

FURY™ SERIES SAFETY, OPERATING AND MAINTENANCE INSTRUCTIONS

Description

FURY™ machines are designed for intermittent or continuous heavy duty pressure cleaning jobs. Applications include cleaning of all types of machinery and equipment, surface cleaning of brick, tile, concrete and metal and cleaning of equipment or facilities where sanitation problems exist.

Unpacking

Unpack shipping carton carefully, checking for hidden damage or missing components. Immediately contact your distributor or the delivering carrier concerning discrepancies. Shipping damage is the responsibility of the carrier and, if found, the carrier must be promptly notified.

Remove shipping carton from machine with machine in normal upright position. Do not lay the machine over into a horizontal position while unpacking. In a horizontal position, oil will leak out of the breather cap on the high-pressure pump. If any evidence of oil leakage during shipment is detected, carefully check the pump oil level before operating the machine and replace oil as necessary with SAE 30 non-detergent motor oil. Inside the main carton is a parts package with the following contents:

1. LPG regulator and hose assembly.
2. Rubber strap for attaching fuel tank.
3. Front caster wheel.
4. Instructions for safety, operation and maintenance.

General Safety Information

ELECTRICAL SAFETY

This machine is designed to operate on 120 volt (230 volt on Fury IIIA) single phase power supply and must be electrically grounded to prevent dangerous shock. The 3-prong electrical plug on the machine must be connected to a heavy-duty 3-wire extension cord that is free from wear or damage. The extension cord size must be at least 12-gauge outdoor type with a maximum length of 50 feet. The extension cord must be equipped with a 3-prong grounding type plug and should be plugged directly into a properly grounded 3-prong receptacle that has been wired properly in accordance with the National Electrical Code and the local codes. If in doubt, have the receptacle checked by a qualified electrician. Do not use a 3-prong to 2-prong grounding adapter. To prevent dangerous electrical shock, plug the extension cord into a UL approved ground fault interrupter device. Immediately repair or replace worn or damaged extension cords. Disconnect the power source before removing machine access panel or attempting any service work on machine. **WARNING: Failure to follow the above safety instructions may result in serious injury or death.**

OPERATION SAFETY

This machine must not be used for any other application or used in any way other than its intended use as a high pressure aqueous cleaning machine in strict accordance with the information in this manual unless otherwise certified, in writing, by the Spartan Manufacturing Corporation Application Engineering Department. **WARNING: The use of this machine for unintended or unauthorized applications may result in serious injury or death.**

Never touch the exhaust outlet or allow any part of your body to be placed over the top of machine exhaust outlet during or immediately after machine operation. Serious burns may result.

Never direct the high-pressure spray against any part of the body. If the high-pressure spray containing cleaning chemical accidentally comes into contact with and breaks the skin, seek medical attention immediately. Injection of cleaning chemicals through the skin can be extremely dangerous.

Never operate the unit near combustible materials or in an explosive atmosphere.

Never disconnect or bypass electrical safety devices.

Ensure that all gas connections between machine and LPG tank are tight. If gas odor is detected immediately shut off the tank valve and check fittings for tightness.

Use the vapor withdrawal propane cylinder provided with this machine for burner operation. DO NOT connect the burner to a liquid withdrawal (forklift type) tank. Connecting the burner to a liquid withdrawal tank will cause severe overheating and damage this equipment.

Always use a face shield or protective goggles during cleaning action to protect eyes.

Always wear heavy gloves on hands to protect from burns.

Operate this machine only in well-ventilated areas or outdoors. Operation of the machine produces dangerous carbon monoxide which can cause serious illness or death. If in doubt about adequacy of indoor ventilation, use carbon monoxide monitoring devices near the machine during operation.

Always wear rubber footgear when operating machine to prevent dangerous electrical shock.

Never stand in a puddle of water while operating machine.

WARNING: Failure to follow the above safety instructions may result in serious injury or death.

