

Operation Manual

Manual de operación

WARNING: Do not use the appliance without reading the instruction manual.



**UL Gas Fired
Operation**

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Machine Unpacking General Safety

Machine Unpacking

All cleaners are carefully inspected and cartoned to protect against shipping damage. If there is damage or missing parts, the transportation company agent should make a notation to that effect on the bill. Refer to the parts list in this manual and advise what parts are missing or damaged. If available, give the invoice number on all order bills. This procedure will enable needed parts to be shipped quickly.

Thank you for choosing our product.



READ ALL Installation, Operation, and Maintenance instructions before operating the machine.

NOTE: Record model number and serial number and date of purchase.



IMPORTANT SAFETY INSTRUCTIONS

The safety alert symbol. This symbol is used to identify safety information about hazards that can result in personal injury.

A signal word (DANGER, WARNING, or CAUTION) is used with the alert symbol to indicate the likelihood and the potential severity of injury. In addition, a hazard symbol may be used to represent the type of hazard

This portion may be the most important in your manual. It is our desire that you have many years of satisfactory use, with no injuries to the operator, maintenance personnel, customers or onlookers. If the operator uses good safety practices, the likelihood of injuries will be minimal.



DANGER indicates a hazard which, if not avoided, will result in death or serious injury.



WARNING indicates a hazard which, if not avoided, could result in death or serious injury.



CAUTION indicates a hazard which, if not avoided, might result in minor or moderate injury.



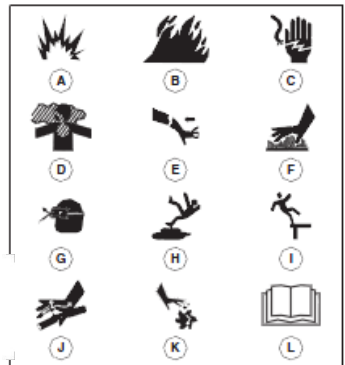
CAUTION, when used without the alert symbol, indicates a situation that could result in damage to the equipment

Read and understand this “OPERATOR’S MANUAL” and “LABELS ON THE MACHINE” before starting.

- A - Explosion
- B - Fire
- C - Electric Shock
- D - Toxic Fumes
- E - Kickback
- F - Hot Surface
- G - Flying Objects

- H - Slippery Surface
- I - Fall
- J - Fluid Injection
- K - Moving Parts
- L - Read Manual
- M - Steam

M



Safety

GENERAL SAFETY

WARNING:

1. Before operating this machine, read and observe all safety, unpacking, and operating instructions. Failure to comply with these instructions could create a hazardous situation.
2. The operator of this equipment should not operate this equipment when fatigued or under influence of alcohol or drugs.
3. The operator of this equipment should be thoroughly familiar with its operation and trained in the job to be accomplished. The operator of this equipment shall not be used by children or untrained personnel.
4. The machine is not to be used by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision and instruction.
5. Children being supervised not to play with the machine.
6. The operator of this equipment should wear protective face shields and other protective clothing as required for safe operations. Do not use this machine within range of persons unless they wear protective clothing.
7. Do not splash or wash down the machine.
8. All installations must conform to all applicable local codes. Contact your electrician, plumber, utility company or seller for details.
9. Follow instructions on how to stop the machine and bleed pressures quickly. Be thoroughly familiar with the controls.
10. Do not operate the machine if any mechanical failure is noted or suspected.
11. When starting a job, survey the area for possible hazards and correct before proceeding.
12. Keep all protective covers and shields in place. Replace all protective covers and shields after adjustments are made to prevent accidental contact with hazardous parts.
13. If a water or fuel leak is found, **DO NOT OPERATE THE MACHINE**. Switch off the mains disconnecting switch and repair.
14. Inspect machine for damaged or worn components and repair or replace to avoid potential hazards. Do not operate the machine if any mechanical failure is noted or suspected.
15. If chemicals are used in conjunction with this equipment, read and follow the product label directions.
16. Do not spray flammable liquids risk of explosion.
17. Use only original spare parts from the manufacturer or approved by the manufacturer.
18. High pressure jets can be dangerous if subject to misuse. The jet must not be directed at persons, live electrical equipment or the machine itself - do not direct the jet against yourself or others in order to clean clothes or foot wear.
19. The spray lance is affected by a kickback force less than 20N and a sudden torque when activating the trigger of the spray handle during operation.
20. Water that has flowed through backflow preventers is considered to be non-potable.

ELECTRICAL SAFETY

WARNING

1. This machine must be electrically grounded. Failure to have the machine grounded may result in the operator being electrically shocked and even death.
2. Fuses or circuit breakers should be compatible with machine requirements.
3. If an extension cord must be used to operate this machine, it should be as short as possible. The extension cord must be properly sized and fitted with a grounding type plug and receptacle.
4. Do not plug-in or un-plug machine with wet hands.
5. Keep power cords and connections (connectors) out of water.
6. All wiring and electrical connections should comply with the National Electrical Code (NEC) and with local codes and practices.

7. Disconnect from electrical power supply or switch off the mains disconnecting switch before carrying out any maintenance. High voltage may be present within this machine. Servicing should only be performed by properly trained personnel.

