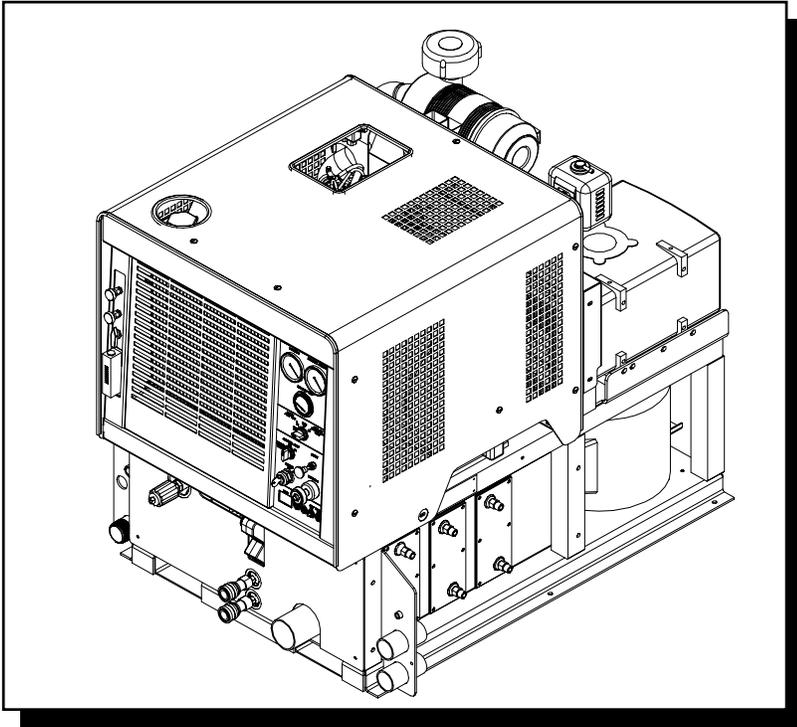


# APEX

# PROCHEM®



Operating Instructions (ENG)

MODELS: **APEX GAS**  
**APEX DIESEL**

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***Read instructions before operating the machine.***

## MACHINE DATA LOG/OVERVIEW

MODEL _____
DATE OF PURCHASE _____
SERIAL NUMBER _____
SALES REPRESENTATIVE # _____

<b>YOUR DEALER</b>
NAME: _____
ADDRESS: _____
PHONE NUMBER: _____

**Welcome**...and congratulations on the purchase of your Mobile Cleaning Unit. This instruction manual is a guide for operating and servicing your unit. **Read this manual completely before installing or operating this unit.** This unit offers you personal convenience. All of your instrumentation and controls have been positioned to give you easy access for operation and daily maintenance.

Proper operation and service are essential to the efficient functioning of this unit. When maintained correctly, this unit will have a long, trouble-free life.

***The service methods described in this manual are explained in such a manner that servicing may be performed accurately and safely. Proper service varies with the choice of procedure, the skill of the mechanic, and the tools or parts available. Before attempting any repair, make certain that you are thoroughly familiar with this equipment and are equipped with the proper tools. Any questions pertaining to operating or servicing this unit should be directed to your nearest dealer.***

***THIS UNIT MUST BE INSTALLED BY THE DEALER FROM WHOM YOU PURCHASED IT IN ACCORDANCE WITH THE PRESCRIBED INSTALLATION PROCEDURES.***

MAKE CERTAIN THAT THE WARRANTY CARD IS FILLED OUT AT THE TIME OF INSTALLATION AND IS RETURNED TO YOUR DEALER.

PROFESSIONAL CHEMICALS CORPORATION  
325 SOUTH PRICE ROAD  
CHANDLER, ARIZONA 85224

Information in this document is subject to change without notice and does not represent a commitment on the part of Professional Chemicals Corporation.

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### ACCEPTANCE OF SHIPMENT

Every part of your cleaning unit was carefully checked, tested, and inspected before it left our manufacturing plant. **Upon receiving the unit, make the following acceptance check:**

1. The unit should not show any outward signs of damage. If damaged, notify the delivering carrier immediately.
2. Check your equipment and packing list. The cleaning unit should arrive equipped with the following items (unless otherwise specified).

***NOTE: Your distributor from whom you purchased this mobile cleaning unit is responsible for the correct installation of this machine. The dealer is also responsible for initial training of your operators and maintenance personnel in the proper operation and maintenance of this unit.***

### EQUIPMENT LIST:

1. Console.
2. Waste tank
3. Hose clamps for vacuum hoses.
4. 150 ft. of 2" vacuum hose.
5. 2 vacuum hose connectors.
6. 150 ft. of 1/4" high pressure hose with quick connects.
7. 50 ft. water supply hose with quick connect.
8. Installation bolting kit.
9. Installation mounting plates.
10. Operation and service manual for engine, water pump, and vacuum pump manuals.

**NOTES:**

## HOW TO USE THIS MANUAL

This manual contains the following sections:

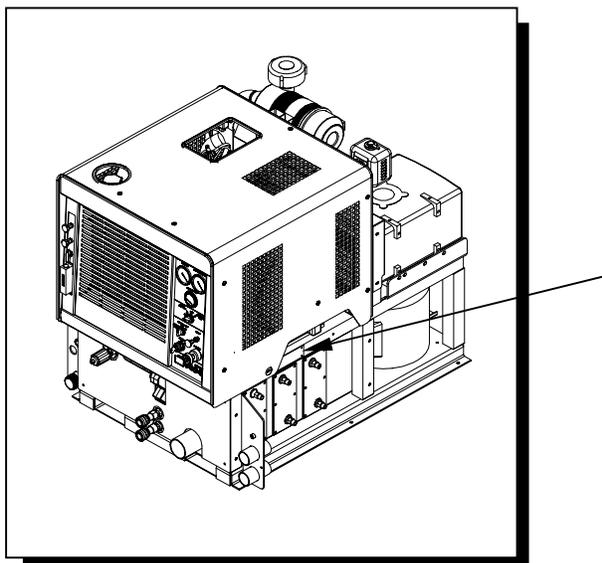
- HOW TO USE THIS MANUAL
- SAFETY
- INSTALLATION REQUIREMENTS
- SYSTEMS
- OPERATIONS
- MAINTENANCE & SERVICE
- PARTS LIST

The HOW TO USE THIS MANUAL section will tell you how to find important information for ordering correct repair parts.

Parts may be ordered from authorized dealers. When placing an order for parts, the machine model and machine serial number are important. Refer to the MACHINE DATA box which is filled out during the installation of your machine. The MACHINE DATA box is located on the inside of the front cover of this manual.

MODEL _____
DATE OF PURCHASE _____
SERIAL NUMBER _____
SALES REPRESENTATIVE # _____

The model and serial number of your machine is on the side approximately where shown.



