris can stop valve from closing. Repair with kit or replace.
From unloaded	Bad o-rings or seals	If quick connect o-ring shows wear, damage or improper seating.
From variable pressure lance	Bad o-rings at adjusting knob	Inspect o-rings for ware or damage and replace as necessary.
Unloaded will not unload	Debris in unloaded	Take bottom nut off unloaded, identify ball, spring and seat. Clean out any debris and reassemble.
	Sever leak on he outlet of unit	Check for leaks and repair.
From pop-off 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 unloaded 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 if necessary.
	Missing metal insert in trigger gun (European style gun)	Inspect to assure insert is in place.
	Blockage in system past gun	Check nozzle or spray accessory for blockage and clear it.
Excess pressure when trigger gun is released	Excessive pressure spikes	After unloaded 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 too tight	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 cause leaking.
No chemical	Chemical valve closed	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 linking or binding prevents chemical delivery.
	Chemical line too long	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 for specs.
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 dilution to 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 unloaded.

BLILER SYSTEM DIAGNOSTICS-Oil Burner Will Not Fire

PROBLEM	POSSIBLE CAUSE	SOLUTION
Not reaching rated pressure	Not activating boiler controls	Correct the fluid problem first-see fluid systems diagnostics.
Thermostat on low setting	Thermostat set to low	Set thermostat to an output temperature requiring heating.
No or low fuel in tank	Burner no getting adequate fuel	Check fuel and ring to proper levels. Inspect fuel tank for water or debris.
	Low fuel shut-off control activated.	Full featured equipment may have a shut off if fuel is low.
No air movement	No air being	Ensure that the blower is working and that the

through	supplied	air band or damper is properly adjusted and in good repair.
	Thermal reset tripped	Press the thermal reset button on burner motor. If the reset trios again an additional problem must be sought.
	Burner motor or capacitor is bad	If motor does not turn, first check thermostat/press switch, the motor starting capacitor and finally the burner motor itself.
Fuel in the fuel tank	Contaminated fuel in the tank	Ensure that the proper clean fuel is being used. If not, siphon any debris or water from the tank.
	Improper fuel in the tank	If the improper fuel is found in the tank, drain and rinse the tank, then fill with proper fuel.
	Low fuel shut-off sensor stuck or faulty	Check the sensor. The assembly may need to be removed to un-stick the float or to replace it completely.
Water in the fuel filter bowl	Water in fuel supply	Drain water from the tank promptly to prevent rusting. If fuel delivery problems persist, check the fuel pump for rust.
Debris in the fuel filter bowl	Clogged strainer	If the fuel strainer or in-line filter is clogged, clean or replace.
	Clogged fuel nozzle	Replace if there is any evidence of clogging or debris.
	Clogged fuel line	Check lines for clogging and clear if necessary.
Water comes out drain at bottom of tank	Water in fuel supply	Check only if no fuel in the filter bowl-drain the tank and check for rust. If problem persists, fuel pump should be checked for rust.
Cannot smell or see fuel at stack	No fuel being supplied	Check fuel delivery and correct any problems.
No fuel to bleed valve	Air leak to pump	Ensure that air is not entering through the lines or connections.
	Broken fuel line	Ensure that the fuel line is connected and is not broken/punctured.
	Clogged fuel filter	Check any clogging that exists in the fuel filter
	Clogged fuel inlet line	Check any clogging that exists in the fuel inlet line
	Frozen fuel pump	If the fuel pump is frozen it will need replaced.
	Broken fuel pump coupling	Check pump coupling if direct or belt driven. Replace or tighten or replace the drive belts if needed.
Steady fuel 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 coli not energizing	If boiler controls work properly, the pressure or vacuum on the fuel pump may be misadjusted. Check solenoid coil again.
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 ensure there is a good connection.
	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 electrode terminals
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 bands closed down	Excessive electrode gap	Ensure electrode gap is properly set.
Ignites with air bands opened up	Choked down	Open air bands to proper setting.