Assembly

1. Connect the end of LPG hose to swivel fitting on front of machine. Tighten fitting using 9/16" and 11/16" open-end wrenches.
2. Connect POL fitting (at red gas pressure regulator) to LPG tank using a 7/8" open-end wrench.
3. Have LPG tank filled at any LPG service station. **CAUTION: DO NOT STORE FILLED PROPANE TANKS INDOORS.**
4. Mount LPG tank on machine by placing rim on bottom of tank in bracket on machine base plate. Use rubber strap with hooks to hold LPG tank in place.
5. Install the front caster wheel using the 1/4" bolts and nuts provided by tilting the machine back at a 45° angle. **DO NOT LAY THE MACHINE BACK IN A HORIZONTAL POSITION. THE PUMP IS EQUIPPED WITH A VENTED BREATHER CAP AND THE MACHINE IS SHIPPED WITH OIL IN THE PUMP.**

Installation

This machine is mounted on 10" rubber tired wheels and a front caster wheel and can be easily moved about from place to place as needed. The area of machine use should be free of combustible materials and explosive atmosphere (solvent vapors, etc.) with sufficient ventilation to supply combustion air and to remove exhaust gases. **CAUTION: COMBUSTION WITH INADEQUATE OXYGEN INCREASES THE PRO-DUCTION OF DANGEROUS CARBON MONOXIDE.**

Ensure that there is at least a four-foot clearance directly above the exhaust outlet to the ceiling or other part of the structure. Avoid placing the machine directly under sprinkler heads or near combustible

materials. Avoid placing the machine directly over potentially combustible material or surface such as an oil puddle. Ensure that an adequate means for water disposal exists in the cleaning area. If no drainage system exists, use a large wet vacuum cleaner to retrieve water from the floor, or an approved water capture system such as Vacu-Boom™. Contact Sales Department for more information.

Ensure that an adequate water supply is available that will provide the GPM rating of water continuously at 20 to 80 PSI. Use a heavy-duty 5/8" or 3/4" OD water hose to supply the machine.

Ensure that an adequate power supply is available to run the machine. A 120 volt or 230 volt, 15 to 20 amp properly grounded electrical outlet should be used. Use a heavy-duty outdoor type 3-wire extension cord.

Operation

TO OPERATE

1. Plug in electrical extension cord to suitable power supply (120 volt or 230 volt, 15 or 20 amp, 3-wire, grounded). See Machine Specifications for proper voltage.
2. Connect 5/8" or 3/4" heavy-duty water hose to a hose bib (spigot) and connect the male end to the water inlet swivel fitting on the machine.
3. Open valve on top on LPG tank.
4. Open valve on water supply to the machine (spigot). Open the trigger gun (squeeze) for a few seconds to purge the air from the system.
5. Place the end of chemical pick up tube into chemical container. The type of cleaning solution used for FURY should be a concentrated water base degreaser detergent that is sufficiently concentrated to allow at least 25/1 dilution with water at the nozzle. It is not necessary to use extra strong alkaline "compounds" as is commonly used with conventional type vapor steam cleaners. Do not use acid. If an acidic chemical such as phosphatizing solution needs to be used, contact your distributor or Spartan Manufacturing Corporation customer service department. There is optional equipment that can be added for this purpose. If detergent chemical is to be used, open the chemical valve on the machine panel about ½ turn. After cleaning is begun, observe the cleaning action and adjust the valve to obtain the proper chemical/water ratio. The amount of valve opening will vary according to chemical concentration. **CAUTION: The end of the chemical pick up tube must always be submersed in liquid when the valve is open to prevent drawing air into the system. If air is drawn in to the system, severe pump damage can occur. After each use of the chemical injection system, always flush the chemical system with clear water for 15 to 30 seconds before shutting the machine off. This can be accomplished by placing the pick up tube into a container of clear water.**
6. Turn on pump switch. Before proceeding further, ensure that a steady stream of water is flowing from the nozzle with no pressure surges. Pressure surges are caused by air in the water hose, machine heating coils and sometimes the building water piping. 30 to 60 seconds is usually required to clear all the air from the system.
7. Turn on the igniter switch. The solid-state igniter is now in operation. Proceed immediately to the next step. **CAUTION: PREMATURE OPERATION OF THE IGNITOR SWITCH BEFORE ALL AIR IS OUT OF THE SYSTEM AND WATER IS FLOWING FREELY, COULD RESULT IN SEVERE DAMAGE TO THE HEATING COILS.**
8. Open the trigger gun by squeezing the trigger and then open the fuel valve on the machine control panel ¼ turn and burner will automatically come on. This procedure of opening the fuel valve manually ¼ turn is for start up when the machine has been switched off for a while. After the initial start, the fuel valve can be left open for automatic response when trigger is operated. See paragraphs 9 and 10 to follow. **CAUTION: NEVER PLACE HEAD OR HANDS OVER EXHAUST OUTLET.**
9. After ignition occurs, open fuel valve to proper setting for the nozzle being used (full open for steam nozzle, partially open to 1-2 PSI fuel gauge reading for fan nozzle). See Use of Nozzles.
10. The flow of water/steam from the nozzle can now be started and stopped by operating the trigger gun. Allow at least 30 seconds for warm up on initial start before cleaning.