The SAFETY section contains important information regarding hazard or unsafe practices of the machine. Levels of hazards is identified that could result in product or personal injury, or severe injury resulting in death.

The OPERATIONS section is to familiarize the operator with the operation and function of the machine.

The MAINTENANCE section contains preventive maintenance to keep the machine and its components in good working condition. They are listed in this general order:

- Engine
- Vacuum Pump
- Water Pump
- Drive Belts, Pulleys & Hubs
- Chemical Pumps
- Hoses
- Vac/Exhaust Heat Exchanger
- General Service Adjustments
- Troubleshooting

The PARTS LIST section contains assembled parts illustrations and corresponding parts list. The parts lists include a number of columns of information:

- **REF** – column refers to the reference number on the parts illustration.
- **PART NO.** – column lists the part number for the part.
- **DESCRIPTION** – column is a brief description of the part.
- **SERIAL NO. FROM** – column indicates the first machine the part number is applicable to. When the machine design has changed, this column will indicate serial number of applicable machine. The main illustration shows the most current design of the machine. The boxed illustrations show older designs. If column has an asterisk (\*), call manufacturer for serial number.
- **NOTES** – column for information not noted by the other columns.

**NOTE: If a service or option kit is installed on your machine, be sure to keep the KIT INSTRUCTIONS which came with the kit. It contains replacement parts numbers needed for ordering future parts.**

**NOTE: The 98# on the lower left corner of the front cover is the part number for this manual.**

# IMPORTANT SAFETY INSTRUCTIONS

When using this machine, basic precautions must always be followed, including the following:

## READ ALL INSTRUCTIONS BEFORE USING THIS MACHINE.

### **WARNING:**

These symbols mean **WARNING** or **CAUTION**. Failure to follow warnings and cautions could result in fatality, personal injury to yourself and/or others, or property damage. Follow these instructions carefully!

### **CAUTION:**

**Read the operator's manual before installing or starting this unit.** Failure to adhere to instructions could result in severe personal injury or could be fatal.

**Operate this unit and equipment only in a well-ventilated area.** Exhaust fumes contain carbon monoxide which is an odorless and deadly poison that can cause severe injury or fatality. **DO NOT** run this unit in an enclosed area. **DO NOT** operate this unit where the exhaust may enter any building doorway, window, vent, or opening of any type.

**Gasoline is extremely flammable and its vapors can explode if ignited.** Store gasoline only in approved containers, in well-ventilated, unoccupied buildings away from sparks or flames. Never carry any gasoline or flammable material in the vehicle. Fumes may accumulate inside the vehicle and ignite, causing an explosion. **DO NOT** store any type of flammable material in the vehicle.

**This unit must be operated with the vehicle or trailer doors open in order to ensure adequate engine ventilation.**

**DO NOT operate engine if gasoline is spilled.** Avoid creating any ignition until the gasoline has been cleaned up. Never use gasoline as a cleaning agent.

**DO NOT place hands, feet, hair, or clothing near rotating or moving parts.** Avoid any contact with moving parts! Rotating machinery can cause injury or fatality.

**Never operate this unit without belt guards.** The high speed moving parts, such as belts and pulleys, should be avoided while this unit is running. Severe injury, damage, or fatality may result.

**DO NOT service this unit while it is running.** The high-speed mechanical parts as well as high temperature components may result in severe injury or severed limbs.

**Never touch electrical wires or components while the engine is running.** They can be sources of electrical shock.

**Engine components can get extremely hot from operation.** To prevent severe burns, **DO NOT** touch these areas while the engine is running - or immediately after the engine is turned off.

**DO NOT touch the exhaust system while this unit is running.** Severe burns may result.

**Before servicing this unit, allow it to "cool down."** This will prevent burns from occurring.

***Water under high pressure at high temperature can cause burns, severe personal injury, or fatality. Shut down machine, allow to cool down, and relieve system of all pressure before removing valves, caps, plugs, fittings, filters, and bolts.***

**DO NOT leave the vehicle engine running while operating this unit.**

**Dangerous Acid, Explosive Gases!** Batteries contain sulfuric acid. To prevent acid burns, avoid contact with skin, eyes and clothing. Batteries produce explosive hydrogen gas while being charged. To prevent a fire or explosion, charge batteries only in well ventilated areas. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries.

Before disconnecting the negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or gasoline vapors are present. When disconnecting the battery, **ALWAYS** disconnect the negative (-) terminal **FIRST**.

**DO NOT smoke around the unit.** Gas fumes may accumulate and be ignited. The battery is also extremely flammable. This will prevent possible explosions.

**DO NOT damage the vehicle in any manner during installation.** When routing fuel lines **DO NOT** place the hose in any location where damage may occur to the hose or vehicle. Avoid any contact with moving parts, areas of high temperature, brake lines, fuel lines, muffler, catalytic converter, or sharp objects.

**DO NOT cut or splice any of the vehicle fuel lines during fuel line installation.** This may result in fuel leaks and potentially dangerous conditions. There is no fuel solenoid shut off on this unit. Use only the provided abrasion resistant fuel hose for fuel lines. When traversing the vehicle floor with fuel lines, always use a bulkhead adapter. This will prevent leakage and ensure that the hose is not punctured by vehicle vibration abrasion.

**DO NOT exceed your vehicle's weight limit.** The console with waste tank and accessories weighs approximately 1160 lbs. Make certain to account for any additional accessories in your weight and balance calculations. Make certain that the vehicle has the correct axle rating. This will prevent unsafe vehicle driving conditions.

**We require high-back seats on all vehicles in which units are to be installed for head and neck protection.** We recommend using a metal partition between the seats and equipment.

**DO NOT operate this unit without the water supply attached and turned on.** The water pump and other vital components may be seriously damaged if this unit is permitted to operate dry without water.

***DO NOT operate this unit without the filter installed in the waste tank.***

**Keep your vehicle work area clean.** Wands, stair tools, and other accessories must be securely fastened before driving the vehicle.

**All high pressure hoses must be rated for 3000 PSI at 250°F.** Thermoplastic hoses do not meet these specifications and should not be used. Severe burns and injury may result if the hoses do not meet these requirements.

**The winterizing loop hose assembly, Part #10-805380, is for winterizing use only.** If used improperly, live steam may escape from this hose, causing it to whip around. Burns or injury may result.