BOILER SYSTEM DIAGNOSTICS-Gas Burner Will Not Fire

PROBLEM	POSSIBLE CAUSE	SOLUTION
No arc at the ignition pilot assembly	Spark gap incorrect	Check the spark gap and reset if necessary. Check for air in the propane line.
	Ignition module bad	Check the ignition module and replace if necessary
Ignition operating properly	Boiler controls malfunctioning	Check boiler controls for good operation and correct problems
Boiler controls operating properly	Gas valve malfunctioning	If pilot and boiler controls operate properly, the problem may exist with the gas valve. Replace if necessary.

Abnormal Flame Characteristics-Gas Fired

PROBLEM	POSSIBLE CAUSE	SOLUTION
Flame intermittently lifts and returns to	Gas velocity exceeds flame	If gas flow is not properly regulated, the regulator may need to be replaced. Gas line

gas port ”candles”	speed	may be too small.
Flame height changes suddenly	Uneven gas supply pressure	Check orifice for partial blockage. If no blockage found, ensure that the gas supply and regulator are working properly.
Flame floats around the combustion chamber	Insufficient air	Check stack for fuel restriction and correct. It may require new ventilation if the original system is inadequate.
Flame has yellow tip	Flame speed improper	Check for proper gas pressure while burner is operating.
Flame comes out from under burner housing	Insufficient air and ventilation	Usually occurs at ignition. Check stack for fuel restriction.
Gas burns inside the burner tube-roars	Burner underrated	Inquire about a burner with the proper rated capacity.
Burner pops when gas is shut off	Flame travels back into burner	Flame travel when the gas is shut off does not damage the unit.

BOILER SYSTEM DIAGNOSTICS

Water Output Temperature Too Low-Oil or Gas Fired

PROBLEM	POSSIBLE CAUSE	SLUTION
Burner firing normally but with outlet temp lower than rated	Thermostat set too low	Set the thermostat to proper output temperature.
Burner firing constantly	Inlet water too cold	If inlet water is freezing to the touch, the boiler may not be able to reach the desired temperature increase. Use a water supply with a higher temperature.
	Sooting	Soot build up on the coil can keep the water from reaching the desired temperature. Remove all soot from the coil and check for smoking.
	Scaling	The outlet fitting to the hose can get scale build-up and reduce heat exchange. Descale and prevent further build-up.

BOILER SYSTEM DIAGNOSTICS-BOILER Controls

PROBLEM	POSSIBLE CAUSE	SLUTION
No voltage solenoid	Boiler control or electrical problem	A millimeter can be used to check continuity through controls and pinpoint the problem areas; Or first check the engine charging coil, then check the 12V diode-automatic manostat, and confirm if there is current.
Solenoid coil does not energize	Bad connection to solenoid coil	Electrical connections to solenoid valve coil should be tight and not corroded
	Coil bad	Check to see if fuel solenoid will energize when the proper voltage is applied Solenoid may need replacing
	Boiler control not	If coil energizes when proper voltage is applied

	activating	check boiler controls
Solenoid coil energizes	Problem occurring elsewhere	If solenoid valve coil energizes when the cleaner is operating in hot water the problem is elsewhere Check the air/fuel delivery

BOILER SYSTEM DIAGNOSTICS-Pressure Switch

PROBLEN	POSSIBLE CAUSE	SOLUTION
Switch activates when pressure is reached but boiler not firing	Control not flowing through switch	A millimeter can indicate if the proper voltage flows through the boiler side of the switch If not the switch may not need replaced
	Switch improperly wired	Switch may be improperly wired for it's function
	Switch bad	If wiring is proper and still no current flow when activated, switch may need replacement
Switch dose not activate	Plunger fouled or stuck	Check pressure plunger to see if it will travel freely .If not the passage may need cleared
	Plunger not moving through switch	Check to see if the plunger is traveling far enough to depress the micro switch .Adjust if necessary
Switch activated manually	Current not flowing through switch	If switch activates manually but boiler does not fire current may not be flowing through The switch may need replacing
	Micros witch not properly adjusted	Micros witch may need readjustment so plunger can trip in
	Switch bad	Replace switch with another one
	Problem elsewhere in the system	If switch works manually and current is flowing properly the problem is elsewhere .Try other boiler diagnostics