11. When the trigger gun is turned on during normal operation, you may see flame momentarily come out of the exhaust opening. This is normal and does not indicate any problem or safety issue. **CAUTION: NEVER PLACE HEAD OR HANDS OVER EXHAUST OUTLET.**
12. When ready end use of pressure washer, first shut off ignition switch and continue spraying cool water for at least two minutes to allow cooling of heating coils and to prevent trapped steam from causing rupture disc failure.

INFORMATION CONCERNING TRIGGER GUN OPERATION

The SPARTAN trigger gun system consists of four component. These components are:

1. Trigger operated gun.
2. Unloader valve. This is installed internally near the pump outlet. Its purpose is to bypass water back to the pump inlet when gun is closed.
3. Burner control electrical pressure switches. These are installed internally and their purpose is to turn the gas burner on and off automatically when the gun is operated.
4. High-pressure rupture disk assembly to protect against the remote possibility of a steam coil rupture. **WARNING: NEVER PLUG OR BYPASS THE RUPTURE DISK ASSEMBLY. IF DISK RUPTURES, IT MUST BE REPLACED WITH A FACTORY REPLACEMENT DISK OF EXACTLY THE SAME BURST RATING. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS INJURY OR DEATH.**
5. Do not run the machine for more than 2 or 3 minutes at a time in the bypass mode (pump running, gun off) to prevent pump damage from heat build up. For longer intervals, shut off pump.
6. always shut off the pump before changing nozzles.

USE OF NOZZLES

The machine may be used for cold water pressure washing, hot water pressure washing or steam cleaning with low temperature wet steam. The machine is equipped with two basic nozzle types, called the steam nozzle and the fan nozzle.

There is one steam nozzle and four fan nozzles. The four fan nozzles are color-coded. The steam nozzle is not.

The steam nozzle is used for steam cleaning applications such as heavy grease, transmission housings and very dirty engines and equipment. When using this nozzle, open the fuel valve on the machine control panel all the way after ignition of burner. The fuel pressure will normally be 4 to 5 PSI with the valve wide open

The fan nozzles are used for hot water and cold water washing applications such as washing trucks, equipment, masonry surfaces, light grease and most engines and small equipment. For cold water washing, run the water pump only when using these nozzles. For hot water washing, open the fuel valve on the machine control panel only part way to approximately 1-2 PSI. After warm up (about one minute) the flow pattern from the nozzle should be in the shape of a line when directed onto a flat surface from a distance of 6" to 8".

If the pattern is more circular than line shaped, the heat should be decreased slightly by lowering the fuel pressure a small amount with the fuel valve on the machine panel until a line pattern is achieved. The line pattern gives optimum results with the fan nozzles. The fan nozzles are color coded as follows:

Red 0° stream
Yellow 15° wide fan spray
Green 25° wide fan spray
White 40° wide fan spray

TO CLEAN

1. Direct steam and/or hot water onto surface to be cleaned at 30° to 45° angle with the surface. Vary the distance from the nozzle to the surface according to the severity of the cleaning required. Twelve (12) inches is about average.
2. Open chemical valve on panel by turning knob approximately ½ turn counter- clockwise. Observe the cleaning action at the nozzle and increase or decrease the cleaning solution flow with the valve to get optimum cleaning effect.
3. When cleaning has been completed, completely close the chemical valve on the panel and rinse all detergent residue from the surface.
4. Use only a concentrated liquid chemical in the chemical system (NO POWDERS). Do not use corrosive acids or alkalines of pH greater than 12.5 in the concentrated form. Do not mix two or more chemicals together.