**Make certain that you receive complete training by the distributor from whom you purchased this unit.**

**This unit uses high pressure and temperature. Improper or irresponsible use may result in serious injury.**

**Do not modify this unit in any manner.** Improper modification can cause severe personal injury or fatality.

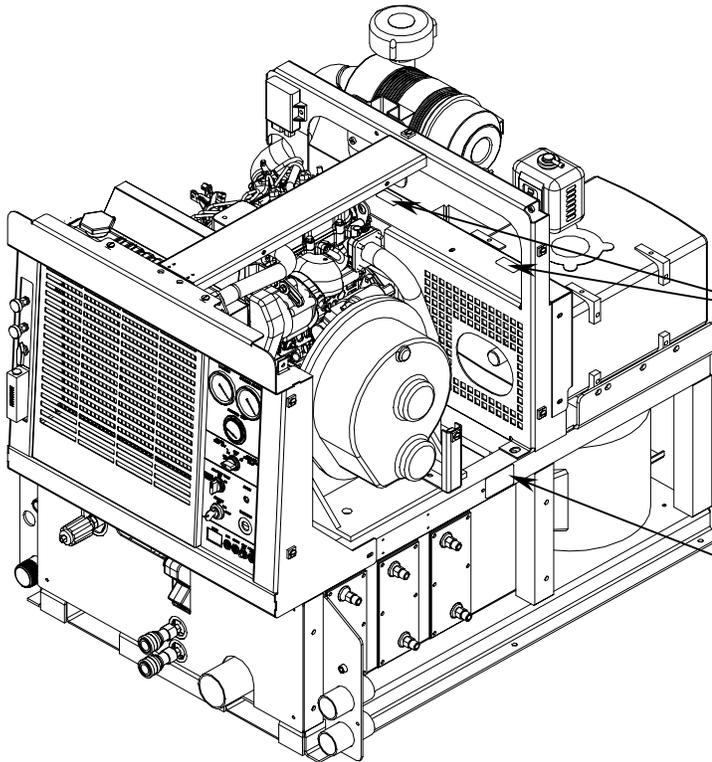
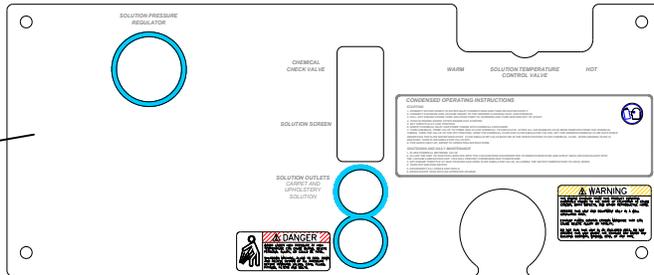
**CALIFORNIA PROPOSITION 65 WARNING:** Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

# HAZARD INTENSITY LEVEL

The following **WARNING LABELS** are found on your cleaning unit . These labels point out important **Warnings** and **Cautions** which should be followed at **all** times. Failure to follow warnings and cautions could result in fatality, personal injury to yourself and/or others, or property damage. Follow these instructions carefully! **DO NOT** remove these labels.

**NOTE:** If at any time the labels become illegible, promptly replace them.

Front panel decal  
Part # 790958



(2) Warning labels required  
Warning label  
Part # 500769



Caution label  
Part # 500770

**TECHNICAL SPECIFICATIONS**

ITEM	DIMENSION/CAPACITY
Engine speed	2740 rpm (high speed) Water Pump ON 1500 rpm (idle speed) Water Pump OFF.
Water pump rpm	965 -1000 rpm
Vacuum pump rpm	3100 rpm
Water flow rate	4.15 GPM (maximum)
Water pump pressure	1000 PSI (maximum)
Vacuum relief valve	13" Hg
Waste tank capacity	80 gallons
Console weight	910 lbs.
Console weight (with waste tank & waste tank accessories)	1160 lbs. (1830 lbs. If waste tank is full)
<b>TORQUE VALUES</b>	
Engine front pulley	300 inch lbs      25 foot/lbs
Vacuum pump hub	192 inch/lbs      16 foot/lbs
Engine rear pulley	480 in//lbs      40 foot/lbs

**JET SIZING:**

Recommended floor tool tip sizing not exceed a total of ".06". Using larger jet sizes on your cleaning unit may reduce cleaning temperatures.

Example:      Tri-jet wand uses three 9502 jets (95° spray angle w/ .02 orifice).  
                  .02 x 3 = .06

When using two floor tools while cleaning with this unit, it is recommended that each tool tip size does not exceed a total of ".045".

Example:      Tri-jet wand uses three 95015 jets (95° spray angle w/ .015 orifice).  
                  .015 x 3 = .045.....045 x 2 tools = .09

Upholstery tool jet size:                      80015  
Stair tool jet size:                              9502

## OPERATION

### INSTALLATION REQUIREMENTS DEALER RESPONSIBILITY

**NOTE:** *Your distributor from whom you purchased this mobile cleaning unit is responsible for the correct installation of this machine. The dealer is also responsible for initial training of your operators and maintenance personnel in the proper operation and maintenance of this unit.*

1. The unit should **NOT** be mounted in any motor vehicle of less than **3/4 ton capacity**.

### **CAUTION:**

**The console with waste tank and accessories must NOT exceed the vehicle's axle weight limit.**

2. If mounting in a trailer, make certain that the trailer is rated for the total weight of the **UNIT AND TRAILER**. Electric or hydraulic brakes should be provided, and a strict compliance with any State and Federal vehicle laws must be maintained.
3. The vehicle tires should have a load rating above the combined vehicle and unit weight.
4. We do not recommend using flooring materials that absorb water. This could result in rust and corrosion of the vehicle floor.
5. Padding under rubber floor mats should be removed before installing this unit.
6. We highly recommend using a drip tray under the console (Part #790552).
7. If using a trailer, the console should be positioned so that it balances properly with respect to the axle. Ten percent (10%) of the overall unit weight should be on the tongue.

**Example:** If loaded trailer weight is 2,000 lbs., tongue weight needs to be a minimum of 200 lbs. to tow properly.

### FUEL REQUIREMENTS

**Use unleaded gasoline ONLY. DO NOT** use any gasoline additives. We recommend the use of clean, fresh, unleaded gasoline intended for automotive use. High octane gasoline should **NOT** be used with the engine on this unit.

### ENGINE OIL REQUIREMENTS

Use high quality detergent oil of at least API (American Petroleum Institute) service class SF or SG. Select the viscosity based on the air temperature at the time of operation as shown in the following table. **NOTE:** Using less than service class SF or SG oil or extending oil change intervals longer than recommended can cause engine damage. The recommended SAE viscosity grade is **10W-30**.

**CHEMICAL REQUIREMENTS**

This cleaning unit, due to its chemical injection pump design, can be used with a variety of water-diluted chemical compounds (either acidic or alkaline), depending on the job to be done. However, to obtain optimum results with this unit, we recommend using the PROCHEM line of chemicals. For information on using the cleaning compounds, refer to the PROCHEM chemical manual.

**WATER REQUIREMENTS**

Hard water deposits will adversely affect the plumbing and heat exchange systems on this unit. The map below will give you an idea of where areas of high water hardness may occur. However, any water supply obtained from a well is almost always hard water and a water softener will be needed to protect your equipment.