MECHANICAL SAFETY

Warning

1. All guards, shields, and covers must be replaced after adjustments are made to prevent accidental contact with hazardous parts.
2. Inspect machine for damaged or worn components and repair or replace to avoid potential hazards. Do not operate the machine if any mechanical failure is noted or suspected. Drive belts if so equipped must be inspected and tightened.
3. To ensure machine safety, use only original spare parts from manufacturer or approved by the manufacturer.
4. High pressure hoses and couplings are important for the safety of the machine: use only hoses, fittings and couplings recommended by the manufacturer

WARNING: Do not use if the supply cord or important parts of the machine are damaged, e.g. safety devices.

FUEL BURNING SAFETY

N.G. (Natural) gas is lighter than air and will generally rise through the venting and escape harmlessly.

L.P. (Propane) gas is heavier than air and like water, will flow to the lowest level. Before lighting the pilot burner, sniff at the lowest level. If you smell gas, follow these rules:

1. Incorrect fuels shall not be used as they may prove hazardous – refer to machine specifications for proper fuel selection.
2. Get all the people out of the building.
3. DO NOT light matches. DO NOT turn electric switches or light switches on or off in the area. DO NOT use an electric fan to remove gas from the area.
4. Shut off the gas supply from the outside of the building.
5. Telephone (from another location) Gas Company and Fire Departments. Ask instructions. DO NOT go back into the building to operate the machine.
6. Do not start the burner unless a full flow of water is coming from the wand. Air leaks or insufficient water to the machine means less than full flow of water through the coil. This could cause hose failure and burns to the operator.
7. Use only fuel for the water heater burner specified in the BURNER section of MODEL SPECIFICATIONS. The use of incorrect fuel may result in fire or explosion and severe injury to the operator.
8. Fuel burning equipment must have proper ventilation for cooling, combustion air, and exhausting of combustion products.
9. Stacking, where required, must be installed in accordance with all local codes. A draft diverter must be installed on a machine connected to an exhaust stack to prevent improper operation. (See GENERAL section of MODEL SPECIFICATIONS for stack size).
10. Where stacking is not required, provide adequate ventilations to prevent any possible accumulation of hazardous fumes.
11. Personnel trained in and familiar with the type of equipment being serviced should only perform adjustments to fuel burning equipment.

WARNING – incorrect fuels shall not be used as they prove hazardous.

SAVE THESE SAFETY INSTRUCTIONS

CAUTION

Always use the factory supplied pressure wash hose with your machine. Do not substitute other hoses as a potential safety problem may develop.

⚠ WARNING

This machine should be operated only by personnel instructed in and familiar with its operation. The discharge produced is up to 300°F/150°C and can cause serious bodily injury to you and anyone coming in contact with it.

⚠ WARNING

ELECTRICAL
SHOCK
HAZARD



WARNING: RISK OF INJECTION OR SEVERE INJURY. KEEP CLEAR OF NOZZLE. DO NOT DIRECT DISCHARGE STREAM AT PERSONS. THIS EQUIPMENT IS TO BE USED ONLY BY TRAINED OPERATORS.

ADVERTENCIA: RIESGO DE INYECCIÓN O LESIONES GRAVES. MANTÉNGASE ALEJADO DE LA BOQUILLA. NO DIRIJA EL FLUJO DE DESCARGA HACIA PERSONAS. SOLO OPERADORES ADECUADAMENTE CAPACITADOS DEBEN USAR ESTE EQUIPO.

AVERTISSEMENT: RISQUE D'INJECTION OU DE GRAVES BLESSURES. RESTER À L'ÉCART DE LA BUSE. NE PAS diriger la décharge FLUX DE PERSONNES. CET ÉQUIPEMENT NE DOIT ÊTRE UTILISÉ QUE PAR UNE FORMATION

⚠ WARNING



⚠ ADVERTENCIA

WARNING: Risk of eye injury. Spray can splash back or propel objects.

ADVERTENCIA: El agua rociada puede salpicar o propulsar objetos.

AVERTISSEMENT: Risque de blessure d'oeil. Le spray peut faire des éclaboussures en arrière ou propulser des objets.



⚠ WARNING



⚠ ADVERTENCIA

WARNING: Kickback from spray gun can cause you to fall.

ADVERTENCIA: El uso de la hidrolavadora puede crear charcos y superficies resbaladizas.

AVERTISSEMENT: Rebondit de pistolet de pulvérisation peut vous causer d'automne.

⚠ WARNING



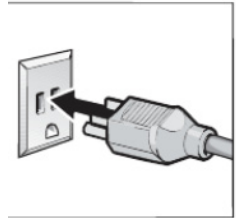
⚠ ADVERTENCIA

Preparing Your Washer

Electrical

1. This machine must be electrically grounded. Failure to have the machine grounded may result in the operator being electrically shocked and even death.
2. Fuses or circuit breakers should be compatible with machine requirements.
3. If an extension cord must be used to operate this machine, it should be as short as possible. The extension cord must be properly sized and fitted with a grounding type plug and receptacle.
4. Do not plug-in or un-plug machine with wet hands.
5. Keep power cords and connections (connectors) out of water.
6. All wiring and electrical connections should comply with the National Electrical Code (NEC) and with local codes and practices.
7. High voltage may be present within this machine. Servicing should only be performed by properly trained personnel.

