

# OPERATOR'S MANUAL

## OPERATION AND MAINTENANCE



HIGH PRESSURE WASHING EQUIPMENT

### **5/3000GOVS**

This manual is confidential and proprietary Hydro Engineering, Inc property. Any requests for this document must be submitted to the manufacturer.

**Hydro Engineering, Inc.**  
**865 West 2600 South**  
**Salt Lake City, UT 84119**

**In Utah: 801-972-1181**  
**Toll Free: 1-800-247-8424**  
**Fax: 801-972-3265**

TRADEMARKS: The HE logo is a registered trademark and Hydroblaster is a trademark of Hydro Engineering, Inc. All other product names mentioned are trademarks of their respective companies or distributors.

# IMPORTANT

*The following information is necessary for installation, parts, service and warranty consideration.*

Refer to Control Panel Label  
for Serial Tag Information

*Please fill in the following for your records.*

**SERIAL NUMBER** \_\_\_\_\_ **MODEL NUMBER** \_\_\_\_\_  
Purchased From \_\_\_\_\_ Date Purchased \_\_\_\_\_  
Address \_\_\_\_\_ Telephone \_\_\_\_\_

## INITIAL INSPECTION AND HANDLING

1. By following the instruction decals on the outside of the container in which this item was shipped, you have opened the packing units and have either found the equipment in good condition or damaged.
2. **If the system was delivered to you by a common carrier and damage is found, even hidden damage, IMMEDIATELY file a claim with your carrier. Their representative must inspect and verify the damage. It is YOUR responsibility, not Hydro Engineering Inc.'s or your distributor's, to file the freight damage claim.**
3. Check the enclosed packing list to verify that all items have been received! Contact your distributor, or Hydro Engineering Inc., immediately, if all parts have not been received. Please contact your distributor or Hydro Engineering, Inc. if assistance is needed with common carriers, identification of parts, assembly, or installation procedures.

**Hydro Engineering, Inc.**  
**865 West 2600 South**  
**Salt Lake City, Utah 84119**  
**1-800-247-8424**

Effective: Oct. 14 2003

## NEW PRODUCT LIMITED WARRANTY

Hydroblaster Pressure Washers & HydroKleen Waste Water Recycling and Filtration Equipment

NEW PRODUCT LIMITED WARRANTY Applies to all Hydro Engineering Inc. Equipment

### LIMITED WARRANTY COVERAGE:

Products manufactured by Hydro Engineering, Inc., are warranted to the original purchaser to be free from defects in materials and workmanship under normal use for specific periods. This Limited Warranty is subject to exclusions, is calculated from the date of the original purchase, and applies to the original components only as shown below. Any parts repaired or replaced under this warranty will fall under that parts limited warranty.

### NINETY DAY LABOR:

This limited warranty includes labor for a period of ninety (90) days from the original purchase date. Labor is provided on the replacement and/or repair of parts covered by this limited warranty only. Labor is not covered for replacement of parts considered as wear items or items rejected under the terms of this limited warranty.

### LIFETIME PARTS:

Some parts supplied on our equipment carry a lifetime limited warranty such as; forged brass pump manifolds, supplied by General Pump Company, they are warranted unconditionally, including freeze damage. These pass through warranties are subject to change by their manufacturer. Please consult our service department for the most recent warranty terms on these items.

### FIVE YEAR PARTS:

This applies to all proprietary parts manufactured by Hydro Engineering, Inc., such as equipment frames, Hydropads, stainless steel equipment covers, panels, guards, coil wraps, and fuel tanks.

### FIVE YEAR PRORATED:

Hydroblaster heating coils are covered for full repair or replacement during the first two years; customer pays 40% of replacement cost during third year, 60% during fourth year and 80% during the fifth year.

### ONE YEAR MINIMUM ON PARTS:

All other components will be warranted based on the original component manufacturer's limited warranty. All carry a one year minimum term. Normal wear items as described below are excluded.

### PASS THROUGH REPLACEMENT PARTS WARRANTY:

Many components such as pumps, motors, engines, etc., may be warranted by their respective manufacturers and are serviced through the manufacturer's local authorized service centers. Hydro Engineering, Inc. is not authorized to provide warranty on many of these items, but will help you contact and expedite the warranty process with the authorized service centers.

### EXCLUSIONS:

1. Normal service and wear items, such as oil filters, fuel filters, nozzles, guns, wands, quick disconnects, o-rings, seals, packing, valve or valve assemblies, water filter cartridges, belts, brushes, discharge hoses, oil skimming belts, filter media, ozone bulbs, etc.
2. Damage or malfunctions resulting from accidents, abuse, modification, alterations, incorrect installation, improper servicing, and failure to follow manufacturer's maintenance instructions, or use of the equipment beyond its stated usage specifications as contained in the operator's manual.
3. Freeze damage, chemical damage, scale/hard water build up, rust, corrosion, or excessive heat.
4. Damage resulting from inadequate- electric, water and venting or fuel supplies.
5. Normal maintenance service, including tune-ups, fuel system cleaning, and clearing of obstructions in fuel or water lines.
6. Freight damage resulting from shipment.
7. Field labor and transportation (mileage) charges for onsite service calls.

### ACQUIRING WARRANTY SERVICE:

To acquire warranty service, you must return the product to your Authorized Hydro Engineering, Inc. Dealer, (or directly to Hydro Engineering Inc. factory), and freight prepaid, with proof of purchase date within the applicable warranty period. If the product is permanently installed, you must notify your Authorized Hydro Engineering, Inc. Dealer (or Hydro Engineering Inc. factory) of the defect. Your Dealer is authorized to file a claim with Hydro Engineering, Inc. Ground freight charges on warranted replacement parts will be paid by Hydro Engineering Inc. For warranty service on components warranted by other manufacturers, your Authorized Hydro Engineering, Inc. Dealer (or Hydro Engineering Inc. factory) can help you obtain warranty service through the manufacturer's local authorized service centers.

### LIMITATION OF LIABILITY:

Hydro Engineering, Inc. shall not be liable for special, incidental, or consequential damages and therefore these damages are expressly disclaimed. Hydro Engineering, Inc.'s liability limit under this limited warranty shall not exceed the purchase price of the product in question. Hydro Engineering, Inc. makes every effort to ensure that all illustrations and specifications are correct, however, these do not imply a warranty that the product is merchantable or fit for a particular purpose, or that the product will actually conform to the illustrations and specifications. **THE WARRANTY CONTAINED HEREIN IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, INCLUDING WASTE-WATER TREATMENT.** Hydro Engineering, Inc. does not authorize any other party including authorized Hydro Engineering, Inc. Dealers, to make any representation or promise on behalf of Hydro Engineering, Inc., or to modify these terms, conditions, or limitations in any way. It is the buyer's responsibility to ensure that the installation and use of Hydro Engineering, Inc. products conforms to local codes.



Hydro Engineering Inc.

865 W. 2600 S. • Salt Lake City, UT 84119  
(801) 972-1181 • (800) 247-8424

## RETURN GOODS AUTHORIZATION (RGA) PROCEDURE

### RETURN GOODS AUTHORIZATION (RGA) PROCEDURE

*Please let us know how we can improve our service to you. We want you to be completely satisfied with the products and services offered by Hydro Engineering, Inc.*

*This guideline is designed to assist you in understanding the procedure we use whenever it is necessary to return an item for warranty consideration, service repairs, or refurbishing.*

### ITEM RETURN PROCEDURE

*1. Contact either the Hydro Engineering, Inc. (HEI) Parts or Service Departments to obtain an RGA authorization number. Please have the Serial number of your equipment when you call.*

*2. A copy of the RGA work order will be faxed or mailed to you promptly.*

*3. Please package the items carefully.*

*4. The RGA number should be written legibly on the exterior of the box(s) to expedite handling your return.*

*5. Ship the product freight prepaid to HEI.*

*6. Item(s) received for warranty consideration will be evaluated and will either be repaired or replaced at the option of HEI. This process may take up to four weeks. You will be notified if further information is needed and/or when a decision is made.*

*7. If warranty is denied, you will be given a written explanation of the decision, along with an estimate of the parts and labor costs necessary to effect repairs for your approval.*

*8. HEI will retain your returned materials for 30 days after notification. Please inform us of your wishes regarding the disposition of non warranted parts within 30 days after notification. All parts received by HEI and not covered by warranty may be returned, repaired, or discarded, at your option. Any item(s) held longer than 30 days without arrangements will be discarded.*

*NOTE: Warranted items are returned to you freight prepaid via ground service. You will be responsible for all return shipping & handling costs for an item denied warranty repair that you want returned.*

*NOTE: RGA numbers are valid for 45 days, if your parts are not returned to HEI within the 45 day cycle; the RGA number will be closed.*

### REPLACEMENT PARTS ORDERS

*If replacement items are needed immediately for parts submitted for warranty consideration, an invoice will be generated for those item(s). This invoice is due and payable per the normal terms of the invoice. New replacement parts and shipping costs are due in full whether warranty is approved or denied!*



Hydro Engineering Inc.

865 W. 2600 S. • Salt Lake City, UT 84119  
(801) 972-1181 • (800) 247-8424

# OPERATION & MAINTENANCE MANUAL HYDROBLASTER SYSTEM

## 5/3000GOVS

### Table of Contents

#### Safety

GENERAL SAFETY .....	1-1
MECHANICAL SAFETY .....	1-1
FUEL SAFETY .....	1-1
COMBUSTION .....	1-1
VELOCITY/PRESSURE INFORMATION.....	1-1

#### Installation

LOCATION .....	2-1
WATER SUPPLY .....	2-1
OIL BURNER FUEL SUPPLY .....	2-1
EXHAUST VENTILATION .....	2-1
ENGINE FUEL.....	2-2
CHEMICALS.....	2-2
FREEZING .....	2-2

#### Operation

LOCATION .....	3-1
WATER SUPPLY .....	3-1
ENGINE FUEL.....	3-1
CHEMICALS.....	3-1
FREEZING .....	3-1
PRE-OPERATIONAL SAFETY INSTRUCTIONS .....	3-1
BEFORE STARTING.....	3-1
STARTING AND OPERATING.....	3-2
DUAL WAND .....	3-2
NOZZLES .....	3-3
COLD WEATHER STORAGE, SHIPPING, AND OPERATION.....	3-3
OPERATING IN FREEZING CONDITIONS .....	3-3

#### Maintenance

GENERAL INSPECTION .....	4-1
HIGH PRESSURE PUMP .....	4-1
CHANGING THE OIL .....	4-1
SAFETY VALVES AND DEVICES .....	4-1
UNLOADER VALVE .....	4-1
PRESSURE SWITCH.....	4-1
RUPTURE DISK.....	4-1
CHEMICAL INJECTION (OPTION).....	4-2
HEATING SYSTEM.....	4-2

# OPERATION & MAINTENANCE MANUAL HYDROBLASTER SYSTEM

## 5/3000GOVS

### Table of Contents (continued)

HOSES .....	4-2
<b>Troubleshooting</b>	
EXCESSIVE PRESSURE .....	5-1
LOW PRESSURE.....	5-1
PRESSURE IS ERRATIC AND/OR LOW .....	5-2
WATER LEAKAGE.....	5-2
OIL LEAKAGE .....	5-2
OIL CONTAMINATION.....	5-3
PUMP NOISE .....	5-3
PREMATURE SEAL FAILURE.....	5-3
PREMATURE VALVE FAILURE .....	5-3
PREMATURE PLUNGER FAILURE .....	5-3
CHEMICAL INJECTION (OPTIONAL) .....	5-3
<b>Nozzle Specification Chart</b>	
NOZZLE VOLUME (GPM) AT VARIOUS PRESSURES (PSI) .....	T-1
<b>Maintenance Schedule</b>	
MODELS: ALL HOT WATER, ENG. DRIVEN, OIL-FIRED HYDROBLASTERS™ .....	T-2
<b>Diagrams</b>	
EXPLODED VIEW: INLET FILTER PLUMBING -- GOVS .....	D-1
EXPLODED VIEW: GVS/SSV: COIL INLET/DISCHARGE PLUMBING .....	D-2
EXPLODED VIEW: PUMP PLUMBING, GOVS, BELT-DRIVEN W/TS PUMP .....	D-3
EXPLODED VIEW: OIL BURNER PLUMBING -- VERTICAL COIL UNITS .....	D-4
EXPLODED VIEW: HOSE, WAND, & GUN ASSEMBLY - #ZZDBL DUAL LANCE .....	D-5
ELECTRICAL SCHEMATIC: 12-25 HP KOHLER ENG., 15A REGULATED BATTERY CHARGING SYS. ....	D-6
ELECTRICAL SCHEMATIC: 12VDC OIL-FIRED BURNER CONTROLS W/OPT. STEAM COMBO .....	D-7
MACHINE MAINTENANCE LOG SHEET .....	D-8

# Safety

**IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS.** Your Hydroblaster is an advanced design engine driven unit engineered to provide a continuous duty jet spray. Many safety features have been integrated into its design to help protect the operator from hazards, however, there are potential safety risks involved with its use. Please read these safety instructions carefully.