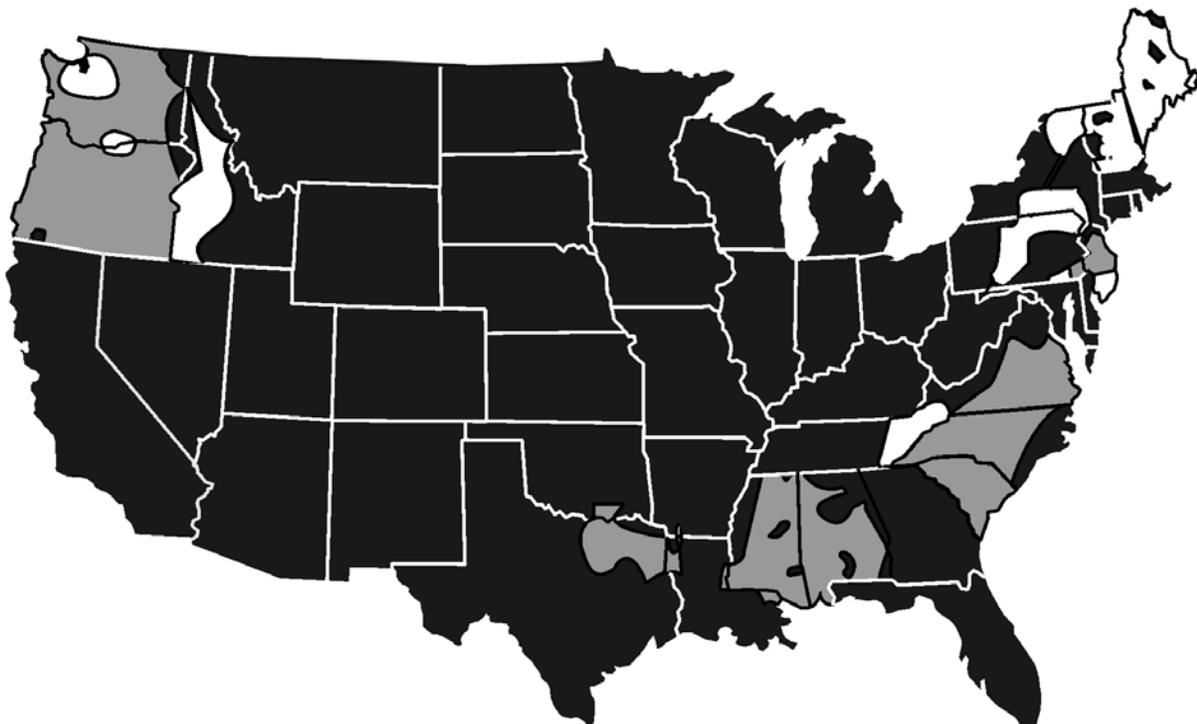
**NOTE: Equipment malfunction or component failure caused by hard water scaling is NOT covered under the warranty.**

If you are operating this unit in an area where the unit will be using water in which the hardness exceeds 3-1/2 grains, we highly recommend a suitable water softener be installed. If using a water softener, it must have a five (5) GPM (or greater) flow capacity without any hose constrictions.

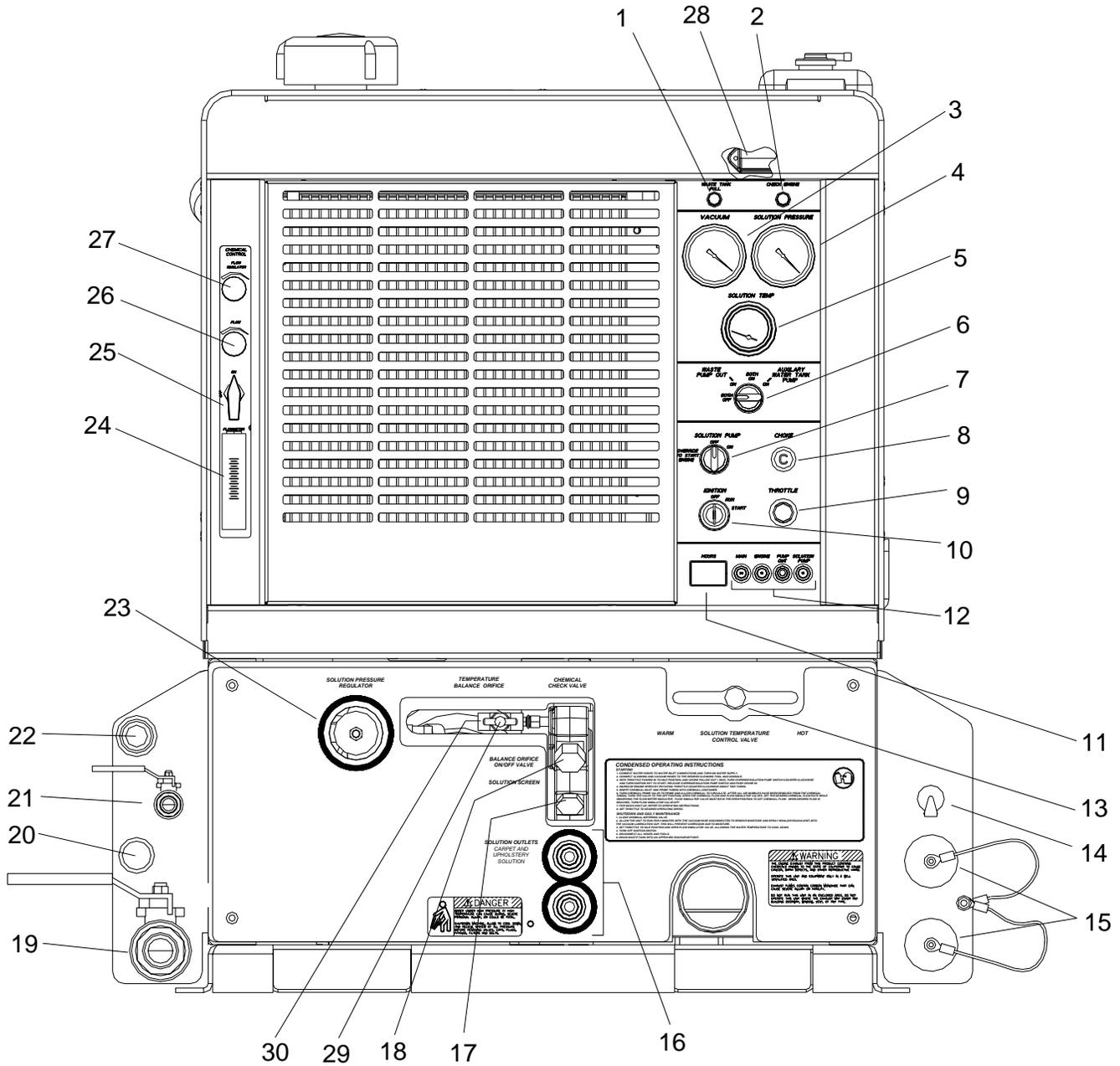
Using a water softener will reduce maintenance and decrease down time caused by hard water scaling. It will also allow cleaning chemicals to be more effective in lower concentrations

If you require a water softener, PROCHEM has a model to meet your needs. Please contact your nearest distributor for information, price, and availability.