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 continuity when activated	Switch contact bad	Replace switch with another one

BOILER SYSTEM DIAGNOSTICS-Flow Switch Optional

PROBLEM	POSSIBLE CAUSE	SOLUTION

Reed switch activates when tested with external magnet	Magnet fouled and will mot move	If magnet does not move freely within its housing, remove debris to unstuck 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 may need 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 fire when thermostat jumped	Problem else where in system	Continue with boiler control diagnostics. If boiler still does not fire, the thermostat may need replaced

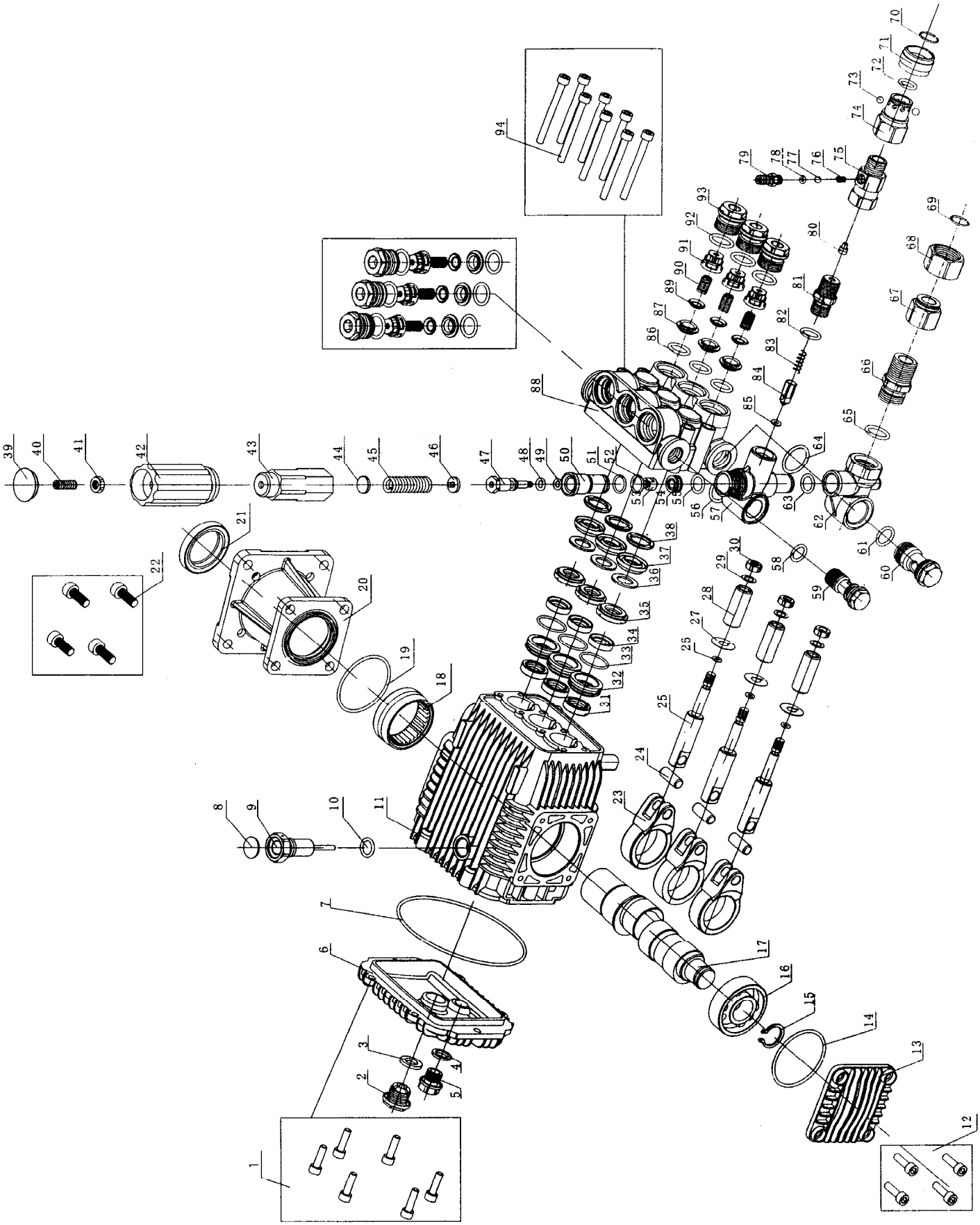
BOILER SYSTEM DIAGNOSTICS-High Temperature Limit