## GENERAL SAFETY

The operator should be thoroughly familiar with equipment operation, limitations, and hazards.

Follow the maintenance instructions specified in the manual.

To reduce risk of injury, close supervision is necessary when this product is used near children.

When starting a job, survey the area for possible hazards and correct before proceeding.

Know how to stop the product and bleed pressures quickly. Be thoroughly familiar with the controls.

Stay alert - watch what you are doing.

Do not operate the product when fatigued or under the influence of alcohol or drugs.

Do not start the system unless the wand is firmly gripped by the operator. Do not overreach or stand on unstable support. Keep good footing and balance at all times.

Keep operating area clear of all persons. Always point the spray in a safe direction.

**▲ WARNING: High Pressure!** Risk of Injection or Severe Injury - Keep Clear of Nozzle - Never put hands or fingers in the water spray path. Do not point water spray toward your body or at anyone else. This product is to be used only by trained operators. Failure to follow these instructions could result in serious bodily injury.

Flow-actuated systems are designed to turn on whenever the operator depresses the trigger on the gun, even if the system start/stop button has not been enabled. Be aware of this fact and use caution when operating a system of this design.

Do not operate the system if any water leakage is observed, guards or components have been removed or defeated, or if any mechanical defect is suspected.

Do not leave the machine running without an operator in attendance.

Do not start the heating system unless a full flow of water is being discharged from the high pressure nozzle. Once the heating system has been turned on, verify that combustion

occurs but only when water is being discharged from the nozzle. If the unit ignites with the trigger off or fails to ignite with trigger on, service immediately!

During normal operation of the Hydroblaster, hot surfaces and high temperature discharges exist on the system. These include areas on and around the engine, pump, and heating coil. Avoid burns by being aware of these areas and staying clear of them during and immediately after equipment operation.

Never stand in water when cleaning electrically powered equipment.

## MECHANICAL SAFETY

All guards, shields, and covers, must be in place to prevent accidental contact with hazardous parts.

Turn the machine off before attempting to make any adjustments.

Inspect machine for damaged or worn components and repair or replace to avoid potential hazards.

## FUEL SAFETY

Do not refuel machine while it is running or hot. Allow it to cool sufficiently to prevent possible ignition of any spilled fuel. Clean up any spilled fuel before resuming operation. Fuel type should be as specified in this manual and on identification labels on the fill ports.

## COMBUSTION

**▲ WARNING: Open Flame!** Do not operate this system in an area with combustible materials.

The heating system consumes a generous amount of oxygen and produces heat and exhaust gases (i.e., carbon monoxide). The area must be well ventilated, and the system provided with an adequate combustion air source.

Adjustments to fuel burning equipment should only be performed by personnel trained in servicing this type of equipment.

## VELOCITY/PRESSURE INFORMATION

High pressure is created by the system. When the water leaves the nozzle, the pressure is turned to water velocity.

When the water dislodges a particle it can travel at high speed for several feet. The use of safety glasses with side shields is recommended.

Never try to block the nozzle or any high pressure leak with your body. The fluid can be injected through the skin. Always point the spray in a safe direction and never at your body or toward anyone else.


Always maintain a firm grip on the on/off gun and wand assembly, especially when starting the system and triggering the gun.

Use only the nozzle specified for your system.

Always relieve the line pressure after use by depressing the trigger on the on/off gun.

### **CHEMICAL SAFETY**

Many commonly used chemicals react violently when exposed to water, creating explosive or noxious vapor hazards. Such material must be removed from the cleaning area or be contained in waterproof container.

 **WARNING:** NO FLAMMABLE SOLVENTS MAY BE USED WITH THIS SYSTEM.

Be careful not to inhale or ingest effluent liquids or vapor. Be aware of the chemicals that are being used, their proper application, and recommended disposal procedures.

Make sure that Material Safety Data Sheets (MSDS) are readily available on all products associated with the process.

When hazardous chemicals are used, wear appropriate protective clothing: gloves, respirator, face mask, glasses, and wet suit as necessary.

# Installation

## LOCATION

The Hydroblaster should be located on a level non combustible surface. This system is a "zero clearance" device but care should be exercised to protect combustible materials from the heating system exhaust products and associated exhaust ducting.

Protect the machine from wind, rain, snow, extreme temperatures, and exposure to the wash area. Install the machine with consideration to the location of the water supply, electrical source, chemical storage, and access for maintenance. On portable systems, make certain that all necessary steps have been taken to keep the unit secure and immobile before operating.

## WATER SUPPLY

The pump must have a steady supply of clean water that exceeds the discharge volume of the system. Generally, a minimum of 10 GPM @ 25-75 PSI is acceptable for the water supply. This unit is equipped with a 3/4" female garden hose type water inlet supply.

Local water conditions may affect the coil pumping system, and water delivery components adversely. In areas where troublesome conditions exist with similar equipment (e.g., water heaters), water conditioning is recommended to enhance the operation of cleaning compounds and extend the service intervals of wetted components.

## OIL BURNER FUEL SUPPLY

Recommended fuels vary with the elevation at which the system is being used.

- For elevations to 4000 ft. - use kerosene, #1 or #2 stove oil, or #1 or #2 diesel fuel.
- Above 4000 ft. - use kerosene, #1 stove oil, or #1 diesel fuel.
- Above 6500 ft. - use kerosene only to reduce sooting of the coil.

Sooting of the coil can be further delayed by using a soot remover fuel additive, available from Hydro Engineering, Inc., part number: 1MN012, (recommended whenever the unit is run on #2 diesel fuel, or above 4000 ft.). Follow manufacturer's label recommendations for proper usage.

In cold weather conditions, the lighter fuel oils (kerosene, #1 stove oil, or #1 diesel) are more easily atomized, and combustion is improved with their use. It is recommended that these lighter fuels be used when ambient temperatures fall below freezing.

Whenever the fuel type or the altitude that the system is operated at is changed, adjustment of the oil burner is

required to maintain proper combustion. The Hydroblaster is set at the factory (4300 ft. elevation) to operate on #1 diesel. If your operating elevation or fuel type is different, contact the factory or your dealer for assistance with burner adjustments to maximize efficiency and avoid coil sooting.

**⚠ WARNING:** Never use gasoline or waste oil in the burner.

## EXHAUST VENTILATION

This machine emits products of combustion either through the heating coil exhaust stack, or from the engine's exhaust pipe (if this is an engine driven system). Exhaust emissions include carbon monoxide, a deadly gas. When operating this machine indoors, the products of combustion must exhaust outdoors. Do not vent this system into a wall, ceiling, or a concealed space of a building.

Whenever the equipment is to be permanently stationed and operated indoors, an exhaust system must be used to route coil exhaust outdoors. The operation and economy of your Hydroblaster will depend greatly upon proper exhaust stacking see **Figure 2-1**. Proper air flow helps chimney draw. A cold stack invites down drafts which are undesirable. Therefore, it is recommended that the installer insulate the stack so that outside air temperatures do not cool it down. If a double wall flue pipe is installed, it will help to insulate the stack.

Extend the stack above the roof line to sufficiently clear the peak of roof tops, thereby reducing turbulent down drafts in the stack.

A rain cap is required on the top of the stack to protect the system.

Limit the number of bends in the flue. These are extremely restrictive to proper exhaust gas flow.

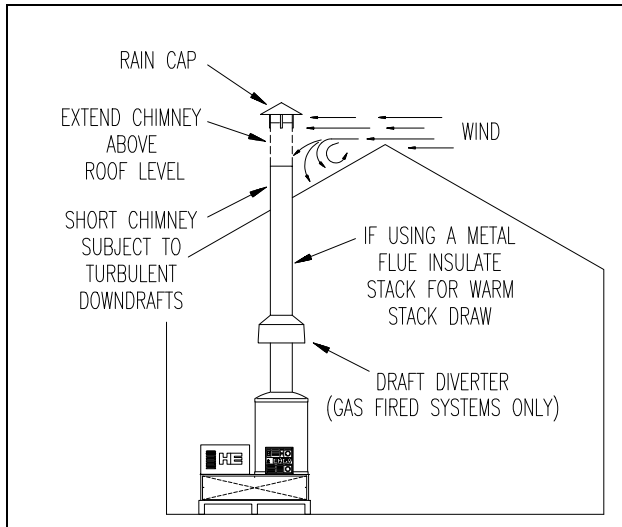


Figure 2-1: Stack Diagram

Never attempt to run the flue horizontally, or reduce the diameter of the flue pipe below that of the mounting ring on the system exhaust port, unless a power vent option has been installed.

Power venting systems that have been shipped separately and/or uninstalled may require that the wiring of the power venting system be done by a qualified electrician. For venting systems not supplied by Hydro Engineering, follow the wiring diagram included with the venting system. If assistance is needed to wire in a non-Hydro Engineering supplied venting system, call our service department at 1-800-247-8424. It may be required that a copy of the wiring diagram for the venting system be faxed to Hydro Engineering.

Make sure that the inside of the flue is free of obstructions. High exhaust temperatures warm the flue stack. Make certain that combustibles are kept away from the stack, and that roof flashing is installed and properly sealed to protect the roof from excess heat and moisture.

Keep the stack exhaust away from building ventilation fans, so that combustion products cannot be returned into the building.

Contact your distributor or a local heating contractor for proper materials. Observe local codes.

## ENGINE FUEL

Use fuel and lubricants as specified in the included engine owner's manual.

## CHEMICALS

Mix cleaning chemicals per the label instructions, and follow safety precautions. Follow all manufacturer safety, handling, application, and disposal instructions. Wear gloves, boots, face shield, and protective clothing appropriate for the chemicals being used.

## FREEZING

This system must be protected from freezing or prepared per the instructions under the **COLD WEATHER STORAGE, SHIPPING, AND OPERATION** heading of the OPERATION section.

# Operation

## LOCATION

The Hydroblaster should be located on a level non combustible surface. This system is a "zero clearance" device but care should be exercised to protect combustible materials from the heating system exhaust products and associated exhaust ducting.

Protect the machine from wind, rain, snow, extreme temperatures, and exposure to the wash area. Install the machine with consideration to the location of the water supply, electrical source, chemical storage, and access for maintenance. On portable systems, make certain that all necessary steps have been taken to keep the unit secure and immobile before operating.

## WATER SUPPLY

The pump must have a steady supply of clean water that exceeds the discharge volume of the system. Generally, a minimum of 10 GPM @ 25-75 PSI is acceptable for the water supply. Information on the maximum inlet and discharge pressure of the pump is listed in the SPECIFICATIONS section of the manual. This unit is equipped with a 3/4" female garden hose type water inlet supply.