**HARD WATER MAP**



# COMPONENTS



## 1. WASTE TANK FULL INDICATOR LIGHT

This indicator light is activated when the waste tank is full. When lit the unit will shutdown protecting the equipment from damage. This also indicates that the waste tank must be emptied before the unit can be brought back in service.

**NOTE: Never dispose of waste water in storm drains, water ways or on ground areas. Always dispose of waste in accordance with local, state and federal laws.**

## 2. ENGINE HIGH TEMPERATURE SHUTDOWN INDICATOR

This light when activated signals an over heat condition with the engine. When this occurs, troubleshooting is required.

## 3. VACUUM GAUGE

This gauge indicates in inches of mercury how much vacuum the system is producing at any given time.

## 4. SOLUTION PRESSURE GAUGE

This gauge registers the amount of pressure in the system.

## 5. SOLUTION TEMPERATURE GAUGE

This gauge measures the temperature of the cleaning solution as it exits the machine.

## 6. WASTE PUMPOUT AND AUXILIARY WATER PUMP SWITCH

This four-position switch is for activating the waste pumpout device. It also serves to activate the fresh water transfer pump. For turning on pumps, rotate clockwise. For turning off pumps, rotate counter clockwise.

## 7. SOLUTION PUMP SWITCH

This switch serves to energize the magnetic clutch to turn the water pump on or off. Turn clockwise for activating the pump and counter clockwise for deactivating the pump.

## 8. CHOKE

The choke cable is for restricting air to the carburetor, this enriches the fuel mixture. The primary purpose is for starting in cold temperatures. When the cable is pulled out air is restricted, when pushed in the engine is in run position.

## 9. THROTTLE

This serves to set the speed of the engine by pulling the throttle lever out. It serves to increase the speed and pushing it in has the effect of slowing down the engine. The lever has a collar lock, which serves to lock in given speeds.

## 10. KEY SWITCH

The key switch controls the power for the machine. To turn the machine on, rotate the key clockwise until the starter engages the engine. When machine is running let off the switch and engine will continue to run. To turn power off, rotate key counter clockwise to stop position, engine will then stop.

## 11. HOUR METER

The hour meter records the number of hours the unit has run. This serves as a time recorder for servicing the machine.

## 12. CIRCUIT BREAKERS

These serve to protect the circuits from electrical spike and over loads and protects wires from damage and fire.

## 13. SOLUTION TEMPERATURE CONTROL VALVE

This valve enables additional heat exchangers to contribute more heat to the system if necessary. By rotating the lever to the right it adds more heat, by rotating to the left it removes heat.

## 14. OIL CUP

The oil cup allows lubricant spray to reach the vacuum blower.

## COMPONENTS

### 15. VACUUM INLETS

The vacuum inlets serve as connecting point for vacuum hoses.

### 16. SOLUTION OUTLETS

The solution outlets are the connecting point for the high pressure cleaning hoses. These outlets are quick disconnects that allow hoses to be plugged into the unit.

### 17. SOLUTION SCREEN

The solution screen is located on the front of the machine. The function of this screen is to trap foreign particles from exiting the machine and plugging the orifices of the cleaning tools. This screen is part of the machine maintenance cleaning.

### 18. CHEMICAL CHECK VALVE

The chemical check valve allows chemicals to enter the system and travel in a singular direction to the wand. The chemical check valve prevents chemicals from traveling up-stream into the solution system of the unit.

### 19. WASTE OUTLET

This valve allows the waste tank to be emptied. Turning clockwise opens the valve.

### 20. WASTE PUMPOUT

This auxiliary pump serves to empty the waste collection tank automatically. A float located inside the tank automatically turns off and on when the solution level reaches certain points.

### 21. WARM WATER OUTLET

The warm water outlet allows the cleaning technician to drain hot water from the water box for mixing chemical.



**Water from this valve is hot.**

### 22. WATER INLET

This quick connect allows the water supply hose to be connected to the unit.

### 23. PRESSURE REGULATOR

This pressure regulating valve allows the water pressure circuit to be adjusted by turning the handle clockwise the pressure will increase, by turning counter clockwise the pressure will decrease.

### 24. FLOW METER

The flow meter is a gauge to indicate how much liquid chemical is being introduced in the water system. The quantity can be increased by turning the chemical flow knob counter clockwise.

### 25. CHEMICAL PRIME CONTROL VALVE

This valve allows the chemical to circulate through the chemical system with little or no restriction. It also purges out air that may be trapped in the lines and cavities of the chemical pump. By turning the valve clockwise the injection system is enabled.

### 26. CHEMICAL METERING VALVE

The chemical metering valve regulates the amount of chemical that is injected into the system. Clockwise rotation of the knob closes the valve. Counter clockwise rotation opens the valve, allowing more chemical to enter the system.

### **27. FLOW SIMULATOR VALVE**

This valve allows solution to move through the machine and chemical to be injected simulating the cleaning process. This allows the operator to set the chemical flow level without connecting tools to the machine. It is also useful in troubleshooting. The valve is turned off by rotating the knob clockwise and opened by turning the knob counter clockwise.

### **28. PANEL LIGHT**

This light is useful if the machine is used in a poorly lit area or night use. It is helpful in reading the instruments and gauges.

### **29. TEMPERTURE BALANCE ORIFICE SHUTOFF VAVLE**

The temperature balance orifice shutoff valve allows the operator to increase solution temperature during two wand operation. This should only be closed during two wand operation.

### **30. TEMPERATURE BALANCE ORIFICE**

The temperature balance orifice helps to balance and stabilize the solution temperature within the system.

## **OPERATION**

### **WATER PUMPING AND HEAT TRANSFER SYSTEM**

Cold water enters the console through the water inlet. When the water box is full the valve will automatically shut off.

Water then flows from the water box, through a strainer, into the water pump where it is pumped to the pressure regulator manifold where the pressure regulator provides and maintains the desired pressure setting.

The pressure regulator manifold includes a nitrogen charged accumulator which helps reduce pressure spikes from the pump.

A certain amount of water is by-passed from the pressure regulator due to over pumping capacity of the water pump. Water that is not called for in the cleaning process is channeled through a heat exchanger box into the first heater core from the front of the unit. This bypass water may circulate several times through the bypass heat exchanger allowing the water to be pre-warmed.