TO SHUT DOWN

1. Close the fuel valve on the machine panel.
2. Turn off ignitor switch. Do not delay.
3. Flush the chemical injector with clear water.
4. Wait about 30 seconds for the water to cool down and then shut off the pump switch.
5. Hang the wand on the wand holder on the top of the machine.
6. Close the valve on propane tank.
7. Disconnect water hose and power cord.
8. If machine could possibly be exposed to temperatures below 32° F while not being used, the machine must be anti-frozen.

FREEZE PROTECTION

Mix one gallon of suitable anti-freeze with water in the proper ratio to protect to the lowest anticipated temperature. A good choice for anti-freeze solution is alcohol based automotive windshield washer solvent. Determine the mixing ratio from the anti-freeze container instructions.

CAUTION: DO NOT USE THE TYPE OF ANTI-FREEZE SOLUTION THAT CONTAINS LEAK STOP COMPOUNDS DESIGNED TO STOP RADIATOR LEAKS IN AUTOMOBILES.

Pour the anti-freeze solution into a suitable container such as a 5-gallon bucket. Connect a 2 to 3 foot length of garden hose to unit and insert the other end into the anti-freeze. Connect electrical power and turn on pump switch and allow unit to fill with anti-freeze. **DO NOT TURN ON HEATING SYSTEM.** If there is water in unit, allow pump to run until anti-freeze may be seen exiting the nozzle. Allow the anti-freeze to flow into a 5-gallon bucket to save anti-freeze. Turn pump off. Steam cleaner is now ready for storage. When steam cleaner is to be operated again, connect garden hose to water supply and turn water on. Let anti-freeze drain back into 5-gallon bucket. This procedure must be done after each usage of the steam cleaner until freezing conditions no longer exist. Damage to heat exchanger coils and pump will result if steam cleaner is stored at 32° F or lower temperature without anti-freeze protection. The coils are not self-draining!

If difficulty is encountered in getting the pump to pick up suction of the anti-freeze from the bucket, do one of two things:

1. Reconnect a water hose to the machine water inlet, turn on the water supply and run pump for a few seconds. This will prime the pump. Disconnect water hose, pour anti-freeze in the hose to fill hose and pump housing. When full, drop the hose into the anti-freeze bucket and proceed as above.

LPG TANK FREEZING

Under certain conditions, it is common for the LPG (propane tank) to freeze during machine operation. When this occurs, frost formation can be seen on the outside of the tank and the steam pressure at the nozzle will decrease.

Tank freezing occurs naturally because of the cooling effect created inside the tank when liquid propane is vaporized during machine operation. The more propane in the tank, the longer it takes to reduce the temperature to the freezing point. Therefore, as a propane tank gets close to empty, it will freeze much faster. Tank freezing can be aggravated by the following:

1. Using an undersized tank or using a nearly empty tank.
2. Moisture in the tank from fuel contamination or from moisture remaining in the tank from hydrostatic testing by the tank manufacturer (first fill of new tank).
3. Continuous operation of machine for long periods using a small tank.

Tank freezing can be reduced or prevented by the following:

1. Refill propane tank when approximately 2/3 of fuel is used.
2. If machine is to be used frequently for periods longer than 30 minutes at a time, use a 100 lb. Cylinder (available from most LPG gas companies).
3. As a temporary measure, the propane tank can be heated with steam or hot water from the machine nozzle. Do not allow steam or water to enter the louvers on the machine access panel.
4. If severe and persistent tank freezing exists, suspect contaminated fuel.

Maintenance

OWNER ADJUSTMENT

The fuel pressure regulator is factory set to maintain the proper operating temperature of 300° F in the nozzle. This adjustment should never be tampered with unless it is determined that it needs to be permanently reset (see Gas Pressure Regular Adjustment). There are no other operating adjustments that can be made.

GAS PRESSURE REGULATOR ADJUSTMENT

This steam cleaner utilizes a continuous flow heat exchanger designed to heat a steady flow of water to a maximum operating temperature of 300° F. There are no water storage tanks in the machine, therefore the amount of heat put out by the propane burner must be matched to the water flow rate to stabilize the output temperature of the steam at the desired point.