Local water conditions may affect the coil pumping system, and water delivery components adversely. In areas where troublesome conditions exist with similar equipment (e.g., water heaters), water conditioning is recommended to enhance the operation of cleaning compounds and extend the service intervals of wetted components.

## ENGINE FUEL

Use fuel and lubricants as specified in the included engine owner's manual.

## CHEMICALS

Mix cleaning chemicals per the label instructions, and follow safety precautions. Follow all manufacturer safety, handling, application, and disposal instructions. Wear gloves, boots, face shield, and protective clothing appropriate for the chemicals being used.

## FREEZING

This system must be protected from freezing or prepared per the instructions under the **COLD WEATHER STORAGE, SHIPPING, AND OPERATION** heading of the OPERATION section.

## PRE-OPERATIONAL SAFETY INSTRUCTIONS

**⚠ CAUTION: THIS MACHINE DESIGNED FOR OUT-DOOR USE ONLY! Open flame! Do not operate this**

**system in an area with combustible materials.** The heating system consumes a generous amount of oxygen and produces heat and exhaust gases (i.e., carbon monoxide). The area must be well ventilated, and the system provided with an adequate combustion air source.

Before starting the Hydroblaster, read the SAFETY section, carefully.

Make a visual check of the Hydroblaster to verify that all the components are properly located and joined.

If a leak is discovered or if a mechanical failure is suspected, **DO NOT OPERATE THE MACHINE.** Fix or repair the problem first.

If the machine will be exposed to freezing temperatures, it is very important to follow the instructions under the **COLD WEATHER STORAGE, SHIPPING, AND OPERATION** heading in this section.

Do not start the engine until all the safety and operating instructions outlined in the engine owner's manual have been observed.

Do not start the heating system unless a full flow of water is exiting from the high pressure discharge nozzle.

**⚠ WARNING:** Avoid the exhaust areas of the Hydroblaster. These areas get very hot during operation and remain hot for a while after the machine has been shut down. Before operation, make a visual check of the system to determine where the exhaust gases will be directed.

## BEFORE STARTING

1. If the machine has been exposed to freezing temperatures, it must be thoroughly warmed to above freezing before operating. Failure to do so can cause damage to the pump packings and unloader valve seals as they may be frozen to other internal parts by a thin film of ice.
2. Verify that the unit is properly secured.
3. Verify that the water supply line has been securely connected to the system.
4. Make certain that there is enough chemical in the chemical container (if applicable).
5. Refer to the MAINTENANCE section of this manual and perform any required maintenance before operating.
6. Refer to the OPERATION and MAINTENANCE sections of your engine owner's manual and perform any required preparatory checks, and/or maintenance before starting.

7. Check the oil level in the high pressure pump and the engine. Refer to the appropriate sections if adding more oil is necessary.

8. Make sure that the burner fuel tank is filled with fuel as indicated. Recommended fuels vary with the elevation at which the system is being used.

- For elevations to 4000 ft. - use kerosene, JP8 fuel, #1 or #2 stove oil, or #1 or #2 diesel fuel.
- Above 4000 ft. - use kerosene, JP8 fuel, #1 stove oil, or #1 diesel fuel.
- Above 6500 ft. - use kerosene only to reduce sooting of the coil.

Sooting of the coil can be further retarded by using a soot remover fuel additive, available from Hydro Engineering, Inc., part number: 1MN012, (recommended whenever the unit is run on #2 diesel fuel, or above 4000 ft.). Refer to **CLEANING THE COIL & TANK ASSEMBLY** heading in the MAINTENANCE section for more information on this product. Follow manufacturer's label recommendations for proper usage.

In cold weather conditions, the lighter fuel oils (kerosene, JP8 fuel, #1 stove oil, or #1 diesel) are more easily atomized, and combustion is improved with their use. It is recommended that these lighter fuels be used when ambient temperatures fall below freezing.

Whenever the fuel type or the altitude that the system is operated at is changed, adjustment of the oil burner is required to maintain proper combustion. The Hydroblaster is set at the factory (4300 ft. elevation) to operate on #1 diesel. If your operating elevation or fuel type is different, contact the factory or your dealer for assistance with burner adjustments to maximize efficiency and avoid coil sooting.

**▲ WARNING:** Never use gasoline or waste oil in the burner.

9. Uncoil or unwind the high pressure hose completely. If the unit is equipped with a hose reel, removing the hose from the reel before operating the unit reduces the stress on the drum and extends the life of the seals in the swivel. DO NOT allow vehicles to drive over the hose.

## STARTING AND OPERATING

NOTE: Refer to the engine owner's manual as necessary.

1. Hold the on/off gun firmly, nozzle pointed away from the operator (in a safe direction) and depress the trigger. Depressing the trigger reduces the starting load on the motor.

NOTE: The throttling capabilities of the engine have been overridden at the factory. The engine speed is factory set to maintain constant pump operating speed.

During initial start up, water may take 60 seconds to begin flowing out of the nozzle. If the water doesn't flow, the pump will have to be primed. Refer to the **NO WATER DISCHARGED FROM NOZZLE** heading in the TROUBLESHOOTING section. Once the system has been primed and the lines filled, water will flow immediately whenever the pump is operated.

2. After water flows from the nozzle, release the trigger on the on/off gun and enable the heating system by turning on the burner toggle switch.

**▲ WARNING:** The heating system is of the instantaneous type. It will ignite immediately when the trigger is depressed on the on/off gun and must *immediately* cease ignition when the trigger is released - **VERIFY THIS!**

If the burner fails to ignite when the trigger is depressed or ignites when the trigger gun is off, turn the system off. The burner must operate with the action of the trigger gun. Refer to the **BURNER CONTROLS** heading in the TROUBLESHOOTING section for further information.

**▲ CAUTION:** Do not run the heating system without fuel. This will damage the fuel pump.

If the burner fails to ignite, do not retry ignition more than once or twice. **Be cautious!** The combustion chamber may accumulate combustible vapors (indicated by white vapor exiting the stack). Excessive attempts may introduce sufficient unburned fuel into the combustion chamber to saturate the insulation wrap surrounding the heating coil (see **Figure 4-13**). If the wrap becomes saturated to the point that fuel drips from the coil housing or white smoke (unburned, vaporized fuel) is discharged when the burner is fired, the insulation loses its ability to properly insulate the coil and a potential for fire exists that requires replacement of the insulation.

Once the burner ignites and ignition is properly controlled by the action of the trigger gun, observe the exhaust for excess smoke. A very slight gray smoke is preferred. Black or white smoke will cause rapid fouling of the combustion chamber and require extensive maintenance. Turn the burner off and make the necessary adjustment to the heating system before operating it further. Refer to the **INSTALLATION** section for fuel and additive recommendations and to the **MAINTENANCE** section for information on burner adjustment and coil servicing.

## DUAL WAND

The dual wand provides operator control of the system discharge pressure.

When the operator opens the dual wand valve by rotating the valve handle, fluid is allowed to flow from both dis-

charge nozzles. This reduces the discharge pressure. When the operator closes the valve, the system pressure is increased back to the normal operating pressure. For an exploded view diagram and specific instructions on the operation of the dual wand, refer to the HOSE, GUN, and WAND ASSEMBLY exploded view diagram.

## NOZZLES

The system is shipped with the spray nozzles installed in the dual wand. A 15 degree and a 40 degree nozzle are supplied unless specified otherwise (the degree of the nozzle refers to the spread of the flat fan spray pattern that is produced when water exits the nozzle). The 15 degree nozzle is installed on the high pressure lance of the dual wand. The 40 degree nozzle is installed on the low pressure lance for soap applications. Several different nozzle types with different spray patterns are available. The type of cleaning determines the type of nozzle and the spray pattern to be used. The narrow spray angle nozzles impact the surface harder and are used for washing, the higher degree wide nozzle spray patterns are used for rinsing and flooding the surface.

A **zero degree** nozzle is used to generate a stream spray (providing maximum impact, but minimal coverage) and is generally used for concentrated cleaning. Spinning nozzles with 0 degree patterns are used to increase coverage while providing high impact.

**▲ CAUTION:** Extreme care should be used when using a zero degree nozzle. High pressure discharge using a zero degree nozzle has piercing capabilities and may cause property damage, or bodily injury.

A **15 degree** nozzle provides significant impact for cleaning heavily soiled areas.

A **25 degree** nozzle is mostly used for general purpose cleaning or rinsing, providing medium spray pattern and impact.

A **40 degree** nozzle provides a wide spray pattern with reduced impact and is generally used for either light duty cleaning, soap application, or rinsing.

NOTE: If you need to replace a nozzle, select the nozzle size specified for your machine's volume and pressure.

## COLD WEATHER STORAGE, SHIPPING, AND OPERATION

If the Hydroblaster is to be shipped, stored for extended periods, or operated in cold weather, antifreezing and anti-corrosion precautions should be taken.

Follow the shut down instructions outlined under the **SHUT DOWN** heading of this section.

1. Shut off the water supply to the pump.

2. Remove the high pressure nozzle from the dual wand.
3. Drain water from the tank and supply lines by opening the ball valve located on the bottom of the water supply tank.

Remove as much water from the system as possible by running the equipment for 60 seconds without the water supply attached.

**▲ CAUTION:** Do not run the machine dry for prolonged periods of time (over three minutes). This will damage the pump.

4. Compressed air may be applied to clear the pump and discharge lines. Remove the nozzle and trigger the gun while forcing air into the pump inlet until very little water is exiting the wand. On some systems optional air stem may be supplied with unit.

5. To protect the system more thoroughly, fill a container with a 50/50 solution of propylene glycol (commercially available for use in recreational vehicle water systems) permanent antifreeze and water. Do not use ethylene glycol because it is environmentally hazardous.

6. Start the pressure washer and squeeze the trigger so the float tank empties completely.

7. Release the trigger, fill the float tank with propylene glycol mixture.

8. Squeeze the trigger for 10 seconds then release to allow the propylene glycol to enter into the pumps bypass line.

9. Squeeze the trigger until the antifreeze mixture exits the discharge nozzle of the wand.

10. Fill the fuel tanks (must be empty before shipping) for extended storage periods to resist water condensation.

11. Protect the system from water and dirt.

## OPERATING IN FREEZING CONDITIONS

Allow water to flow through the pump and hoses for 2 or 3 minutes. This should bring the temperature of the system above freezing and prevent ice from forming and getting lodged in the lines. Keep the gun and hose clear of ice by continuously running water through the lines or by the installation of a weep system.

# Maintenance

Before performing any maintenance, shut down the system, disconnect from power, and relieve the pressure in the discharge lines by depressing the trigger on the gun.

## CLEAN FOR MAINTENANCE

If compressed air is used, use eye protection. Exercise caution with solvents. Some may attack paints, insulation and lubricants. Some are highly flammable. If used, make sure the area is well ventilated. If high pressure cleaning is used, use eye protection, and protect electrical components from water. Make sure the equipment is completely dry before returning it to service.

## GENERAL INSPECTION

Check for loose fasteners and guards. Replace any missing, defective, or defeated safety equipment or enclosure panels.

## HIGH PRESSURE PUMP

The pump is a triplex (3 plunger) pump. Each plunger works with an inlet and discharge check valve. Filtered water is drawn into the pump inlet through the inlet check valves as the plungers move back. When the plungers moves forward, the inlet check valves close preventing water from exiting out the inlet port. The water travels through the outlet check valves to the outlet of the pump.

The water pump is very durable. Most suspected pump problems are problems originating from other failed, or improperly adjusted components.

All pumps have replaceable parts. These parts include oil seals, v-packing, o-rings, and check valves. Contact Hydro Engineering for parts and instructions on how to rebuild your pump.