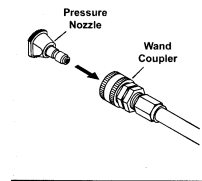
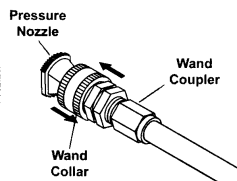
Connect Discharge Hose to Gun Assembly



1. Apply pipe tape or sealant to threads on gun.
2. Attach discharge hose to gun using two open-end wrenches. Tighten hose fitting enough to prevent leaks.

Connect Spray Tip to Wand

1. Before installing spray tip, attach machine to water source and the run machine with wand pointed in safe direction until steady flow come from the end of wand shut down machine and install nozzle.
2. Choose desired spray tip, pull back nozzle extension collar, insert spray tip and release collar. Tug on spray tip to make sure it is securely in place.



Installation

Installation

Gas Line

Consider all gas consuming appliances on the gas line. Total the BTU's required and refer to the chart to get proper line size. Note: A 90 degree elbow is like adding ten feet to the total length. Below is a chart showing the recommended pipe size based on the maximum BTU/hr input to the machine. These pipe sizes are based on proper water column pressure for various gases and on a 0.5 inch pressure drop per 100 feet of pipe.

1. Find your maximum BTU across the top of the chart.
2. On left hand column, read closest distance from meter to machine.
3. The number in the square indicates proper pipe size (in inches).

Fuel Supply: This machine must have a fuel supply as specified in the FUEL section of the MODEL SPECIFICATIONS.

Gas Pressure

Gas pressure to the control is the next step.

Natural Gas (N.G.): Maximum inlet pressure is 9 inches of water column. With the burner on, the inlet pressure should not fall more than 1.5 inches of water column. Manifold pressure should be regulated to the heat required, but in no case less than 3 inches of water column, or more than five inches of water column.

Liquid Propane (L.P.): Maximum inlet pressure is 13 inches water column. Minimum inlet pressure is 10 inches water column.

Minimum inlet pressure is 10 inches water column. With the burner on, the inlet pressure should not fall more than 1 inch of water column. A regulator must be placed in the gas line before the gas control inlet. The combination gas valve does not have a regulator with L.P. The manifold pressure will be 1 inch of water column less than the inlet pressure or 10 to 12 inches of water column.

Gas Supply Line Size

MAXIMUM BTU INPUT

NATURAL GAS

	200,000	250,000	300,000	350,000	400,000	450,000	500,000	550,000	600,000	650,000	700,000	750,000	800,000	850,000	900,000	950,000	1,000,000	1,050,000	1,100,000	1,150,000	1,200,000	1,250,000	
0 - 50	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2
0 - 100	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2	2	2	2	2	2 1/2
0 - 150	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2	2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2
0 - 200	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2

LP GAS

	200,000	250,000	300,000	350,000	400,000	450,000	500,000	550,000	600,000	650,000	700,000	750,000	800,000	850,000	900,000	950,000	1,000,000	1,050,000	1,100,000	1,150,000	1,200,000	1,250,000	
0 - 50	1	1	1	1	1	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
0 - 100	1	1	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2	2
0 - 150	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2	2	2
0 - 200	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2	2	2	2	2

Location

This machine should be installed by only qualified technicians. The machines are intended for indoor use only. The machine should be installed in an independent room where it will not be subjected to spillage or splashing of water. The machine should be set upon a level surface where it will not be affected by extreme heat, and freezing temperatures. Install the machine considering locations for chemical pick-up, fuel connections, electrical connections, water hook-up, venting, and maintenance.

Venting

This machine emits carbon monoxide, a deadly gas, and must be vented if used in an enclosed area. Improper venting can cause poor combustion, delayed ignition, down drafts, and the possibility of freezing the coil. Contact your distributor or local heating and air conditioning dealer for proper materials. Local codes must be observed.

Water Supply

This machine must have a water supply meeting or exceeding the maximum discharge volume specified in the PERFORMANCE section, and a minimum water inlet pressure specified in the GENERAL section of the MODEL SPECIFICATIONS.

Barrier

We recommend a barrier be installed between the machine and wash area to prevent moisture from coming in direct contact with electrical controls, motors and transformers. This will increase the machine's life and lessen electrical problems.

Chemicals

Mix chemicals per the chemical manufacturer's printed directions. Follow all mixing, handling, application, and disposal instructions. Wear gloves, boots, goggles, and protective clothing appropriate for the chemical being used.



WARNING

**Carbon
Monoxide
Hazard**



CAUTION

If the machine has been exposed to sub-freezing temperatures, it must be thoroughly warmed to above freezing before operating. Failure to warm machine can cause damage to pump and other components.



Gas and Electricity

Gas and electricity must be shut off when installing or servicing.

Fire Hazard

Keep combustible materials away from gas machines. DO NOT allow lint or dust to collect in the burner area.

Qualified Personnel

All installation and servicing must only be performed by qualified personnel and must conform to the local codes and with the National Fuel Gas Code ANSI Z223.1/NFPA No.54.

Electrical installation

Electrical Installation

Electrical

Connect machine to an electrically grounded circuit that is fused or circuit-breaker-protected. The circuit must match that which is specified in the ELECTRICAL section under MODEL SPECIFICATION.