The amount of heat input at the burner is measured by the PSI reading on the panel fuel pressure gauge (normally 1 to 5 PSI). The fuel pressure is controlled by the red pressure regulator which connects to the propane tank. This regulator is designed to maintain a constant outlet pressure regardless of variation of inlet (tank) pressure. The outlet pressure setting can be adjusted up or down with the adjustment knob on top of the pressure regulator.

The red pressure regulator adjustment knob is set at the factory to give the proper outlet PSI to match the water flow in each machine. The setting for each machine will be slightly different (usually between 3 and 5 PSI on steam) because of sight gauge and burner variances, etc. This pressure regulator setting should never have to be adjusted unless:

1. The regulator adjustment knob has been tampered with.
2. A regulator is replaced.
3. The machine is used in a location where the line water pressure coming to the machine is less than 30 PSI (some well systems) or more than 100 PSI (some industrial systems).

If the pressure regulator adjustment knob is improperly adjusted, the machine will either get too hot after running for a short period or it will never achieve adequate operating steam pressure at the nozzle. If either of these conditions exist, first check for a flow restriction in the water system such as a clogged strainer, clogged nozzle, or coil scaling and check the water pressure gauge reading. If the water pressure gauge reads in excess of (see chart, below) stoppage is indicated. If the water pressure gauge reads low, (see chart, below) or less, pump, unloader or nozzle problems are indicated.

MODEL	TOO HIGH	TOO LOW
FURY IA	1000 PSI	500 PSI
FURY IIA	1200 PSI	600 PSI
FURY IIIA	1800 PSI	1000 PSI
FURY IVA	2200 PSI	1600 PSI

If the pressure regulator must be adjusted, proceed as follows:

1. Start machine and have it running with panel fuel valve wide open.
2. Loosen lock nut immediately below pressure regulator adjustment knob.
3. Observe the exact PSI reading on the fuel pressure gauge.
4. If machine is getting too hot, turn adjusting knob counterclockwise just enough to lower the gauge reading ¼ PSI below the original setting observed in step 3. Let machine run for 5 minutes. If excessive heat is eliminated and nozzle steam pressure is adequate, retighten lock nut and job is finished. If further adjustment is necessary, repeat step 4 (1/4 PSI at a time).
5. If machine is not developing adequate nozzle steam pressure, turn adjusting knob clockwise just enough to raise the gauge reading ¼ PSI above the original setting observed in step 3. Repeat as necessary (1/4 PSI at a time) until pressure is adequate. Tighten lock nut.

If a regulator must be adjusted from scratch, start with a PSI reading of 4 PSI and then proceed as in steps 4 and 5 above.

DESCALING

In many areas of the continental U.S., scale build up is never experienced in the heating coils, however in some hard water areas periodic descaling will be required. Hard water has 100 milligrams per liter of calcium or magnesium carbonate (commonly called “lime”). The need for descaling can be detected by an excessively low (see chart in Gas Pressure Regulator Adjustment section) water system pressure reading. CAUTION: There are also other causes for low pressure. See troubleshooting chart page 10. The pressure decrease will occur gradually as the deposits slowly decrease the flow diameter of the heat exchanger coils. A sudden increase in water system pressure usually indicates a stoppage rather than a scale build up. Lime scale can also be detected by inspecting inside the hose end fittings. Lime will appear as a white coating. The descaling procedure is as follows:

1. Fill an open top 5-gallon container approximately half full with water and dissolved descaler chemical. Approved descaler chemical may be ordered from Spartan Manufacturing Corporation parts and service department.
2. Remove steam nozzle from wand and drop it into the acid/water solution to soak while flushing the coils.
3. Connect a short piece of hose (2 to 3 feet long) to machine water inlet and put the other end into the bucket of solution.
4. Put the end of the wand (without nozzle) into the bucket of solution.
5. Plug in drop cord to the machine and turn on pump. **CAUTION: DO NOT TURN ON HEAT.** Allow solution to circulate through the machine for approximately 3-5 hours or until loose scale has come out of system.

6. Shut off machine and disconnect short hose. Connect a regular water supply hose to the machine, turn on the water, start pump and flush the coils thoroughly with fresh water to remove all particles of scale that may be loose in the system.
7. Replace steam nozzle and test machine for normal operation.