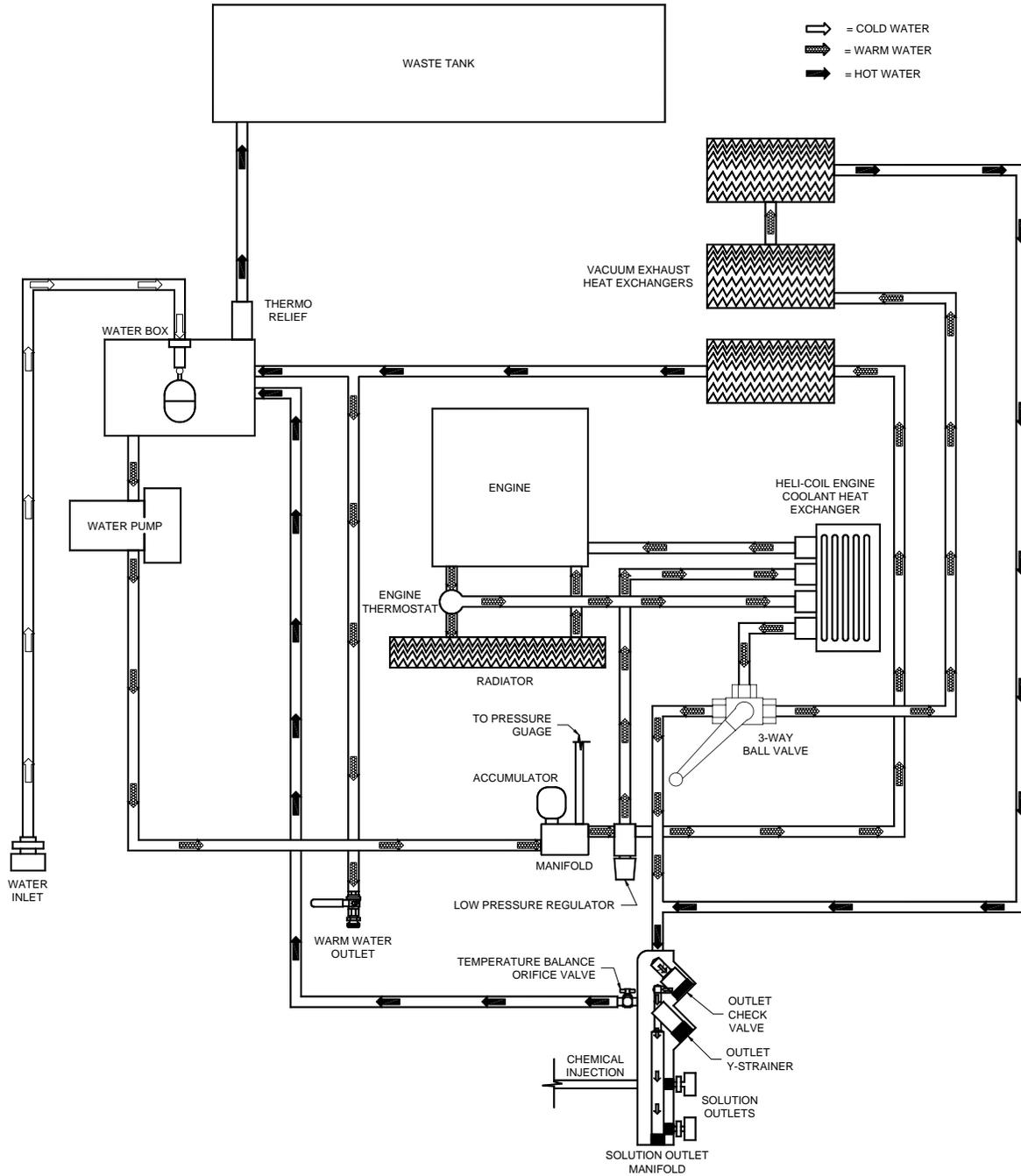
The next stage of heating and water flow is to the helicoil, when water is called for in the cleaning process it flows to the helicoil under pressure. Heat from the engine coolant is exchanged to the cleaning solution through a series of spiraled copper tubing. This allows the engine coolant to travel in a counter rotating direction to the cleaning water during the exchange process creating a very efficient transfer of heat out of the engine and into the cleaning solution.

The third stage of plumbing and heat exchange takes place in the 2nd heater core located in the heater box. This is the hottest point of the gases coming from the vac pump and the engine. These hot gases are forced through heater core #2 creating the third stage of heat transfer to the cleaning solution.

Finally, the hot solution passes to the outlet manifold where cleaning chemicals are injected from the chemical pulse pump. This manifold serves as a temperature sensing point and a connecting point for the high-pressure hoses. Also a check valve is located in this outlet manifold prohibiting chemicals from backing up into the system.

The cleaning solution then passes through high-pressure hoses and is distributed by the cleaning tool to a surface that is being cleaned, completing the water pumping and heating cycle of the cleaning unit.