Extension Cord

The use of an extension cord that has undersize wire compared to the amp draw of your machine will adversely limit the starting load carrying abilities of the motor and machine's performance. Use only 3-wire extension cords that have 3-prong plugs and 3-pole cord connectors that accept the plug from the product. Use only extension cords that are intended for outdoor use. These extension cords are identified by a marking "Acceptable for use with outdoor appliances; store indoors while not in use." Use only extension cords having an electrical rating not less than the rating of the product. Do not use damaged extension cords. Use an extension cord in good repair free of frays or cracks in the outer covering. Do not abuse extension cord and do not yank on any cord to disconnect. Keep cord away from heat and sharp edges. Always disconnect the extension cord from the receptacle before disconnecting the product from the extension cord.

Copper Wire Size Minimum AWG	Machine AMP Draw* 3 Conductor Wires	Machine AMP Draw* 2 Conductor Wires
16	10	13
15	--	--
14	15	18
12	20	25
10	25	30
8	35	40
6	45	55
4	60	70
2	80	95



WARNING

To reduce the risk of electrocution, keep all connections dry and off the ground. Do not touch plug with wet hands.

Based on Ambient Temperature of 86°F (30°C)

Based on no more than 100 feet

* Use AMP Draw indicated the same or higher than your machine output.

EXAMPLE: Machine AMP Draw 51, use 55 (2 Conductor): The thermostat type of cord shall be C, PD, E, EO, EN, S, So, SRD, SJ, SJO, SV, SVO, SP.

The thermo set plastic types shall be ET, ETT, ETLB, ETP, ST, STO, SRDT, SJT, SJTO, SVT, SVTO, and SPT.

Three Phase Installation

Three phase power must be connected so that the motor has clockwise rotation as you look at the shaft end of the motor.

Fuel Installation

Fuel Installation

N.G. and L.P.

Caution must be taken to ensure that no raw gas is present in the surrounding area before attempting to put the machine into operation, or when relighting the pilot burner.

Gas Supply

Do not connect the machine to supply piping before testing gas supply pressure. Excessive pressure may cause damage to gas control valve.

Leak Test

All the gas connections should be tested for leaks per the Leak Test instructions found in the GAS VALVE SERVICING.

Converting N.G. to L.P.

The regulator and vent tube on the gas valve must be removed, a plate installed on the gas valve, and main burner jets and pilot burner orifices changed.

Converting L.P. to N.G.

A regulator must be installed on the gas valve, a vent tube added, and main burner jets and pilot burner orifices changed.

L.P. Fired Machines

This machine should be installed with consideration to cold weather. As weather gets colder, the rate of liquid being vaporized into gas in the fuel storage tank will decrease. The storage tank(s) must be sized sufficiently large enough to ensure an adequate supply of vaporized fuel at all anticipated outdoor temperatures. Your L.P. supplier can recommend the correct tank(s) knowing the piping layout and the BTU demand found in the MODEL SPECIFICATIONS.

Fuel Outage

If your L.P. tank runs out of fuel or if the natural gas supply is interrupted, turn off the gas at the machine. After L.P. tank is filled, or the natural gas is restored, relight pilot burner per LIGHTING PILOT BURNER instructions.

Water Installation

Water Installation

Water Temperature Variation

On machines not equipped with a temperature control device, the temperature of the discharged water is dependant on the incoming water temperature. Some minor adjustment to the fuel input may be required if the incoming water is significantly different than 50°F.

Water Conditions

Local water conditions affect the coil adversely more than any other element. In areas where troublesome conditions may exist with like equipment (such as water heaters), we recommend the use of a water softener.

Freezing

This machine must be protected from freezing according to storage section of MACHINE MAINTENANCE.

Water Exposure

If your gas control valve has been exposed to water in any way, do not attempt to use it. It must be replaced. Do not attempt to repair the gas control valve.

CAUTION

If the machine has been exposed to sub-freezing temperatures, it must be thoroughly warmed to above freezing before operating. Failure to warm machine can cause damage to pump and other components.

Venting

Venting

The information contained herein is offered for reference only. You must comply with local codes and investigate through your gas and other utility companies when installing, as there may be some special local requirements you must comply with. Also see ANSI Z223.1

Draft Diverters (stacked cleaners)

Gas fired machines operate on the “Natural Draft” principle that rising heat creates an air lift. To eliminate a draft through the combustion chamber and cause pilot outages, a bell type draft diverter must be used.

A draft diverter must be used on all cleaners that are stacked. This included any chimney even if not expelled to the outside.

Use a draft diverter of the inverted funnel or bell type that meets all codes for capacity and materials. Mount the draft diverter directly to the stacking flange on the machine.

The draft diverter’s function is to insure that the barometric pressures are as close to the same as possible at the air inlet and outlet to the coil and will not be changed by either up drafts or down drafts.

Installation of a draft diverter *WILL not prevent the coil from freezing*. In areas where freezing temperatures are common, some type of down draft prevention must be used. Check local codes for acceptable methods for the prevention of down drafts.

GAS FIRED MACHINES ARE SUITABLE FOR CONNECTION TO A TYPE B GAS VENT WHEN USED WITH THE DRAFT DIVERTER PROVIDED. S'DAPTE À UNUN TUYAU D'ÉVACUATION DE GAZ DU TYPE B LORSQUE LA HOTTE DE TIRAGE FOURNIE EST UTILISÉE.

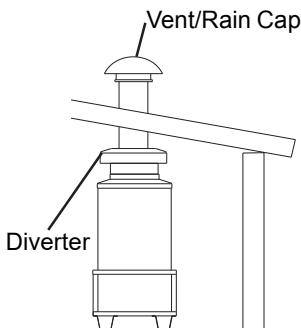
Venting Installation Information

Never reduce the stack size. The diverter and stacking should be the same size as the stack opening on the machine.