HEATING COIL REPLACEMENT

1. Remove lid from top of exhaust outlet.
2. Lay machine back to a 45° position. Do not lay machine all the way back to a horizontal position. IF this is done, the oil will run out of the pump breather cap. If the oil is lost, it will be necessary to refill the pump with SAE 30 non-detergent motor oil before restarting the machine. The correct oil level is halfway up in the pump sight glass.
3. From bottom of machine, disconnect one end of coil set from pump and other end from steam hose outlet.
4. From top end of machine, carefully slide entire coil set horizontally out of machine. Do not stretch or “accordion” the coil. Push from the bottom and support on bottom with hand.
5. The coil set is in two parts – outer coil and inner coil. Carefully separate the coil sections by disconnecting the compression unions holding them together. Replace the defective coil section (s) and reassemble the coils taking care not to deform or damage the coils.
6. From the top end of the machine, carefully slide entire coil set horizontally into machine.
7. From bottom of the machine, connect coil set to pump and to steam hose outlet. Ensure that coil does not touch spark plug or plug wire.
8. Stand machine up to normal operating position.
9. Replace lid.
10. Test machine, Check for leaks at fittings. When restarting the machine, ensure that all air is purged from system before restarting burner to prevent coil damage.

WATER PUMP REPLACEMENT

1. Remove flex hose connection at pump inlet.
2. Remove flex hose connection from the pump discharge where it connects to the unloader valve.
3. Remove the unloader assembly and the unloader mounting bracket to allow enough room to remove the pump and motor assembly from the machine cabinet. The unloader assembly is the unloader valve and associated fittings that are located above the pump.
4. Disconnect motor wires. **WARNING: ENSURE THAT POWER CORD IS DISCONNECTED FROM POWER SOURCE BEFORE DISCONNECTING MOTOR WIRES.**
5. Remove motor reset pushbutton from sidewall of cabinet by removing two small screws.
6. Remove 4 motor hold down bolts.
7. Lift out pump/motor unit.
8. Carefully separate pump and motor. If pump/motor unit has been in service for a while, the motor shaft and hollow pump shaft may be stuck or seized together making removal difficult. Apply a penetrating solvent such as WD-40 directly to the shaft and allow time for the penetrant to work before further attempting removal. For further advice or assistance, contact Spartan factory service department.
9. When replacing pump/motor unit into machine, ensure that all motor wires are properly and securely connected, including the green motor ground wire.

WARNING: FAILURE TO PROPERLY RECONNECT THE GREEN GROUND WIRE TO THE GROUNDING CONNECTION INSIDE THE MOTOR TERMINAL BOX COULD RESULT IN DEATH OR SERIOUS INJURY UNDER CERTAIN OPERATING CONDITIONS IF THE MOTOR SHORTED OUT.

MOTOR REPLACEMENT

Follow the same procedure as Water Pump Replacement.

ELECTRONIC CIRCUIT BOARD REPLACEMENT

NOTE: The electronic circuit board is contained in a moisture sealed box enclosure that is mounted inside the control cabinet on the back wall. In the event of a problem in this unit, replace the box. Do not open the box or attempt to service the circuit board.

CAUTION: OPENING THE BOX AND TAMPERING WITH THE ELECTRONIC CIRCUITRY CAN RESULT IN UNSAFE OPERATION.

1. Ensure that electrical power to the machine is disconnected.
2. Remove front access panel.
3. Disconnect plug in wire connector on circuit board.
4. Disconnect high voltage lead which supplies the spark plug.
5. Remove mounting screws for the circuit board box and remove the box.

REPLACEMENT OR SERVICING OF UNLOADER VALVE

1. Disconnect inlet hose, outlet hose and bypass hose from unloader assembly.
2. Remove unloader assembly from support bracket and remove from machine.
3. On a workbench, remove all fittings attached to the unloader valve.
4. Reassemble the unloader assembly and reinstall in machine in reverse order of removal.