## CHANGING THE OIL

To maintain satisfactory pump performance, the oil level should be checked periodically (according to the interval shown in the **MAINTENANCE SCHEDULE**, if included in your manual). Use fresh 30W non-detergent oil. The oil level may be checked by using the dipstick on top of the pump, or the dot on the oil gauge window on the crankcase. Use the lubricants specified in the pump exploded view diagram. If your system is a direct-drive engine/pump system which utilizes a gear reduction box, use 90W hypoid gear lube oil (9.5 oz.) when replacing the oil in the gear box. Follow the same procedure for changing the pump oil when replacing the gear box oil. **NOTE:** Check oil for contamination and correct level before each use. **NOTE:** Drain the oil after operating the machine. Warm oil drains easily and carries stirred up contaminants with it.

## SAFETY VALVES AND DEVICES

**WARNING: IF A SAFETY DEVICE FAILS REPLACE IMMEDIATELY, DO NOT ATTEMPT TO BYPASS, PLUG OR MANUALLY OVERRIDE. REPLACE WITH FACTORY PARTS ONLY.**

There are a number of automatic controls and safety devices featured on the system. The combination of pressure, flow, and temperature sensors guarantees fail safe operation and protects the system and the operator from potential hazards involved with its use.

## UNLOADER VALVE

The unloader valve controls the flow of water discharged from the water pump either to the bypass port whenever the trigger on the gun is released (closed) or to the high pressure port when the trigger is depressed. These valves are designed to respond to change in either system pressure (pressure-actuated) or flow (flow-actuated). Occasionally, systems that are designed to run at very low PSI will utilize a relief valve to act as an unloader. The operation of this type of relief valve is very similar to an unloader valve.

**WARNING: Do not attempt to adjust the unloader.** The unloader is factory preset to operate at maximum efficiency. Improper adjustment to the unloader could damage the pump or create premature rupture of parts that may cause injury or death.

## PRESSURE SWITCH

The pressure switch is a single pole double throw (SPDT) switch which operates with the rise and fall of system pressure. the electrical operation and fall of system pressure. the electrical operation and the application of the pressure switch is identical to the SPDT flow switch. This switch is often wired in series with another pressure switch or a flow switch. Together they monitor the operation of the pumping system and assist in controlling the operation of the burner. The pressure switch is installed in the high pressure discharge line in a location that is pressurized only when the system is discharging a high velocity water jet from the discharge nozzle. If the burner continues to run while the system is in bypass more than likely the pressure switch has failed. Contact Hydro Engineering for replacement parts.

## RUPTURE DISK

The rupture disk is a device which protects the machine from thermal expansion and excessive pump pressure; if the pressure in the coil reaches 8000# the rupture disk will burst and relieve the pressure. This is not a resetable part. If the disk ruptures replace only with a new disk cap (p/n 0JD373) and check for proper burner operation.

## CHEMICAL INJECTION (OPTION)

The chemical (or soap) injector is a device that is used to meter chemical, or detergents into the high pressure discharge system at a maximum rate of about twenty parts water to one part concentrated chemical solution.

Injectors may be used on systems as either inlet or discharge injectors. Most Hydroblasters use a discharge injector. Discharge injectors are located in the pump outlet plumbing. Injectors on hot water systems are installed in the outlet side of the coil. Systems supplied with high pressure hose reels will often have the injector mounted at the reel inlet, especially if the reel is mounted remotely from the machine. The amount of chemical or soap dispensed can be either increased or decreased by rotating the adjusting knob on the bottom of the injector. Flow may be restricted at the strainer on the chemical pickup line. Flush the strainer with fresh water to clean.

## HEATING SYSTEM

The heating system on this machine is oil-fired or gas fired.

## OIL FIRED BURNER

The oil burner is responsible for creating a mixture of fuel and air (oxygen) and maintaining continuous ignition of that mixture when the call for heat is received.

When the heating system is turned on the following events occur:

- The burner motor, along with the directly coupled blower fan and fuel pump, accelerate to operating speed.
- The fuel pump draws fuel from the supply tank and pressurizes the fuel to between 125PSI and 140PSI.
- The fan injects air into the combustion chamber.
- The fuel solenoid valve opens allowing fuel to be discharged from the fuel nozzle.
- The ignitor assembly is energized creating a continuous high voltage current which arcs across the electrodes in front of the fuel nozzle thereby igniting the fuel air mixture.

Maintenance on the oil burner consists of replacing the fuel oil filter (p/n: OIL194). Contact Hydro Engineering for replacement filter and instructions.

### THE OIL BURNER MOTOR

Some oil burner units require that the electrical motor be periodically lubricated with drops of oil through a small oil hole in the motor cover. If the motor has no hole it is permanently lubricated and requires no oiling. Some motors

have a resettable thermal overload that may need to be reset if the burner motor does not rotate.

## AIR BANDS AND SHUTTERS

Air bands are used to control the amount of air allowed into the combustion chamber. The factory presets (listed on the oil burner diagram) provide good performance under normal operating conditions. Changes in fuel type, operating elevation, or coil condition may require air flow adjustments to maintain a clean burn.

## HIGH TEMPERATURE LIMIT SWITCH

The high temperature limit switch is a NC (normally closed) device that is designed to open a circuit whenever its bimetallic-metallic sensor detects a temperature rise above a preset level. Check the electrical diagram to identify the switch supplied with this system. Most systems come with a non-adjustable temperature switch. This switch is used to open the electrical circuit which supplies power to the burner system if the system temperature exceeds the device's preset limit. Once the system temperature drops to normal levels, the switch automatically resets. This switch is mounted in the plumbing on the discharge side of the heating coil. On most Hydroblasters, the switch has a preset temperature of 225 degrees Fahrenheit. On steam units, it is set at 325 degrees.

## HEATING COIL

The heating coil absorbs the heat generated by the burner in the combustion chamber and transfers the heat to the water flowing through it. Coils are constructed from lengths of pipe welded end to end. A continuous length of pipe is wrapped around one or more mandrels to create a hollow combustion chamber and a pancake section. To prolong the life of the coil have it descaled and or desooted regularly.

## HOSES

Visually inspect the hose before using the machine and as indicated in the **MAINTENANCE SCHEDULE**, if included with your manual. Check for evidence of cracks, crushed areas, blisters, bulging, cuts, leaks, and chafing. Replace as necessary.

## NOZZLES

**WARNING:** When changing nozzles using quick disconnects, check to see that the locking ring has snapped into the lock position. If the ring has not properly locked into position, the nozzle will be ejected out of the lance as soon as the trigger is depressed, possibly causing property damage and/or bodily injury.

NOTE: When checking the nozzle for obstruction(s), make sure that the system has been turned off and the pressure released.

# Troubleshooting

**▲ CAUTION: RELIEVE PRESSURE BEFORE ATTEMPTING TO DISCONNECT ANY FITTINGS OR HOSES! NOTE: FOR ENGINE TROUBLESHOOTING, REFER TO ENGINE MANUAL.**

## NO WATER DISCHARGED FROM NOZZLE

1. Verify that the water supply is on to the system. Check the inlet water bowl filter screen. This filter must be free of contaminants. Check pump inlet lines and filters for air leakage. Make sure that the pump is being driven by the motor either by observing the pump crankshaft or by observing oil movement in the oil level window.

Listen carefully for any unusual pump noises that might indicate a broken crankshaft or connecting rod. Refer to the **PUMP NOISE** heading in this section for further information.

Check for a plugged nozzle, a plugged nozzle screen, or a restriction in the high pressure discharge lines. Identifying the problem is best achieved through process of elimination. Install a pressure gauge at the pump head. If the operating pressure (discharge mode only) is in excess of the nameplate pressure rating, start with the removal of the discharge nozzle and continue removing components as indicated, working back toward the high pressure pump, until the problem is identified. With all discharge plumbing removed, the pressure at the pump should be 0 PSI.

If it hasn't been done already, remove the trigger gun. Blow through it to check for restrictions.

2. The discharge chemical injector has an internal orifice that may be obstructed. The injector will normally maintain a back pressure of 600 to 900 PSI (varies with different system flow rates) at the pump head when the discharge is open (no nozzle installed). If a higher pressure is observed, the injector should be removed from the system. Inspect and clean as required. Refer to the information under the **CHEMICAL INJECTION** heading in this TROUBLESHOOTING section for additional information.

If the system is not equipped with a discharge injector, pump head pressure should not exceed 200 PSI when operated with standard hose lengths (40 to 50 ft.), and without the nozzle installed.

3. If the pump water supply originates in a holding tank, the pump may have lost its prime. If the system has been purged of water for service, shipment, or storage purposes, or if it ran out of water during operation, it may need to be primed.

Generally, the unit will prime itself if it is operated for ten to twenty seconds with the trigger of the on/off gun depressed. If the system will not self prime, it has an air lock or an obstruction. To clear the air lock, open the priming valve on the discharge port of the pump to the atmo-

sphere. Turn the system on and then off, allow it to come to a complete stop. Continue jogging the pump until water begins exiting the open port.

## EXCESSIVE PRESSURE

If the pump is pumping water out of the priming valve but no water is discharged from the nozzle after the valve is closed, the system may have a defective unloader valve, a plugged nozzle, or a discharge line obstruction.

## LOW PRESSURE

1. When low pressure is suspected, install a test gauge in the high pressure discharge line as close as possible to the pump and a second gauge at the inlet of the trigger gun. Test the operating pressure at both locations. Do not depend on the system gauge, it may possibly be defective or out of calibration.

**NOTE:** All system nameplate pressure ratings indicate the pressure at the pump.

2. A worn nozzle is the most likely reason for low pressure. The pressure that the system produces depends on the size of the orifice in the nozzle and the amount of water being pushed through it. As water flows through the nozzle, the diameter of the orifice is increased. Because it requires less pressure to push the flow through a larger hole, the system pressure declines. Consult the system serial tag for the volume and pressure rating of the unit. Using this information, refer to the **NOZZLE SPECIFICATION CHART** to determine the proper nozzle for your system.

3. A pressure drop at the discharge nozzle is experienced whenever water flows through pipes, orifices, control valves, and hoses. If the pump head pressure is within specification but the pressure at the nozzle is low, excessive discharge restrictions are indicated. Check for a plugged nozzle, a plugged nozzle screen, or a restriction in the high pressure discharge lines. Identifying the problem is best achieved through process of elimination.

Observe the pattern of the water as it is discharged from the nozzle. If it is inconsistent, an obstruction is indicated. Remove the nozzle and clean thoroughly.

Remove the gun, wand, and nozzle assembly. Blow through it to check for restrictions.

Inspect the discharge hose for kinks or flat spots.

3a. The orifice in the discharge injector may be obstructed. To determine the back pressure that should be maintained at the inlet of the injector when the discharge is open, first consult the soap injector specification sheet to determine the size of the orifice in the injector. Then turn to the **NOZZLE SPECIFICATION CHART**. Locate the orifice size in the left column and move across the chart to the

rated flow of the unit. The top of this column contains the rated pressure of the injector nozzle. If a higher pressure is observed on a gauge installed at the inlet of the injector, the injector should be removed from the system. Inspect and clean as required.

When the chemical injector has been removed from the discharge line, the pump head pressure should not exceed 200 PSI when the system is operated with the standard 50 out of discharge hose, and without the nozzle installed.

If high pressures are observed, install a 300 PSI test gauge at the inlet of the coil and remove the discharge hose, gun, and wand assembly. If the pressure loss (pressure created by the resistance to the water flowing through the coil) exceeds 100 PSI, the coil has a build up of internal deposits which must be removed.

4. The unloader valve may be malfunctioning. It may be allowing excessive amounts of water to flow from its bypass port while in high pressure mode. Observe the flow from the bypass port of the valve with the trigger depressed on the on/off gun. A small amount of water flow from the bypass port is required for proper valve operation (10% of the system's rated flow for pressure actuated and 5% for flow actuated unloaders). If, after adjustments, the bypass flow exceeds these amounts, repair or replace the valve.

5. Worn pump packing or piston/plunger damage may be indicated. Refer to the **PREMATURE SEAL FAILURE** and **PREMATURE PLUNGER FAILURE** headings in this section for further information.