Straight stacking through the roof is preferred. Horizontal runs are not desirable, but if necessary, be sure to pitch the stack upward at a rate of two inches per foot. When horizontal stacks are used, vertical stacking must extend at least two feet for every foot of horizontal stack.

Stack extension above the roofline should be sufficient to clear the peak of the roof (refer to ANSI Z223.1 page 100 of SPECIFICS).

A rain cap U.L approved should be installed on the stack.



**Carbon
Monoxide
Hazard**



Operation

Operating Instructions

Pre Start-Up

The first time the machine is operated, after repairs have been made or if the machine has set for a period of time (30 days or more), follow these procedures:

Flush the machine per instructions in MACHINE MAINTENANCE.

Electrical: Connect the machine to an electrically grounded circuit that is fuse or circuit breaker protected. Do not use any type of adapter. If the correct type of receptacle is not available, the have on installed by a qualified electrician.

Oil Level: Check the oil level in the water pump.

Belt: Make sure belt tension and condition is as specified in MACHINE MAINTENANCE.

Stack Cover: Remove the stack cover (if so equipped).

Water Supply: This machine must have a water supply meeting or exceeding the maximum discharge volume specified in the PREFORMANCE section, and a minimum water inlet pressure of 20 PSI/ 1.37 BAR.

Lime: Water containing large amounts of lime, calcium or other similar materials can produce a coating on the inside of the spray tip, impact nozzle and coil pipe.

Float Tank: Check the float tank (if so equipped) to assure it is full and the float valve shuts off securely.

Float Tank Drain Plug: Install drain plug (if so equipped).

Float Tank Ball Valve: Check the position of the ball valve on the outlet side of the float tank (if so equipped) that it is in the open position.

Combi (if equipped):

Note: In process of making steam, the water flow through the coil has to be decreased. The amount of water is determined by the pressure and water temperature of your location.

If the incoming water temperature is as high as 70°F, the amount of water going through the coil has to decrease very little.

If the incoming water temperature is as low as 40°F, the amount of water going through the coil has to be decreased.

The water temperature is relative to the season variation and should be taken into consideration when operating steam.

Combi Setting (if equipped):

1. Set temperature control at 300°F/150°C MAXIMUM.
2. Completely open the water bypass metering valve (if so equipped) handle turning it counter clockwise found on the pump assembly.
3. With a small common screw driver, turn the screw on the metering valve (if so equipped) clockwise to DECREASE the temperature and counter clockwise to INCREASE the temperature.

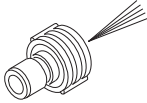


Quick-Connect Spray Tips

These tips have fixed spray patterns that are more consistent than those produced by an adjustable nozzle. Each tip is color-coded for easy identification. *Black* has a larger hole for low-pressure soap application. *White* (40°) produces a wide-fan spray for general cleaning and rinsing. *Green* (25°) provides a narrower-fan spray for tough stains in general cleaning applications. *Yellow* (15°) maintains a tight-fan spray with intense cleaning power for heavy-duty cleaning and paint preparation. *Red* (0°) creates a concentrated pinpoint water jet for stubborn stains on concrete, masonry, or steel, and for stripping paint.

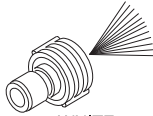
* Not all machines come equipped with all Quick-Connect Spray tips

LOW PRESSURE
APPLY CHEMICAL

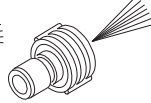


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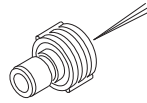
HIGH PRESSURE
GENTLE RINSE



WHITE
40°



GREEN
25°



YELLOW
15°



RED
0°



WARNING

**ELECTRICAL
SHOCK
HAZARD**



WARNING

Risk of injection or severe injury. Keep clear of nozzle. DO NOT direct discharge stream at persons. This equipment is to be used only by trained operators.



WARNING

This machine should be operated only by personnel instructed in and familiar with its operation. The discharge produced is up to 300°F/150°C and can cause serious bodily injury to you and anyone coming in contact with it.

CAUTION

A good flow of water must be flowing from the end of a gun for 30 seconds before proceeding. Lack of water can cause damage to the water pump and like components.

Start-Up

Refer to the MAINTENANCE SCHEDULE for any maintenance to be performed before operation.

1. Select temperature (if so equipped).
2. With the gun assembly in hand (on trigger gun models hold the trigger gun valve in open position) and with a good flow of water turn the switch to the 'pump' position.
3. Turn the switch to the "burner" position.

Combi (if equipped): Install the open gun assembly.

To clean:

Start on the lower portion of the area to be cleaned and work up using long, even, overlapping strokes.

Dirt is generally removed easily if grease and/or oil are not present; however, if grease and/or oil are present, hot water and chemical will accelerate in the cleaning process.

Combi (if equipped): Regulate the temperature indicated on the thermometer to 300°F by turning the regulating valve.

To apply chemical:

Use factory recommended chemicals for best cleaning action and for extended pump life. Contact your dealer for chemicals available. Follow instructions on the chemical container.

Mix chemicals per label instructions. Use necessary safety precautions.

Insert chemical screen into chemical container.

Adjust metering valve (if so equipped).