PROBLEM	POSSIBLE CAUSE	SOLUTION
Electrical continuity through switch	Connections loose or 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 switch but the boiler still does not fire, there is a problem elsewhere in the system. Continue with boiler control diagnostics
Mo continuity through switch	Switch bad	Replace switch

BOILER SYSTEM DIAGNOSTICS-Low Fuel Shut-Off

PROBLEM	POSSIBLE CAUSE	SOLUTION
Fuel level low	Switch may be operating properly	Add fuel and retest
Fuel level proper	Level sensor stuck	Check level sensor for proper movement. Clear, or replace sensor assembly
	Reed switch bad	Check level sensor for proper action .Replace switch if needed

EXPLODED VIEW OF PUMP



PARTS LIST OF PUMP

Item	Description	Item	Description
1	Bolt, cover of crank case	46	Under washer, spring
2	Oil gauge	47	Water return valve
3	Gasket oil gauge	48	Gasket, valve rod
4	Gasket, oil drain plug	49	Inner gasket, valve jacket
5	Oil drain plug	50	Water return valve jacket
6	Crank case cover	51	Outer gasket valve jacket
7	Gasket, cover of crank case	52	Outer gasket valve jacket
8	Cover, oil inlet plug	53	Water return valve core
9	Oil inlet plug	54	Water return valve seat
10	Gasket, oil inlet plug	55	Gasket, valve seat
11	Crank case	56	Gasket, outlet tee connector
12	Bolt, Crank shaft case	57	Water outlet tee connector
13	Crank shaft case	58	Gasket, fix bolt
14	Gasket bearing cover	59	Fix bolt, outlet tee connector
15	Bearing clip	60	Fix bolt, inlet tee connector
16	Ball bearing	61	Gasket, inlet tee connector
17	Crank shaft	62	Water inlet tee connector
18	Needle rotter bearing	63	Gasket, the two tee connector
19	Gasket, bearing cover	64	Gasket, inlet tee connector
20	Flange	65	Gasket, water inlet connector
21	Oil seal, flange	66	Water inlet connector
22	Bolt, flange	67	Screw cap
23	Connecting rod	68	Water inlet swivel nut
24	Plunger pin	69	Clip
25	Plunger rod	70	Gasket, 3/8″ QD
26	Gasket, plunger rod	71	Compaction, 3/8″ QD
27	Water checking flake	72	Clip, QD
28	Ceramic plunger	73	Steel ball, QD
29	Washer, plunger fix nut	74	3/8″ QD body
30	Plunger fix nut	75	Detergent injector
31	Plunger oil seat	76	Spring, injector
32	Locating ring	77	Ball, injector
33	Gasket, locating ring	78	Gasket, injector nozzle
34	Locating ring water seal	79	Injection nozzle
35	Compaction ring, water seal	80	Water shooting tube
36	Compaction flake water seal	81	Water outlet joint
37	U-Packing	82	Gasket, water outlet joint
38	U-Packing seat	83	Spring water outlet cone valve
39	Pressure adjusting handle cover	84	water outlet cone valve
40	Pressure adjusting screw	85	Gasket, water outlet cone valve
41	Fix nut, adjusting screw	86	Cylinder
42	Pressure adjusting handle	87	Gasket, check valve
43	Pressure adjusting seat	88	Washer check valve
44	Upper washer, spring	89	Check valve

45	Pressure adjusting spring	90	Spring check valve
91	Check valve box	93	Check valve compaction cap
92	Gasket compaction cap	94	Bolt cylinder