6. Check valves direct the flow of water through the pump. If they do not seal properly, the output of the pump can be severely reduced. Refer to the **PREMATURE VALVE FAILURE** heading in this section for further information.

7. Discharge leaks will reduce the system pressure. Repair leaks immediately.

## PRESSURE IS ERRATIC AND/OR LOW

1. Restrictions in the pump supply lines will affect the pump discharge pressure. Check the lines for kinks, cracks, holes, or abrasions.

If the system is equipped with an optional inlet soap injection system, make sure that the soap metering valve is off, the hoses and connections are sound, and that the soap pickup line is completely submerged in the soap solution. A restrictive orifice is placed in the pump inlet supply line to produce sufficient vacuum at the pump inlet to suck the soap into the system. Make sure that the restrictor orifice is properly located, clear of obstructions, and of the correct size. If the problem persists, but only when the soap valve is turned on, tighten the valve stem packing nut on the soap valve.

2. The introduction of air into the pump inlet lines, will cause erratic pump output. Check the supply lines for kinks, cracks, holes, or abrasions.

## WATER LEAKAGE

1. If the pump manifold shows signs of leakage, a loose plug, fitting, or defective O-ring is indicated. Check the threads and O-ring for damage, if the threads are damaged, check the threads in the manifold. Inspect the manifold for cracks. Do not attempt to use a component that shows signs of mechanical damage. Replace as required.

2. Water leakage underneath the manifold generally indicates that the pump packing is worn. It may also be caused by a defective packing support component, a loose or cracked plunger, defective internal plunger seal O-rings, or the manifold may be cracked.

3. If a pipe fitting is leaking, separate the connection, check for cracks in the fittings. If no defects are observed, apply a minimum of three full wraps of teflon tape to the threads. When applying the tape make sure to leave the first thread clean of tape. This will help avoid contaminating the system with pieces of teflon tape.

4. If a quick disconnect assembly is leaking, service or replace as indicated in the MAINTENANCE section of this manual.

5. Leakage from the on/off gun must be repaired immediately. Guns may be rebuilt by qualified service personnel, but the cost of replacement with a new unit is generally about the same.

6. Discharge hose leaks generally occur at the fitting adjacent to the on/off gun. Because this leak imposes a potential personal safety problem as well as contributing to erratic system operation, it should be repaired immediately. Inspect the hose for damage as outlined in the MAINTENANCE section. If any of these defects are found, replace the assembly. If the hose is in good shape, a new end can be installed. Make sure to reinstall the hose guard at the operator's end of the hose. It will protect the operator from leaks and reduce the strain applied to the hose. Field repair ends are available for short term repairs but are not recommended for continuous service.

7. External unloader valve leakage of any type is unacceptable. A personal safety problem may be indicated. Refer to the **UNLOADER VALVE** heading in the MAINTENANCE section

8. Pop off valve leakage indicates a defective valve. Replace the valve.

## OIL LEAKAGE

1. When oil leakage is observed, check the oil sight gauge or the dip stick to determine if excess oil is in the

crankcase. The pump has a tendency to throw oil or blow seals when overfilled.

2. Oil leakage between the crankcase and the wet end indicates that the piston/plunger rod seals are worn or extruded from their housing.
3. Oil leakage around the crank output shaft indicates that the seal is worn or extruded, the seal retainer O-ring is defective, the crankshaft is worn or has excessive side to side movement, or a main bearing is defective.
4. Oil leakage at the rear of the crankcase indicates that the oil sight gauge, rear cover, or dip stick seals are defective. Inspect the oil sight gauge and rear cover screws for tightness and make sure that the rear cover O-ring is intact and properly installed.

## OIL CONTAMINATION

1. Water in the crankcase can be caused by condensation accumulating in the pump. Shorten the interval between oil changes to eliminate this problem.

Inspect the area under the pump between the crankcase and wet end. If water is present, refer to the **WATER LEAKAGE** heading in this section. Water that leaks from the wet end can travel along the piston/plunger rod and enter the crankcase. Repair the leak and change the oil.

2. Particle contamination in the crankcase oil indicates a potential failure in the drive end of the pump. If the particles are brass or silver shavings, bearing wear is indicated.

NOTE: It is not unusual for a new pump to show some small particle contamination at the first 50 hour oil change. The contamination is a combination of residues left by manufacturing and the break-in process.

## PUMP NOISE

1. A regular loud knocking noise may indicate that the crankshaft is not properly engaging the associated drive component. Tighten or replace as required. If removal is required, verify the integrity of the mating surfaces and the keystack material. Make sure that the surface of the shaft is not scored.

If the drive system is secure, the crankcase must be opened to allow inspection of the pump main bearings, connecting rods, crankshaft, and crossheads.

2. An erratic tapping noise, often in combination with low pressure, indicates a problem in the wet end of the pump. Generally this is a result of a restricted water supply, worn packing or check valves.

## PREMATURE SEAL FAILURE

1. A damaged plunger or cylinder housing surface that abrades either the internal or external sealing edges of the

packing will damage the seals. Inspect all static and dynamic surfaces when replacing the packing and make sure that all support rings and adapters are in perfect condition.

2. Abrasives in the fluid being pumped will reduce the life of the packing. The reduction in seal life depends on the size and type of abrasives suspended in the water. It is recommended that no particles over 25 microns be allowed into the Hydroblaster.

3. Excessive pump inlet pressure or vacuum (causes cavitation), excessive pump discharge pressure, and excessive pump inlet water temperature can all reduce packing life. Consult the PUMP exploded view diagram for the correct operational limits.

4. Running the pump dry for more than two or three minutes will also damage packings.

## PREMATURE VALVE FAILURE

Valve wear can be caused by cavitation (high water inlet vacuum, often in conjunction with elevated inlet water temperatures), or abrasives in the water. Make sure that the water supply is adequate and properly filtered.

## PREMATURE PLUNGER FAILURE

1. Excessive plunger wear, like wear, can be caused by cavitation (high water inlet vacuum, often in conjunction with elevated inlet water temperatures), or abrasives in the water. Make sure that water supply is adequate and properly filtered.

2. Extreme or sudden temperature variations can cause the plunger to crack.

## CHEMICAL INJECTION (OPTIONAL)

If the chemical injection system provides only low or no soap flow, begin troubleshooting by:

1. Verifying that the solution pick up line is not drawing air. The line must be in the solution (it has a tendency to float) and it must be securely attached to the chemical inlet port and the suction screen. Check the chemical pick up screen and the line to make sure that they are clean and free of obstructions

2. Check for an obstruction in the chemical injector. The orifice in the injector is small. If an object obstructs the flow of water through the injector, soap flow may stop and system pressure may rise beyond rated output. The injector must be removed from the line to clear the obstruction.

3. Check for excessive restrictions in the discharge high pressure hose line.

4. Check for a stuck check valve in the chemical suction port of the injector. The ball in this valve may become stuck

or the O-ring that the ball seals against may become damaged. Replace.

5. The system discharge water temperature may be too high. The performance of the injector will begin to decline as water temperatures approach 180 degrees F. At 200 degrees F discharge temperature, the injector will no longer operate. If the application requires elevated water temperatures, consider installing an optional inlet water chemical injection system. If elevated temperatures are not required, reduce the BTU input into the heating system.

If the chemical injector discharges water into the solution concentrate, the check valve is not operating and requires service. Replace as required.

## Nozzle Specification Chart

**Table 1: NOZZLE VOLUME (GPM) AT VARIOUS PRESSURES (PSI)**

Nozzle Size	Orifice Dia. (in)	Orifice Dia. (mm)	40 PSI	100 PSI	250 PSI	500 PSI	600 PSI	700 PSI	800 PSI	1000 PSI	1200 PSI	1500 PSI	2000 PSI	2500 PSI	3000 PSI	3500 PSI	4000 PSI
2	.034	.86	.20	.32	.50	.71	.77	.80	.89	1.0	1.1	1.2	1.4	1.6	1.7	1.9	2.0
4	.052	1.32	.40	.63	1.0	1.4	1.6	1.7	1.8	2.0	2.2	2.5	2.8	3.1	3.5	3.8	4.0
4.5	.055	1.4	.45	.71	1.1	1.5	1.7	1.9	2.0	2.2	2.4	2.8	3.0	3.6	3.9	4.3	4.5
5	.057	1.45	.50	.79	1.3	1.8	1.9	2.1	2.2	2.5	2.8	3.1	3.6	4.0	4.4	4.7	5.0
5.5	.060	1.52	.55	.87	1.4	1.9	2.1	2.3	2.5	2.8	3.0	3.4	3.8	4.4	4.8	5.2	5.5
6	.062	1.57	.60	.95	1.5	2.1	2.3	2.5	2.7	3.0	3.2	3.7	4.2	4.8	5.2	5.6	6.0
6.5	.064	1.63	.65	1.0	1.7	2.3	2.5	2.7	2.9	3.3	3.6	4.0	4.6	5.2	5.7	6.0	6.5
7	.067	1.7	.70	1.1	1.8	2.5	2.7	2.9	3.1	3.5	3.8	4.3	5.0	5.6	6.1	6.6	7.0
7.5	.070	1.78	.75	1.2	1.9	2.7	2.9	3.2	3.4	3.8	4.1	4.6	5.3	6.0	6.5	7.0	7.5
8	.072	1.83	.80	1.3	2.0	2.8	3.1	3.4	3.6	4.0	4.4	5.0	5.6	6.2	7.0	7.5	8.0
8.5	.074	1.88	.85	1.3	2.2	3.0	3.3	3.6	3.8	4.3	4.6	5.3	6.0	6.7	7.4	8.0	8.5
9	.076	1.93	.90	1.4	2.3	3.2	3.5	3.8	4.0	4.5	5.0	5.5	6.4	7.1	7.8	8.5	9.0
9.5	.078	1.98	.95	1.5	2.4	3.4	3.7	4.0	4.3	4.8	5.2	5.8	6.8	7.6	8.3	9.0	9.5
10	.080	2.03	1.0	1.6	2.5	3.5	3.9	4.2	4.5	5.0	5.4	6.1	7.0	8.0	8.7	9.4	10.0
12	.087	2.21	1.2	1.9	3.0	4.2	4.6	5.0	5.4	6.0	6.4	7.3	8.4	9.5	10.4	11.2	12.0
15	.094	2.39	1.5	2.4	3.8	5.3	5.8	6.4	6.8	7.5	8.2	9.2	10.6	12.0	12.9	14.0	15.0
20	.109	2.77	2.0	3.2	5.0	7.1	7.8	8.4	9.0	10.0	10.8	12.2	14.2	16.0	17.4	18.8	20.0
30	.141	3.58	3.0	4.7	7.5	10.6	11.6	12.8	13.6	15.0	16.4	18.4	21.2	24.0	26.0	28.0	30.0
40	.156	3.96	4.0	6.3	10.0	14.2	15.6	16.8	18.0	20.0	21.6	24.4	28.4	32.0	34.8	37.6	40.0

A commonly used standard for nozzle size is the nozzle number which is equivalent to the nozzle flow capacity in gallons per minute (GPM) at 4000 pounds per square inch (PSI) pressure. The nozzle spray angle is the arc of the spray pattern, usually 0, 15, 25, or 40 degrees, in high pressure cleaning applications. The spray angle does not affect the nozzle volume.

To determine the nozzle required for your system, refer the system identification plate for the rated volume and pressure. Scan the top row of the nozzle specification chart to find the desired operating pressure. The operating pressure selected may generally be any pressure less than or equal to the maximum system operating pressure. Scan down the column with the selected operating pressure header until you reach the cell with a flow rate that is 5 to 10 percent less than the system flow rate (5 to 10 percent of flow is required through the bypass port of the unloader valve for proper operation). Finally, scan left from the selected flow rate cell to read the nozzle size in the far left cell of the row.