If the gun assembly is equipped with variable or multiple nozzle assembly, adjust as desired.

To rinse:

If the machine is equipped with a panel mounted metering valve, close the chemical metering valve (if so equipped). NOTE: It is advisable to dip the chemical screen in a container of clean water and open the valve 1 minute to clean the valve of any remaining residue.

If the gun assembly is equipped with variable or multiple nozzle assembly, open and close to clean nozzle of any remaining residue.

After a clear flow of water is noted from the end of the wand, start from the top, working downward using long, overlapping strokes.

Shut-Down

Turn the switch to the pump 'position' (if not already done so in the cold water rinse).

After cool, clear water is coming from the end of the wand, turn switch to the 'off' position.

Combi (if equipped): Completely close the water bypass metering valve (if so equipped) handle turning it clockwise found on the pump assembly.

Install the trigger gun assembly.

Turn off the water supply.

If freezing conditions may exist, refer to STORAGE in MACHINE MAINTENANCE.

Replace stack cover (if so equipped).

Machine Maintenance

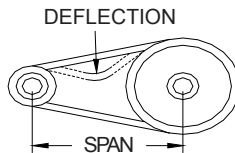
Machine Maintenance

Belt Tension

Deflection for each inch of span between pulley centers with a 6-pound force applied in the middle of the span.

Example: A 6-pound force applied at the middle of an 8-inch span should produce a deflection of $\frac{8}{64}$ inch or $\frac{1}{8}$ inch.

Belts can be tightened or loosened by loosening the nuts holding the pump assembly to the motor mount. Then tighten or loosen the j-bolt on the motor mount. Retighten the pump assembly after the desired tension is reached.



Spray Tip Maintenance

Remove the spray tip from the gun assembly.

Blow out debris with the compressed air from the outside in. Any debris remaining in the inlet side of the nozzle should be cleaned out. If lime or chemical scale is present in the inlet side, the nozzle may be soaked in de-scaling solution or replaced. If the tip is worn, replace with one specified in the GENERAL section of MODEL SPECIFICATIONS or MODEL EXPLODED VIEW.

Before replacing spray tip flush the machine per "FLUSHING."

Reinstall spray tip to gun assembly.



Coil Back Pressure Check

A regular maintenance schedule for descaling your heating coil is essential to insure its longevity.

The frequency of descaling depends upon the amount of use and the condition of the water.

1. Check the condition of your water pump unloader valve. Remove the hose and gun assembly from the coil outlet.
2. Remove any flow restrictions, such as guns and hoses, from the coil outlet.
3. Install a pressure gauge between the water pump and coil inlet.

Discharge Volume	Back Pressure
GPM	Requiring Descaling
2-3	50 PSI
3-4	75 PSI
4-5	100 PSI
6	150 PSI
8-10	175 PSI
Use a 1000 PSI pressure gauge	

4. Turn on the water supply. Check the float valve (if so equipped) to assure float tank is full and the float valve shuts off securely.
5. Check the position of the ball valve (if so equipped) on the outlet line of the float tank assuring it is in the open position.
6. Turn on the switch to the "PUMP" position. If the coil back pressure reading is above that found in the chart above then your machine needs to be de-scaled.

A separate descaling pump is recommended so that scale and other chemicals will not come in contact with your water pump and cause premature wear.

NOTE: Contact your local dealer for descaling of your unit.

7. Disconnect the water supply.
8. Disconnect the electrical supply.
9. Reinstall the hose and gun assembly.
10. Remove the pressure gauge.

Descaling instructions are available upon request.

Flushing

1. Connect machine to an electrically grounded circuit that is fuse or circuit breaker protected.
2. Connect machine to a pressurized water supply meeting the requirements specified in the GENERAL section of the MODEL SPECIFICATIONS.

3. Turn on the water supply.
4. Check the float tank (if so equipped) to assure it is full and the float valve shuts off securely.
5. Check the position of the ball valve (if so equipped) on outlet line of the float tank assuring it is in the open position.
6. Remove spray tip from gun assembly.
7. With the gun assembly in hand (on trigger gun models hold the trigger gun valve in open position) and with a good flow of water turn switch to the PUMP position.

Storage

1. Rinse the chemical line by inserting the screen into a container of clear water and open the metering valve 1 minute to clean it of any remaining residue. Be sure the chemical metering valve is closed when finished.
2. Check the position of the ball valve (if so equipped) on the outlet of the float tank assuring it is in the closed position.
3. Attach an air chuck to the air valve stem on the pump assembly. With the trigger gun in the open position, apply air until a mixture of air and very little water is coming from the gun wand. Then turn switch to the "BURNER" position and depress the vacuum switch. Run it for 45 seconds allowing any remaining water to turn to steam. Allow it to blow for 60 seconds. Turn switch to the "OFF" position.
4. Remove the air chuck.
5. Fill a 1-gallon container with Ethylene Glycol type antifreeze. Minimum should be a mixture of ½ antifreeze and ½ water strength before each use, as the antifreeze will dilute with use.
6. FLOAT TANK EQUIPPED: Pour the anti-freeze solution into the float tank.
7. WITHOUT FLOAT TANK: Install a 2-ft. garden hose to the water inlet. Insert the other end into a container of antifreeze solution.
8. Turn on the switch to the "PUMP" position.
9. Turn off the switch just prior to running out of antifreeze mixture.
10. Disconnect electrical supply.
11. Fill the fuel tank with kerosene or #1 or #2 diesel.
12. It is recommended to install a coil cover to keep coil free of debris.
13. Drain the float tank.
14. Place machine in a dry place protected from weather condition.