SINGLE SYSTEM WATER FLOW DIAGRAM  
LOW PRESSURE



# OPERATION

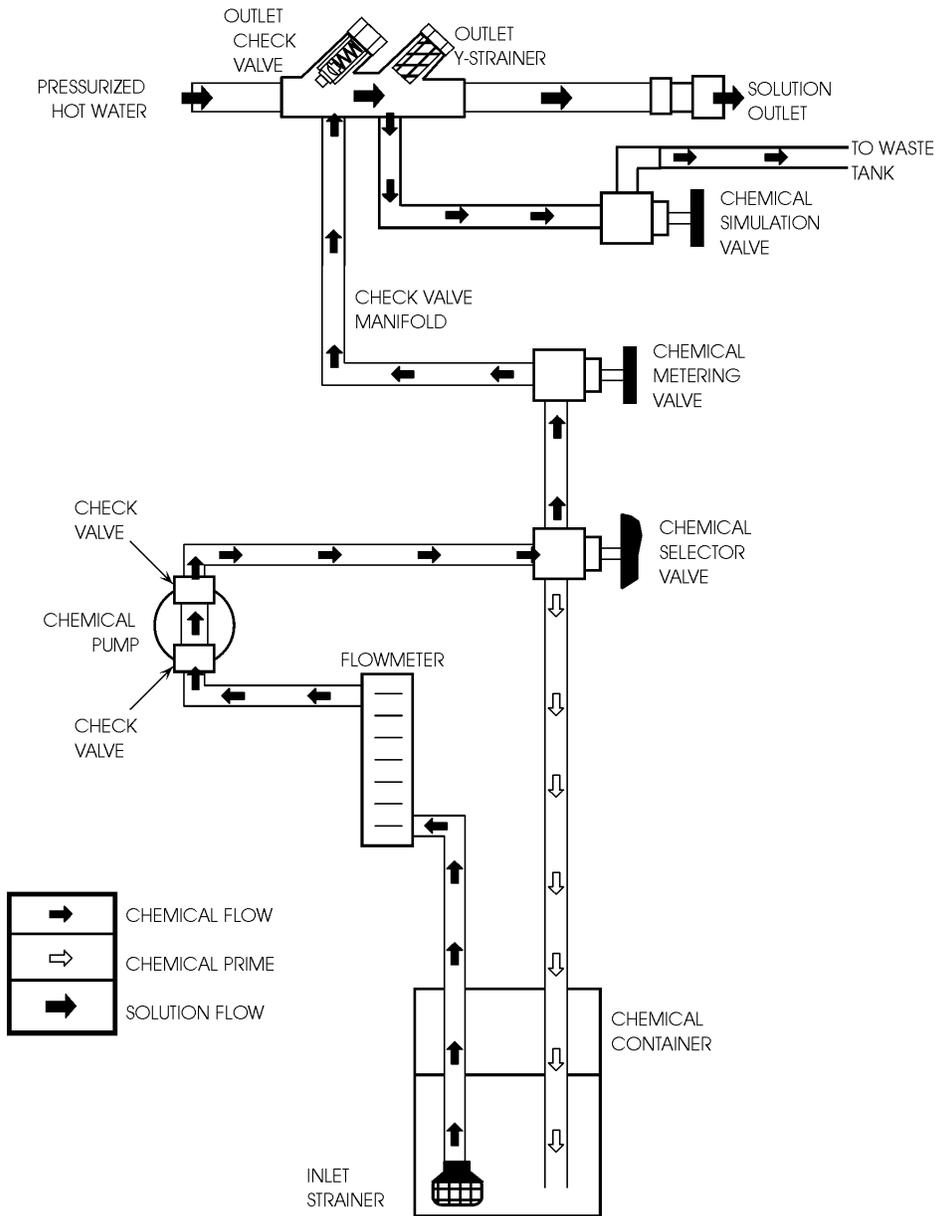
## CHEMICAL INJECTION SYSTEM

The chemical injection system is unique in that it utilizes the pressure spikes generated by the high-pressure water pump to move chemical into the main pressure stream. The high pressure spikes move the diaphragm in the chemical pulse pump forcing small amounts of liquid chemical to be moved in a single direction of flow with the aid of two check valves.

The chemical is picked up from the container and fed through the flow meter to the chemical pulse pump where it is pressurized.

After reaching the chemical pulse pump the chemicals can either go into a bypass loop to purge air from the system. The chemical can then be directed by the chemical selector valve to the metering valve. The metering valve creates an orifice allowing the correct amount of chemical to enter the outlet manifold. The outlet manifold assembly is complete with a check valve that will not allow the chemicals to travel upstream into the plumbing system of the unit.

The chemicals are then mixed with hot pressurized water that make up a solution for cleaning application.



# MAINTENANCE

## SERVICE SCHEDULE

<b>Engine</b>	Daily	Check engine oil level. *** Fill to proper level
<b>Engine</b>	Daily	Check coolant level in overflow bottle
<b>Vacuum Pump</b>	Daily	Spray WD-40 in lubrication cup at front of console for 5 sec.
<b>Water Pump</b>	Daily	Check oil level.** Fill to proper level
<b>Solution Inlet Tube Strainer</b>	Daily	Check strainer for blockage, remove any debris
<b>Vacuum Inlet Filter (In Waste Tank)</b>	Daily	Clean filter, inspect, replace if damaged
<b>Vacuum Hoses</b>	Daily	Wash out with clean water
<b>Automatic Waste Pump</b>	Daily	Inspect and remove any debris or sediment
<b>Chemical Filter</b>	Daily	Inspect daily
<b>Vacuum Pump</b>	Weekly*	Check oil level. Fill to proper level
<b>Water Box Float Valve</b>	Weekly	Check for proper seating and shut-off
<b>Water Pump Inlet Filter</b>	Weekly*	Check for debris and clean
<b>Battery</b>	Weekly*	Check for proper fluid level. Fill with distilled water only
<b>Solution Outlet Y-Strainer</b>	Weekly*	Inspect and remove any debris or blockage
<b>Temperature Balance Orifice</b>	Weekly	Remove, check, and clean
<b>High Pressure Hoses</b>	100 hrs	Inspect for damage or impending damage
<b>Pressure Regulators</b>	100 hrs	Lubricate o-rings
<b>Engine</b>	100 hrs	Change engine oil***
<b>Engine</b>	100 hrs	Change oil filter***
<b>Engine</b>	100 hrs	Check fan belt tightness
<b>Battery</b>	100 hrs*	Clean battery terminals
<b>Float Valve Seal</b>	200 hrs.	Replace seal
<b>Engine</b>	200 hrs	Service air cleaner elements*
<b>Engine</b>	200 hrs	Check radiator hoses and clamp tightness
<b>Fuel Pump</b>	200 hrs	Check hose connections
<b>Engine</b>	200 hrs	Check spark plugs for carbon deposits and proper gap
<b>Flow Simulator And Chemical Valves</b>	200 hrs	Inspect and/or adjust packing nuts

\* Or as often as required

\*\* Change water pump crankcase oil after the first 50 hours

\*\*\*Change engine crankcase oil and filter after the first 50 hours

\*\*\*\*Perform drive belt, pulley and hub maintenance after the first 25 hours of operation, and then again at 100 hours

\*\*\*\*\*If using AEON PD synthetic lubricant, 4500 hours or every 2 years, whichever comes first

# MAINTENANCE

## SERVICE SCHEDULE

<b>Vacuum Exhaust Heat Exchanger</b>	500 hrs	Inspect cores and remove debris.
<b>Water Pump</b>	500 hrs	Change oil**
<b>Pulley Set Screws &amp; Hub Cap Screws, Water Pump Clutch Shaft Bolts</b>	500 hrs	Check for proper torque valves. Re-torque, if required****
<b>Drive Pulley</b>	500 hrs	Inspect, clean and check for pulley groove wear****
<b>Drive Pulley</b>	500 hrs	Check pulley alignment****
<b>Drive Belts</b>	500 hrs	Inspect and clean****
<b>Drive Belts</b>	500 hrs	Check belt tension****
<b>Chemical Pump &amp; Check Valves</b>	500 hrs	Replace diaphragm and check valves.
<b>Heater Core</b>	500 hrs	Clean and inspect.
<b>Engine</b>	1000 hrs	Replace spark plugs.
<b>Check Valve (Solution Outlet)</b>	1000 hrs	Inspect, clean, and repair, if needed.
<b>Vacuum Pump</b>	1500 hrs	Drain, flush, and replace oil *****
<b>Engine</b>	Yearly	Flush radiator and change engine coolant.
<b>Engine</b>	Yearly*	Replace in-line fuel filter on engine.
<b>Engine</b>	Yearly*	Replace air cleaner element.
<b>Nitrogen Accumulator</b>	Yearly*	Replace Accumulator.
<b>Waste Tank Filters/Strainers</b>	Yearly	Check for damage and blockage. Replace if needed.
<b>Engine</b>	2 years	Replace radiator hoses and hose clamps.
<b>Battery</b>	2 years	Replace.
<b>Engine</b>	3 years	Replace ignition wires.