To order replacement nozzles, specify the nozzle size and the spray angle.

## Maintenance Schedule

**Table 2: MODELS: ALL HOT WATER, ENG. DRIVEN, OIL-FIRED HYDROBLASTERS™**

DO THE SPECIFIED TASK	AFTER EACH CYCLE OF INDICATED HOURS					
	Every Day	After first 50 hours	50 Hours	100 Hours	500 Hours	Yearly
Inspect engine generally.	<input type="checkbox"/>					
Inspect system wiring for fraying, broken wires, etc. Repair as necessary.				<input type="checkbox"/>		
Inspect all hoses and fittings on machine.	<input type="checkbox"/>					
Inspect all nozzles on the system clean or replace as necessary.			<input type="checkbox"/>			
Inspect water filter for contaminants.	<input type="checkbox"/>					
Check fuel levels in gas tank and oil tank.	<input type="checkbox"/>					
Check oil level in engine and pump.	<input type="checkbox"/>					
Replace pump/gearbox crankcase oil.		<input type="checkbox"/>			<input type="checkbox"/>	
Replace engine oil.		<input type="checkbox"/>		<input type="checkbox"/>		
Replace fuel filter on oil burner.		<input type="checkbox"/>		<input type="checkbox"/>		
Replace air filter(s) on engine (see eng. manual).				<input type="checkbox"/>		
Replace fuel filter on engine (see eng. manual).				<input type="checkbox"/>		
Replace oil filter on engine (see eng. manual).				<input type="checkbox"/>		
Inspect belts for tightness.				<input type="checkbox"/>		
Replace belts on engine (see eng manual).					<input type="checkbox"/>	
<b>For systems with a trailer:</b>						
Make a visual inspection of the trailer (including the axle and suspension systems).					<input type="checkbox"/>	
Inspect brake linings.						<input type="checkbox"/>
Check for proper operation of the parking brake system (If so equipped).					<input type="checkbox"/>	
Check tire tread wear.						<input type="checkbox"/>
Grease wheel bearings.						<input type="checkbox"/>

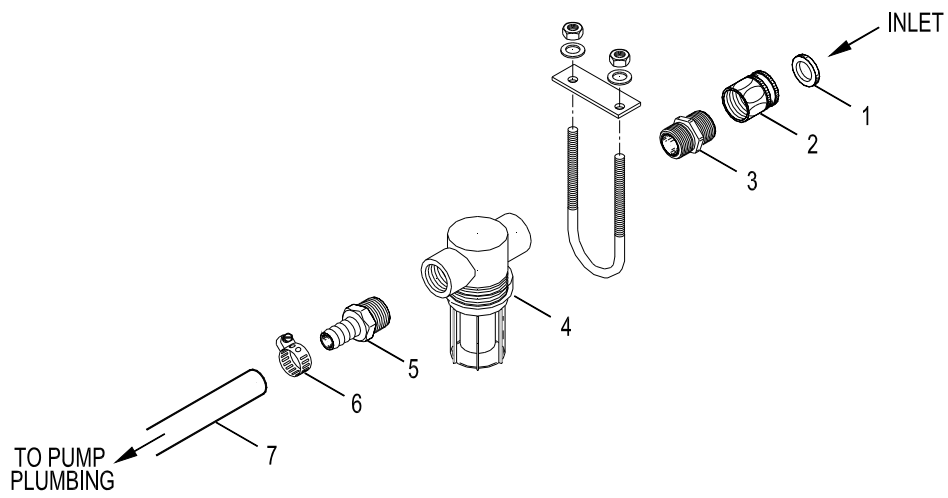
**NOTE: Check the engine owner's manual for a maintenance schedule specifically setup for the engine.**

Follow a regular schedule of inspection and servicing, based on operating hours. Keep an accurate log book of maintenance, servicing, and operating time. Use the "Maintenance Schedule" (based on favorable conditions) to serve as a guide to get long and efficient operation of your Hydroblaster.

Regular service periods are recommended for normal service and operating conditions. For severe duty, extreme temperatures, etc., service more frequently. Neglecting routine maintenance can result in individual or multiple component failure on the Hydroblaster™.

**Diagrams**

DIAGRAM 1: EXPLODED VIEW: INLET FILTER PLUMBING -- GOVS



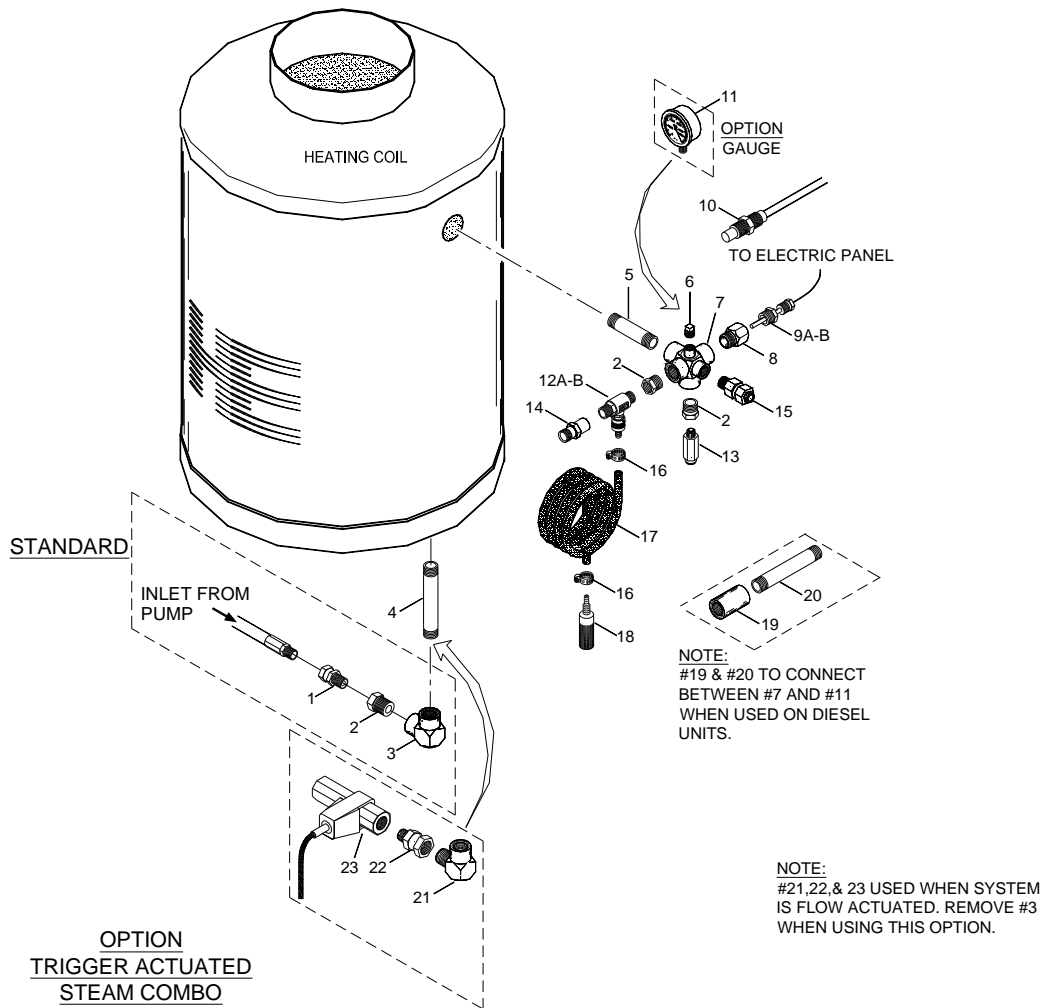
PARTS LIST

#	PART #	DESCRIPTION	#	PART #	DESCRIPTION
1	1HR755	WASHER, GARDEN HOSE	5	0FX533	HOSE BARB, 3/4" HB x 3/4" MPT
2	0OW863	COUPLER, SWIVEL, 3/4" FGH x 3/4" FPT	6	1DZ790	CLAMP, HOSE, 9/16" - 1 1/4"
3	0DY027	NIPPLE, BRASS 3/4" MPT	7	0GF610	HOSE, ALL-PURPOSE, 3/4"
4	1LM742	FILTER, WATER, INLET, CLEAR, 3/4"			