CAUTION

If the machine has been exposed to sub-freezing temperatures, it must be thoroughly warmed to above freezing before operating. Failure to warm machine can cause damage to pump and other components.

Machine Maintenance Schedule

Motor Driven Gas Fired Cleaners

	daily	Each HR 1 st 8 HRS	AFTER 1 st 50 HRS	EVERY 50 HRS	EVERY 100 HRS	EVERY 500 HRS	YEARLY
Oil Bath Water Pump:							
Oil Level- check and add as needed per PUMP SERVICE insert	•						
Oil Change- drain and refill per PUMP SERVICE insert							
CAUTION: Used oil must be disposed into an environmentally safe container and brought to an oil recycling center			•			•	
Oil Contamination- milky color indicates water	•						
Hoses:							
Blistering, loose covering	•						
Abrasion of cover exposing reinforcement	•						
Cuts exposing reinforcement	•						
Belts:							
Cracks or fraying	•						
Belt tension- For correct belt tension, see MACHINE MAINTENANCE insert		•		•			
Filter-Water:							
Check water inlet hose screen for debris	•						
Check float tank screen for debris	•						
Leaks:							
Check for water and build up of scale at pipe connections	•						
Fuel:							
Adequate fuel supply	•						
Guards and Shields:							
Check that all guards and shields are in place and secure	•						
Pump Motor with Grease Fittings:							
Remove drain plug. Use 1 or 2 full strokes of Shell "DOBLIUM RB", Chevron "SR1 No.2" or Texaco "PREMIUM RB". Operate for 20 minutes and replace drain plug							•
Freezing Temperatures:							
Freezing temperatures break coils and water pumps. See STORAGE in the MACHINE MAINTENANCE section for cold weather instructions	•						
Spray Tip:							
Check for debris	•						

Troubleshooting

Water Heater - Electronic Ignition

Trouble	Possible Cause	Remedy
Machine will not rise to operating temperature.	Low fuel pressure	See specified pressure in the FUEL section of MODEL SPECIFICATIONS .
	Poor combustion	See "Poor combustion".
	Improper fuel supply	Use fuel specified in FUEL section of the MODEL SPECIFICATIONS .
	Temperature control inoperative	See the TEMPERATURE CONTROL section.
	Incoming water temperature too low	Raise incoming water temperature.
Machine overheats (Dry steam – very little moisture, very hot steam)	Insufficient water	Increase water flow and pressure. Check coil back pressure.
	Temperature control inoperative	See TEMPERATURE CONTROL section.
	Improper fuel supply	Use fuel specified in FUEL section of the MODEL SPECIFICATIONS .
	Improper fuel pressure	See FUEL section of the MODEL SPECIFICATIONS for specified fuel pressure.
	Incoming water temperature too high	Lower incoming water temperature.
Machine smokes	Improper fuel supply	Use fuel specified in FUEL section of the MODEL SPECIFICATIONS .
	Improper burner jets	Remove and replace jets per BURNER ASSEMBLY .
	Loose burner jets	Tighten burner jets.
	Missing burner jets	Install appropriate burner jets see BURNER ASSEMBLY .
Machine fumes (exhaust burns eyes)	Improper fuel pressure	Fuel pressure should be N.G. 7.5" W.C. MIN/ 9"MAX L.P. 10" W.C. MIN/ 14"MAX.
	Improper venting.	See National Fuel Gas Code (ANSI Z223.1 and NFPA No. 54)
	Plugged Vent	Check for Obstruction.
Poor Combustion	Low fuel pressure	Fuel pressure should be N.G. 7.5" W.C. MIN/ 9"MAX L.P. 10" W.C. MIN/ 14"MAX.
	Improper fuel supply	Use fuel specified in FUEL section of MODEL SPECIFICATIONS .
	Improper venting	See National Fuel Gas Code (ANSI Z223.1 and NFPA No. 54)
	Fuel pressure too high	Fuel pressure should be N.G. 7.5" W.C. MIN/ 9"MAX L.P. 10" W.C. MIN/ 14"MAX.

Water Heater Electronic Ignition Troubleshooting Continued

Water Heater Lock Out- Spark present but No gas	Gas pressure incorrect	Set fuel pressure at N.G. 7.5" W.C. MIN/ 9"MAX L.P. 10" W.C. MIN/ 14"MAX.	
	Low voltage	Correct power supply- 10.5 VDC minimum	
	Blocked main burner tube	Clean burner tube	
	Blocked main burner orifice	Clean or replace orifice	
	Loose wires on valve	Secure wire connections	
	Loose valve wire on wiring harness	Repair wire on edge connector or repair wiring circuit board harness	
	Defective valve	Replace valve	
	Defective circuit board	Replace circuit board	
	Defective solenoid valve	Replace coils or solenoid valve	
	No gas to solenoid valve	Correct gas supply	
	Dirty connector on circuit board	Clean edge connector	
	Water Heater Lock Out- Gas present but No spark	High tension lead wire loose	Secure wire connection on circuit board
		Electrodes loosely attached to main burner	Secure electrodes to main burner
Dirty electrodes		Clean electrodes	
Wires loose in electrode porcelain		Replace electrode	
Cracked porcelain on electrode		Replace electrodes	
Defective circuit board		Replace circuit board	

Water Heater - Standing Pilot

Trouble	Possible Cause	Remedy
Pilot will not stay lit	Check for drafts	Install draft diverter.
	Pilot flame not sharp blue	Clean pilot orifice.
	Defective thermocouple	Test and/or replace thermocouple.
	Improper fuel pressure	Fuel pressure should be N.G. 7.5" W.C. MIN/ 9"MAX L.P. 10" W.C. MIN/ 14"MAX.
	Incorrect pilot orifice	See pilot orifice specified in the FUEL section of MODEL SPECIFICATIONS.