TROUBLE SHOOTING CHART

SYMPTON	POSSIBLE CAUSE (S)	CORRECTIVE ACTION
Pump will not run.	<ol style="list-style-type: none"> 1. Tripped breaker on control panel. 2. Defective drop cord. 3. Tripped breaker in building power supply. 4. Defective motor condenser 5. Defective pump switch on panel. 6. Broken or disconnected wire between pump switch and motor 7. Defective pump. 8. Defective motor. 	<ol style="list-style-type: none"> 1. Reset breaker. 2. Replace drop cord. 3. Reset breaker and reduce load on circuit. 4. Replace condenser. 5. Replace switch. 6. Repair or replace broken wire. 7. Replace pump. 8. Replace motor.
Ignitor will not operate.	<ol style="list-style-type: none"> 1. Defective spark plug assembly 2. Defective electronic circuit board. 3. Broken or disconnected spark plug wire 4. Defective ignitor switch. 	<ol style="list-style-type: none"> 1. Replace spark plug assembly. 2. Replace electronic circuit board. 3. Replace wire. 4. Replace switch.
Burner does not come on – spark ok – no gas.	<ol style="list-style-type: none"> 1. LPG tank valve closed. 2. Defective fuel solenoid valve. 3. Broken or disconnected wires to solenoid valve. 4. Pressure locked solenoid valve. 5. Defective electronic circuit board. 	<ol style="list-style-type: none"> 1. Open valve. 2. Replace donut coil in solenoid valve. 3. Repair or replace wires. 4. Caused by excess gas pressure at inlet port of solenoid valve. Disconnect propane hose at swivel fitting and momentarily open panel gas valve to relieve pressure. 5. Replace circuit board.
Erratic behavior of fuel system such as flame coming out of top of stack continuously.	<ol style="list-style-type: none"> 1. Use of wrong type of LPG fuel tank. 2. On a machine equipped with trigger gun, it is normal for flame to momentarily come out of top of stack on start up. 	<ol style="list-style-type: none"> 1. Use only a vapor type LPG fuel tank such as furnished with the machine and used on trailers and campers. DO NOT use a liquid type LPG tank as used on industrial forklift trucks.
Sudden loss of heat during operation.	<ol style="list-style-type: none"> 1. Fuel tank empty. 2. See section on “LPG Tank Freezing” 	<ol style="list-style-type: none"> 1. Refill tank 2. Change tank or add heat to tank. See LPG tank freezing on page 6.

TROUBLE SHOOTING CHART CONTINUED

<i>SYMPTON</i>	<i>POSSIBLE CAUSE(S)</i>	<i>CORRECTIVE ACTION</i>
Panel circuit breaker trips.	<ol style="list-style-type: none"> 1. Low voltage in power supply to machine. 2. Undersized or defective power cord. 3. Motor overload caused by defective pump or motor. 	<ol style="list-style-type: none"> 1. Correct power supply problem. 2. See "Electrical Safety". 3. Repair or replace motor or pump. See "Pump Will Not Run".
Inadequate temperature and pressure at nozzle (loss of cleaning power - not sudden).	<ol style="list-style-type: none"> 1. Misadjusted fuel pressure regulator. 2. Defective pump. 3. Out of fuel. 	<ol style="list-style-type: none"> 1. Adjust fuel pressure regulator. See "Maintenance". 2. Replace pump. 3. Refill propane tank.
Excessively high water system pressure.	<ol style="list-style-type: none"> 1. Misadjusted unloader 2. Downstream restriction in high-pressure hose or water system. 3. Use of wrong size nozzle. 	<ol style="list-style-type: none"> 1. Adjust unloader valve. 2. Replace high-pressure hose or locate restriction. 3. Use correct nozzle.
Excessively low water system pressure.	<ol style="list-style-type: none"> 1. Unloader bypassing while gun is open. 2. Partially clogged nozzle. 3. Misadjusted unloader. 4. Coil scaling 5. Inadequate water supply. 6. Bad water pump. 7. Worn nozzle. 	<ol style="list-style-type: none"> 1. Replace unloader valve. 2. Remove and blow out nozzle with compressed air. 3. Adjust unloader. 4. Descale coils 5. Check water source. 6. Replace water pump. 7. Replace nozzle.
Chemical will not flow.	<ol style="list-style-type: none"> 1. Gummed up injector from residual chemical. 2. Stoppage in chemical pick up tube. 	<ol style="list-style-type: none"> 1. Open and clean out the injector. Pay special attention to the ball check valve inside injector. 2. Clear the stoppage.