PN: PLGSVINLT

01-27-03 #1

**DIAGRAM 2: EXPLODED VIEW: GVS/SSV: COIL INLET/DISCHARGE PLUMBING**



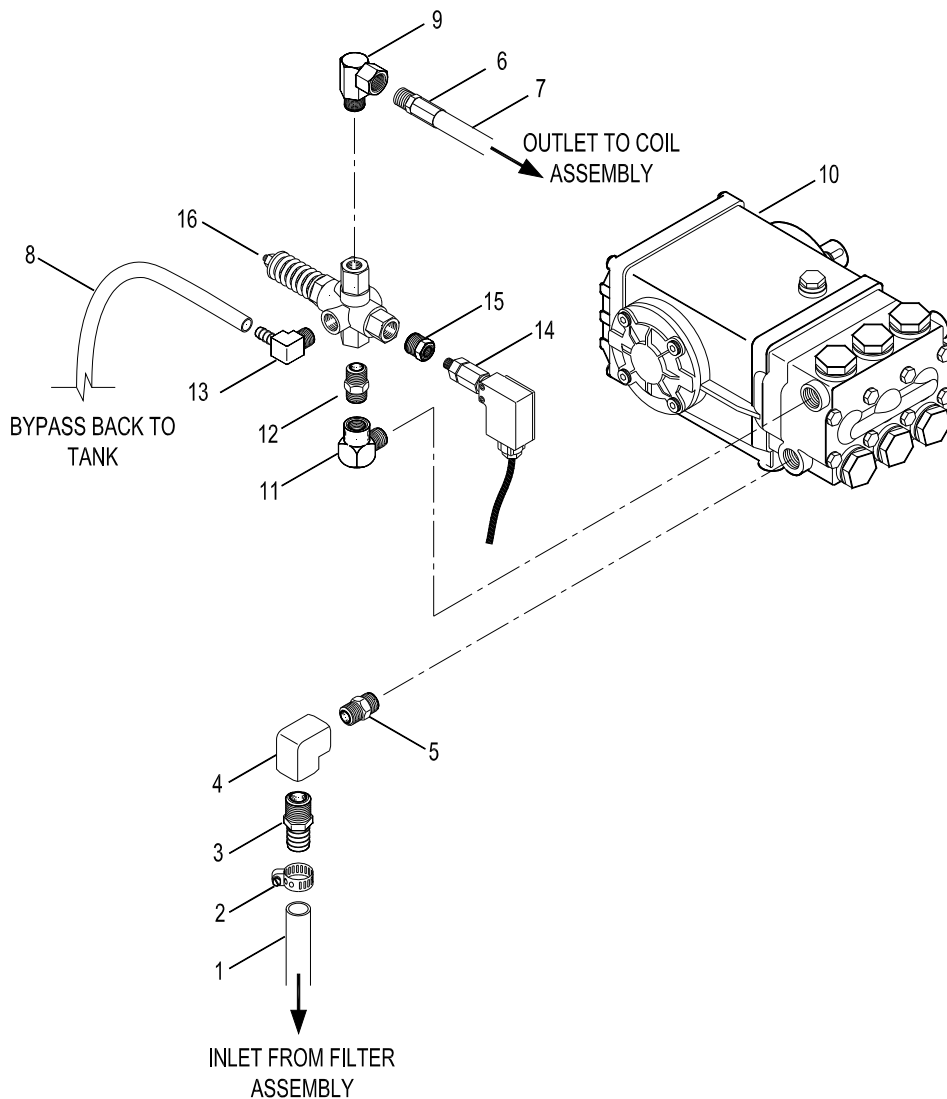
**\* PARTS LIST \***

#	PART #	DESCRIPTION	#	PART #	DESCRIPTION
1	0AH074	SWIVEL, 3/8MPT X 3/8FPT	12B	0MH199	INJECTOR, CHEMICAL, (2.1 MM), 4-5 GPM
2	1MA889	BUSHING,RDCR,HEX,SCH 80,1/2MPTX3/8FPT	13	0DM909	VALVE, RELIEF, 0-6000 PSI, 1-6 GPM
3	1LZ872	ELBOW, PIPE, SCH80, 1/2FPT	14	1T1780	TWIST QD, NIPPLE, BRASS, 3/8" FPT x MPT
4	1LZ879	NIPPLE, SCH80, 1/2" MPT x 5" LONG	15	0JD372	RUPTURE DISK ASSY, 8000#, 3/8" MPT
5	1LZ876	NIPPLE, SCH80, 1/2" MPT x 3" LONG	16	1JO243	CLAMP, HOSE, 7/32" - 5/8"
6	0DR951	PLUG, BRASS, 1/4"	17	0VG627	HOSE, ALL-PURPOSE, 1/4"
7	1LY865	CROSS, MULTI, 8FPTx4FPTx8FPTx8FPTx6FPTx8FPT	18	1MT073	STRAINER, CHEMICAL
8	0DU989	ADAPTER, BRASS 1/2" MPT x 1/2" FPT	19	1LZ870	COUPLING, SCH80, 1/2" FPT
9A	1NZ396	THERMOSTAT, SPDT, ADJ: 30/150 C, 5" CAP	20	S8PN-5	NIPPLE, SCH80, 1/2" MPT x 5" LONG
9B	1SU649	THERMOSTAT, SPDT, ADJ: 86/250 C, 5" CAP	21	1LZ872	ELBOW, STREET, SCH80, 1/2FPT X 1/2MPT
10	0DO920	THERMOSTAT, 225" HIGH LIMIT, NC	22	0AH076	SWIVEL, HYDRAULIC, 3/8MPT X 1/2FPT
11	0QY402	GAUGE, PRESSURE, 0-5000 PSI, B.M.	23	1PN798	SWITCH, FLOW, 5000 PSI, 8 GPM, 40-180° F
12A	0MH198	INJECTOR, CHEMICAL, (1.8 MM), 3-3.5 GPM	24		

PLSSVD-35GR1

06-01-12

**DIAGRAM 3: EXPLODED VIEW: PUMP PLUMBING, GOVS, BELT-DRIVEN W/TS PUMP**



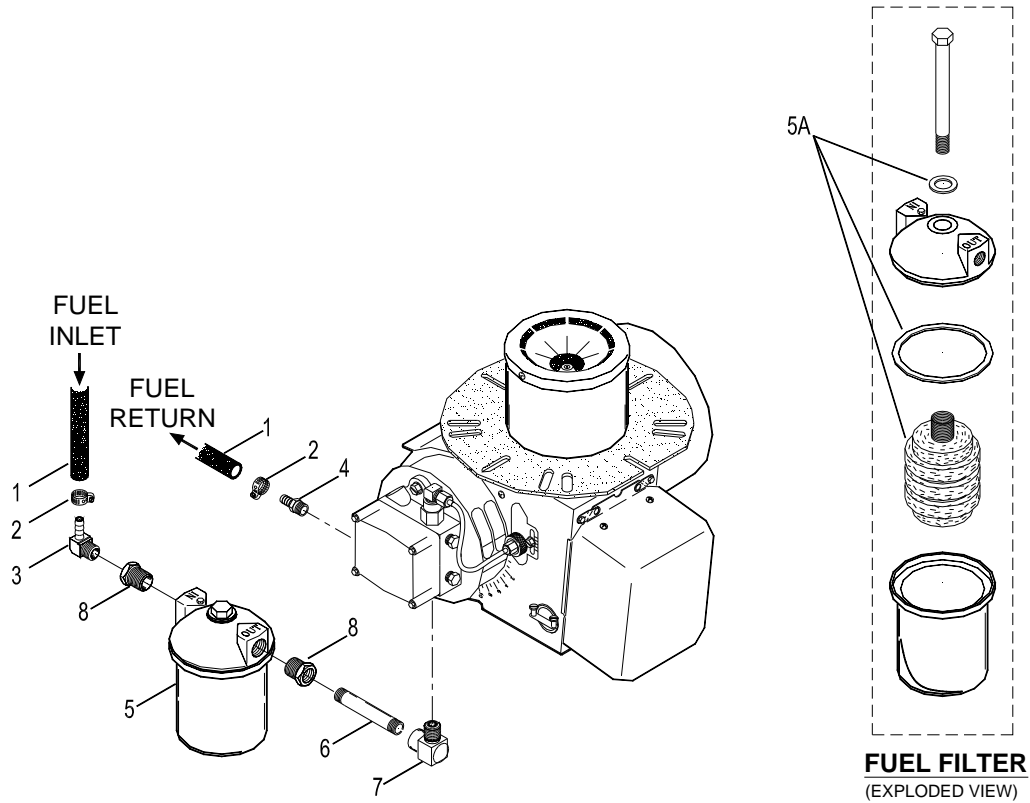
**\* PARTS LIST \***

#	PART #	DESCRIPTION	#	PART #	DESCRIPTION
1	0GF610	HOSE, ALL-PURPOSE, 3/4"	10	PUMP	SEE EXPLODED VIEW DIAGRAM
2	1DZ790	CLAMP, HOSE, 9/16" - 1 1/4"	11	1LX855	ELBOW, STREET, SCH80, 3/8" MPT x FPT
3	0FX535	HOSE BARB, BRASS, HX STOCK, 3/4HBX1/2MPT	12	1LX850	NIPPLE, SCH80, 3/8" MPT x 1" LONG
4	0ED075	ELBOW, BRASS, BAR STOCK, 1/2FPT	13	2HV553	HOSE BARB, LOC ON,90DEG. 3/8"HBX3/8"MPT
5	0DZ031	NIPPLE, HEX, BRASS BAR STOCK, 1/2"	14	0TA946	SWITCH, PRESSURE, 3 WIRE
6	0QD941	CRIMP END, HOSE, 3/8" MPT x 3/8" CRIMP	15	1LY861	BUSHING,RDCR,SCH80, 3/8" MPT x 1/4" FPT
7	0ZX736	HOSE, PRES. WASHER, 3/8" ID, 3000PSI	16	1PB671	UNLOADER, PRESSURE, GPM @3150 PSI
8	2HV556	HOSE, LOCK ON, 3/8",BLACK			
9	0JZ598	STREET ELBOW, 90', HYDRAULIC, 3/8"MXF			

GSV\GOVSBP2TNK.DWG

04-02-08

**DIAGRAM 4: EXPLODED VIEW: OIL BURNER PLUMBING -- VERTICAL COIL UNITS**



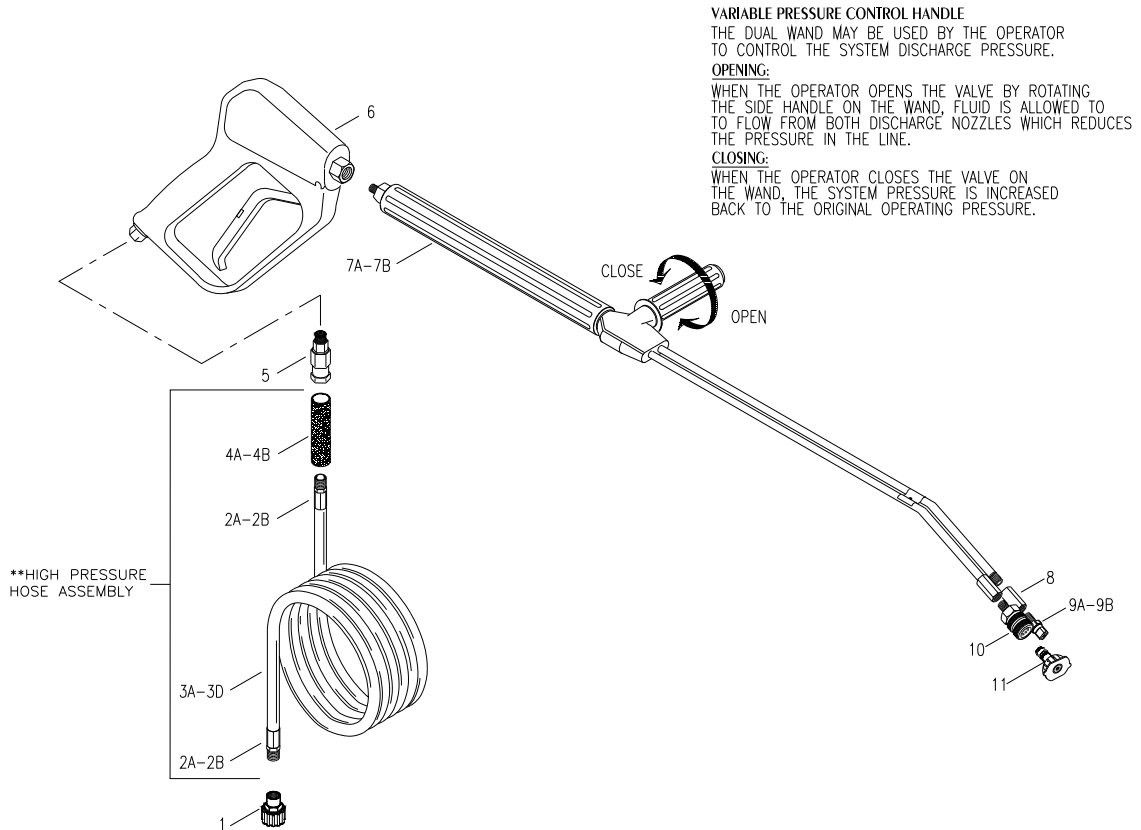
**\* PARTS LIST \***

#	PART #	DESCRIPTION	#	PART #	DESCRIPTION
1	1GJ415	HOSE, FUEL, 1/4" ID	5A	0IL194	ELEMENT KIT, FUEL FILTER, FOR 1A-25A FILTERS
2	1JQ243	CLAMP, HOSE, 7/32" - 5/8"	6	1LV835	NIPPLE, SCH80, 1/4" MPT x 2" LONG
3	0DE601	HOSE BARB, 90°, 1/4" HB x 1/4" MPT	7	1LW840	ELBOW, STREET, SCH80, 1/4" FPT x 1/4" MPT
4	0FY543	HOSE BARB, BRASS, 1/4" HB x 1/4" MPT	8	1LY861	BUSHING,RDCR,HEX,SCH 80,3/8MPTX1/4FPT
5	0IL193	FILTER, FUEL W/ELEMENT, 1/4" FPT IN/OUT			