Pump

Trouble	Possible Cause	Remedy
Oil leaking in the area of water pump crankshaft	Worn crankshaft seal, bad bearing, grooved shaft, or failure of retainer o-ring.	Remove and replace.
Excessive play on crankshaft	Defective bearings.	See "Worn bearing."
	Excess shims.	Set up crankshaft.
Loud knocking in pump	Loose connecting rod screws.	Tighten connecting rod screws per PUMP SPECIFICATIONS
	Worn connecting rod.	Replace connecting rod per PUMP MAINTENANCE.
	Worn bearings.	Replace bearings per PUMP MAINTENANCE.
	Loose plunger bushing screw.	Tighten plunger screw per PUMP SPECIFICATIONS.
Oil leaking at the rear portion of the pump	Damaged or improperly installed oil gauge window gasket or rear cover.	Replace gasket or o-ring.
	Oil gauge loosed.	Tighten oil gauge.
	Rear cover screws loose.	Tighten rear screws to torque values in PUMP SPECIFICATIONS.
	Pump overfilled with oil, displaced through crankcase breather hole in oil cap/ dipstick.	Drain oil. Refill to recommended oil level as stated in OIL LEVEL in PUMP MAINTENANCE.
Water in crankcase	May be caused by humid air condensing into water inside.	Maintain or step up lubrication schedule.
	Worn or damaged plunger screw o-ring.	Remove and replace. See PLUNGER SERVICE in PUMP MAINTENANCE.
Worn bearing	Excessive belt tension.	See BELT TENSION in MACHINE MAINTENANCE.
	Oil contamination.	Check oil type and change intervals per PUMP SPECIFICATIONS.
Short bearing life	Excessive belt tension.	See BELT TENSION in MACHINE MAINTENANCE.
	Misalignment between pump and motor.	Re-align pump and motor.
	Oil has not been changed on regular basis.	Check oil type and change intervals per PUMP SPECIFICATIONS.

Pump Troubleshooting Continued

Short seal life	Damaged plunger bushing.	Replace plunger bushing.
	Worn connecting rod.	Replace connecting rod.
	Excess pressure beyond the pump's maximum rating. High water temperature.	Match pressure stated in PUMP SPECIFICATIONS. Lower water temperature stated in PUMP SPECIFICATIONS.
Dirty or worn check valves	Normal wear.	Remove and replace.
	Debris.	Check for lack of water inlet screens.
Presence of metal particles during oil change	Failure of internal component.	Remove and disassemble to find probable cause.
	New pump.	New pumps have machine fillings and debris and should be drained and refilled per PUMP SPECIFICATIONS.
Water leakage from under head	Worn packing.	Install new packing.
	Cracked/scored plunger.	Remove and replace plunger.
	Failure of plunger retainer o-ring.	Remove and replace plunger retainer o-ring.
Loud knocking noise in pump	Pulley loose on crankshaft.	Check key and tighten set screw.
	Defective bearing.	Remove and replace bearing.
	Worn connecting rod, crankshaft, or crosshead.	Remove and replace.
Frequent or premature failure of the packing	Scored, damaged, or worn plunger.	Remove and replace plungers.
	Overpressure to inlet manifold.	Reduce inlet pressure.
	Abrasive material in the fluid being pumped.	Install proper filtration on pump inlet pumping.
	Excessive pressure and/or temperature of fluid being pumped.	Check pressures and fluid inlet temperature. Be sure they are within specified range.
	Over pressure of pumps.	Reduce pressure.
	Running pump dry.	Do not run pump without water.

Pump Troubleshooting Continued

Low Pressure	Dirty or worn check valves.	Clean/replace check valves.
	Worn packing.	Remove and replace packing.
	Belt slipping.	See BELT TENSION in MACHINE MAINTENANCE.
	Improperly sized spray tip or nozzle.	See MACHINE SPECIFICATIO SN for specified spray tip or nozzle.
	Inlet filter screen is clogged.	Clean inlet filter screen.
Pitted valves.	See VALVE SERVICE in PUMP MAINTENANCE.	
Erratic pressure; pump runs rough	Dirty or worn check valves.	Clean/replace check valves.
	Foreign particles in valve assemblies.	
	High inlet water temperature.	See temperature in PUMP SPECIFICATIONS.
Excessive vibration	Dirty or worn check valves	See "Dirty or worn check valves."
Scored plungers	Abrasive material in fluid being pumped.	Install proper filtration on pump inlet plumbing.
Fitted plungers	Cavitation.	Decrease inlet water temperature and/or increase inlet water pressure.
Cavitation	High inlet fluid temperature, low inlet pressure.	Lower inlet fluid temperature and raise inlet fluid pressure.