PN: PLVOBR-PL

11-08-10

**DIAGRAM 5: EXPLODED VIEW: HOSE, WAND, & GUN ASSEMBLY - #ZZDBL DUAL LANCE**

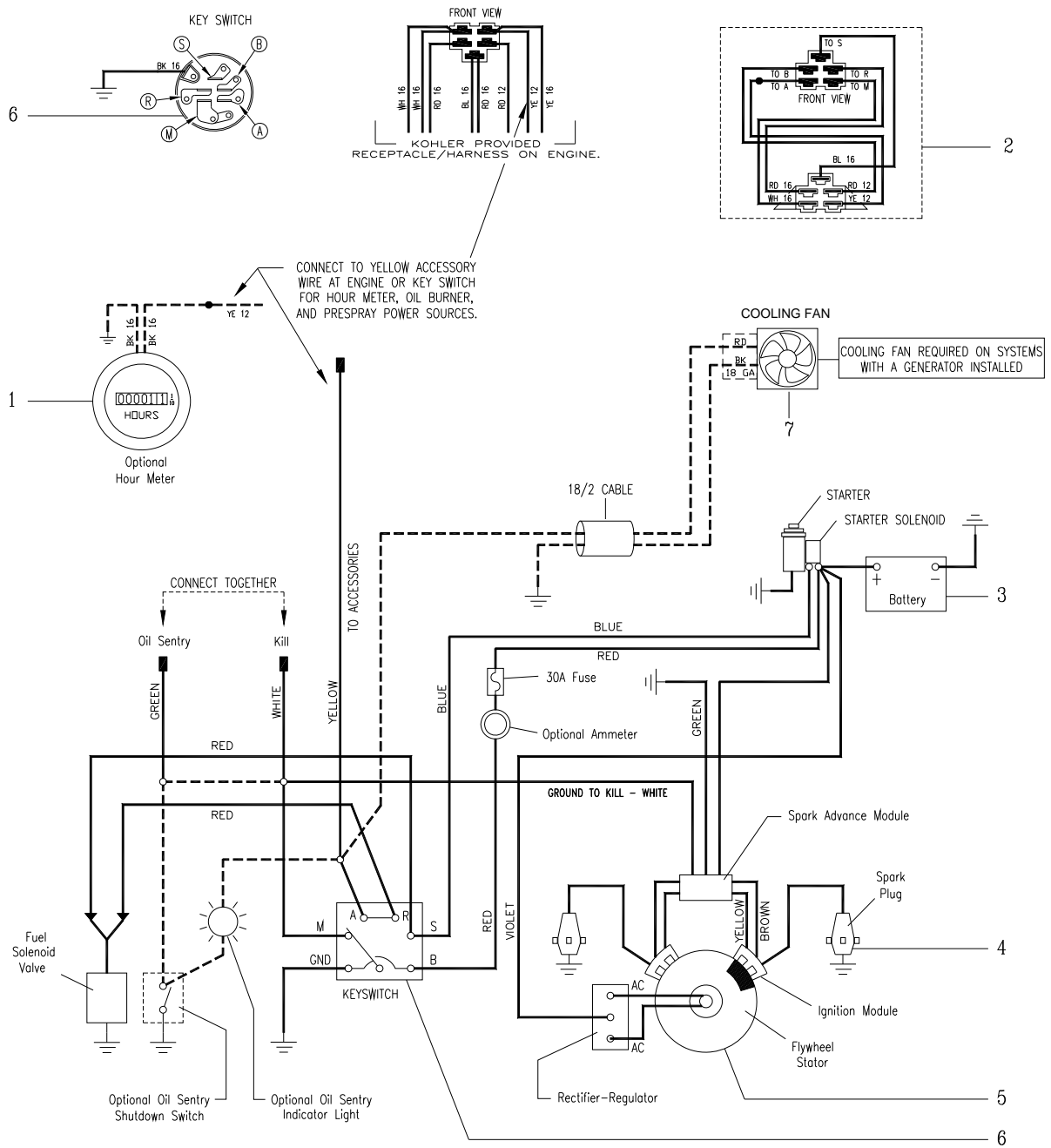


\* REFER TO THE TABLE FOR INFORMATION.  
 \*\* HIGH-PRESSURE HOSE ASSEMBLIES INCLUDE ALL ITEMS SHOWN IN GROUP. ASSEMBLIES ARE AVAILABLE IN STOCK LENGTHS OF 15, 50, AND 100 FT. OTHER LENGTHS MAY BE SPECIFICALLY ORDERED.

#	PART #	SPECIFIC INFORMATION
2A	ODQ941	USED WITH ALL 3/8"ID HIGH PRESSURE HOSE.
4A	OHZ073	
2B	ODQ942	USED WITH ALL 1/2"ID HIGH PRESSURE HOSE.
4B	OHZ078	
9A	OSU880	USED ON ALL INDUSTRIAL MACHINES
9B	OSS864	USED ON ALL SCREENPRINT MACHINES

PARTS LIST					
#	PART #	DESCRIPTION	#	PART #	DESCRIPTION
1	1T1784	COUPLER, TWIST-DISCONNECT, BRASS, 3/8" FPT	6	ON/OFF GUN, CALL FOR PART NUMBER	
2A*	ODQ941	CRIMP END, HP HOSE, 3/8"MPT X 3/8"CRIMP	7A	1PD699	WAND, DUAL, VARIABLE PRESSURE, 36"
2B*	ODQ942	CRIMP END, HP HOSE, 3/8"MPT X 1/2"CRIMP	7B	1PE701	WAND, DUAL, VARIABLE PRESSURE, 72"
3A**	OZ741	HOSE, HIGH PRESSURE, 3/8"ID, 4500PSI MAX.	8	1CP439	COUPLING, REDUCER, DUAL WAND, 1/4" X 1/8"
3B**	OZ736	HOSE, HIGH PRESSURE, 3/8"ID, 3000PSI MAX.	9A*	OSU880	NOZZLE, 40', #20 ORIFICE, BRASS, 1/4"MPT
3C**	1BX257	HOSE, HIGH PRESSURE, 1/2"ID, 3500PSI MAX.	9B*	OSS864	NOZZLE, 40', #10 ORIFICE, BRASS, 1/4"MPT
3D**	1BX255	HOSE, HIGH PRESSURE, 1/2"ID, 2000PSI MAX.	10	1E1887	COUPLER, QUICK-DISCONNECT, 1/4"MPT, BRASS
4A*	OHZ073	STRAIN RELIEVER, FOR 3/8"ID HP HOSE	11		HIGH PRESSURE NOZZLE, REFER TO THE NOZZLE CHART FOR SIZE
4B*	OHZ078	STRAIN RELIEVER, FOR 1/2"ID HP HOSE			
5	1TH774	SWIVEL, BRASS, 3/8" MPT X FPT, 3650#, 320 °F			

**DIAGRAM 6: ELECTRICAL SCHEMATIC: 12-25 HP KOHLER ENG., 15A REGULATED BATTERY CHARGING SYS.**

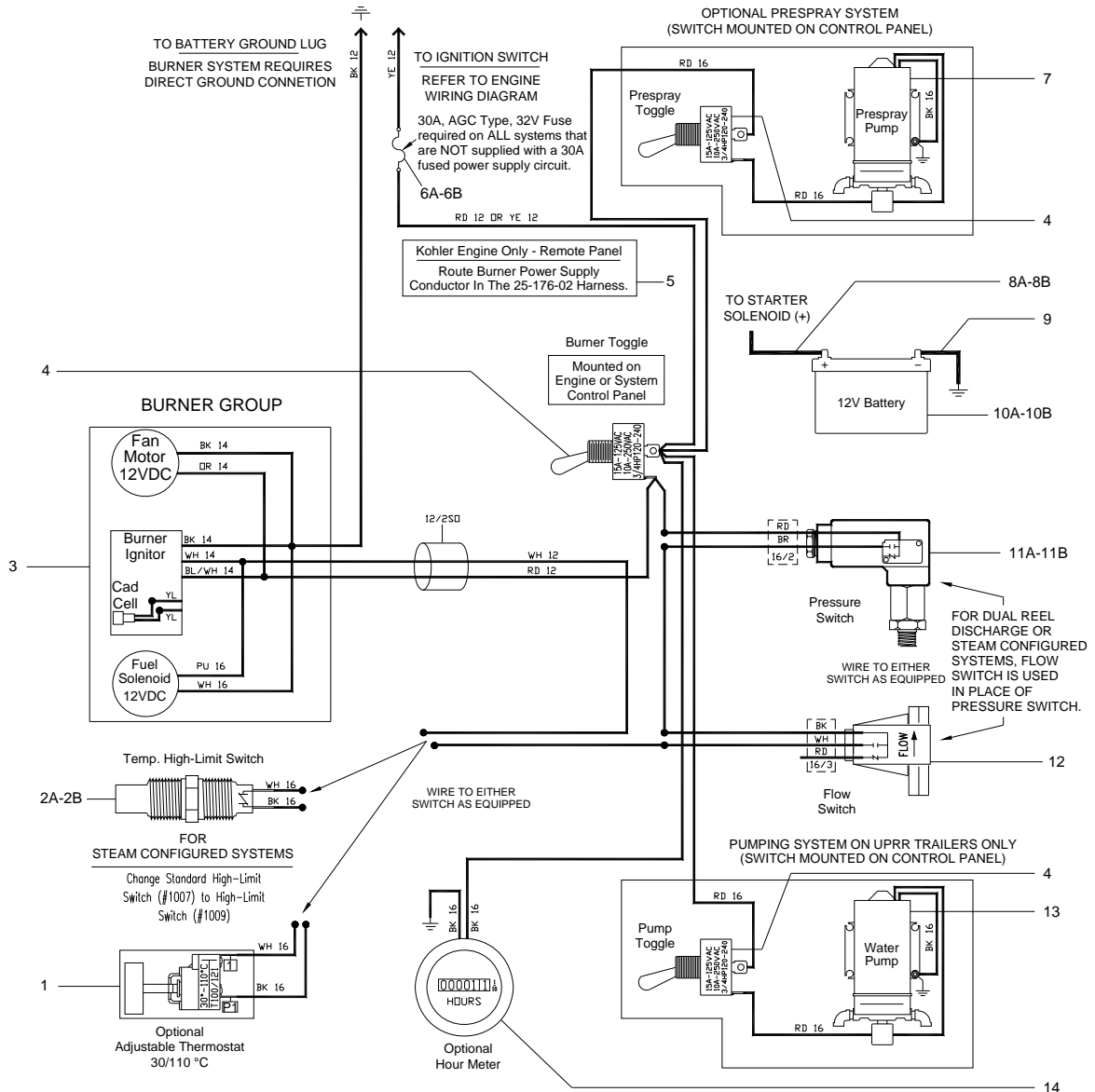


**\* PARTS LIST \***

#	PART #	DESCRIPTION	#	PART #	DESCRIPTION
1	OGY862	METER, HOUR, 4-40V/DC	5	OMC149	STATOR, KOHLER ENG. 18, 20, & 25HP
2	OMH190	HARNESS, WIRING, 72", KOHLER	6	OMJ212	SWITCH, KEY, KOHLER ENGINES
3	OMS307	BATTERY, 12V, GROUP 26	7	2FB836	FAN, AXIAL, 48.5 CFM., 12 V, 2600 RPM
4	OF0442	SPARK PLUG, 18-25HP KOHLER ENGINE			

05-14-09

DIAGRAM 7: ELECTRICAL SCHEMATIC: 12VDC OIL-FIRED BURNER CONTROLS W/OPT. STEAM COMBO



\* PARTS LIST \*

#	PART #	DESCRIPTION	#	PART #	DESCRIPTION
1	1SU649	THERMOSTAT, ADJUSTABLE, 30/110 °C	8B	0FK408	CABLE, BATTERY, 6 GA., 20" LONG
2A	0DO920	THERMOSTAT, 225° HIGH LIMIT, NC	9	0EP199	CABLE, BATTERY, 6 GA., 12" LONG
2B	0DO923	THERMOSTAT, 340° HIGH LIMIT, NC	10A	1PX899	BATTERY, SPIRAL CELL, 12V, GRP 75/35
3	1HI664	BURNER, OIL, 12V-2.5GPH, MODEL ADC	10B	0MS307	BATTERY, 12 VOLT, GROUP 26
4	0LF911	SWITCH, TOGGLE, SPST, 15A	11A	0TA946	SWITCH, PRESSURE, SPDT, 15A, 5800N/3600MAX
5	0MH190	HARNESS, WIRING, 72", KOHLER	11B	1PA667	SWITCH, PRESSURE, RATED 5800#, 3/8" MPT
6A	1AY004	HOLDER, FUSE	12	1PN789	SWITCH, FLOW, 5000PSI, 8GPM, 40-180 °F
6B	1AX996	FUSE, MINI, 30 AMP	13	0JT538	PUMP, 12V, 3.6GPM, 45PSI, SANTOPRENE
7	1BC043	PUMP, SHURFLO, 12V, 60PSI	14	0GY802	METER, HOUR, 4-40VDC
8A	0GS748	CABLE, BATTERY, 6 GA., 44" LONG			