\* Or as often as required

\*\* Change water pump crankcase oil after the first 50 hours

\*\*\*Change engine crankcase oil and filter after the first 50 hours

\*\*\*\*Perform drive belt, pulley and hub maintenance after the first 25 hours of operation, and then again at 100 hours

\*\*\*\*\*If using AEON PD synthetic lubricant, 4500 hours or every 2 years, whichever comes first

## KEY CHECKPOINTS

**NOTE:** *Initiation of a planned preventative maintenance program will assure that your unit has optimum performance, a long operating life, and a minimal amount of "down" time.*

## ENGINE COOLANT SYSTEM (RADIATOR) MAINTENANCE

Your engine radiator coolant system is an important part of the power plant operation. In addition, this heat exchange system is used to provide heat for cleaning operations is also highly dependent on the engine coolant system. Follow the recommended coolant system maintenance in the Maintenance Schedule in this manual and your engine owner's manual. Refer any additional questions to your dealer.

## EXTERNAL FUEL PUMP MAINTENANCE

The power plant for unit receives fuel from the main gas tank of your van/truck. An external fuel pump that provides this fuel is located on the underside of the van/truck. Loose fittings and hose connections will cause your unit to perform poorly. Follow the recommended fuel pump maintenance in the Maintenance Schedule in this manual. Refer any additional questions to your dealer.

## SOLUTION SUPPLY SYSTEM MAINTENANCE

The chemical supply system pulls chemicals from your chemical bottle utilizing a pump that works off the water pump pulsing. Any clogged filters or loose connections will result in a chemical supply system malfunction or a malfunction at the cleaning tool. Maintenance of the solution outlet check valve and strainer are vital to effective cleaning operation and minimal unit downtime. Additionally, the hoses related to supplying water and chemical to the outlet manifold are under high pressures and experience thermal expansion and contraction. Periodic inspections of these hoses for tears, cracks, and failing connectors are necessary to avoid unwanted leaks. To keep your solution supply system functioning properly, follow the chemical pump and solution outlet maintenance in the Maintenance Schedule in this manual. Refer any additional questions to your dealer.

## HEAT EXCHANGER SYSTEM MAINTENANCE

The heat exchange system in your unit transfers energy between the unwanted heat of the power plant and the solution supply system of the unit. The heat transfer of this system is highly dependent on the surface area contact in the heat exchanger cores located in the heat exchanger box. This surface area amount is adversely minimized when the supplied water is not softened to recommended levels. Hard water will result in scaling on the inside walls of the heat exchanger tubes. It is recommended that you use a dealer approved water softener to avoid premature heat exchanger core failure. Contact your local dealer for advice on the water hardness levels in your area.

Additionally, the heat exchanger tubes are very sensitive to freezing conditions. As the water freezes during cold conditions, it expands in the heat exchanger tubes and causes damage. Often the tubes are cracked and require the replacement of the heat exchanger core. Refer to the Freeze Protection instructions section in this manual. Refer any additional questions to your dealer.

## VACUUM PUMP MAINTENANCE

The total function of the unit is based around the performance of the vacuum pump. Heat transfer used to raise the temperature of the solution is gained from the air drawn by the vacuum pump and solution is removed from the carpet with the vacuum suction of the vacuum pump. General maintenance actions for the vacuum pump as listed in this manual are vital to prolonged vacuum pump operations. Daily lubrication of the pump is required to avoid seizure of the system. Also, waste tank filters and strainers must be maintained to prevent unwanted debris from entering the vacuum pump.

## MAINTENANCE

### **WARNING:**

**DO NOT** service this unit while it is running. The high-speed mechanical parts as well as high temperature components may result in severe injury, severed limbs, or fatality.

**NOTE:** Use the hour meter as a guide for coordinating the maintenance schedule.

## ENGINE

1. Check the engine oil level **daily**, when in use. Make certain that proper oil level is maintained. **NEVER** overfill.
2. Change the break-in oil after the first **50 hours** of operation. Thereafter, change oil every **100 hours** of operation. **USE ONLY KUBOTA BRAND OIL FILTERS. USING ANY OTHER TYPE OIL FILTER WILL VOID YOUR ENGINE WARRANTY.**

**Oil Recommendation.** Use high-quality detergent oil of at least API (American Petroleum Institute) service class SF or SG. The recommended SAE viscosity grade for summer is **10W-30**, and **10W-30** winter.

**NOTE:** Using less than service class SF or SG oil or extending oil change intervals longer than recommended can cause engine damage.

3. Re-torque the manifold and exhaust tube nuts, cylinder head bolts, and carburetor attaching nuts after the **first 200 hours** of use.
4. Check the spark plugs every **200 hours**. Clean if necessary. Replace the spark plugs every **1000 hours**. **NOTE:** Never sandblast spark plugs. Spark plugs should be cleaned by scraping or wire brushing.

Clean the air cleaner element every **200 hours**. Replace the element yearly.

5. Check the engine idle RPM every **200 hours** and adjust, if necessary. **NEVER** adjust engine RPM without a tachometer. Refer to Kubota Engine Operation and Service Manual.
6. Check the coolant level in the radiator overflow container **daily**. If no coolant is seen, remove the cap and add coolant. Change the coolant with a 70:30 coolant to water ratio every **1000 hours**.
7. Replace the in-line gas filter **yearly**.

**NOTE:** For additional engine service information, obtain a “Kubota Service and Repair Manual” from any authorized Kubota Service Center. If service or repair is required, contact an authorized Kubota Service Center. You will need to provide the serial number of the engine.

## VACUUM PUMP

Refer to the Vacuum Pump Operation and Service Manual for specific instructions.

**Lubrication:** We recommend that you use AEON PD Synthetic Blower Lubricant in the gear end of the vacuum pump for all operating temperatures. AEON PD is formulated especially for positive displacement blower service to provide maximum blower protection at any temperature. One filling of AEON PD will last a minimum of 2 times longer than a premium mineral oil.

**NOTE: AEON PD (Part# 05-008039) is the oil which PROCHEM puts in the vacuum pump at the factory. Topping off or adding petroleum oil to synthetic oil is NOT recommended.**

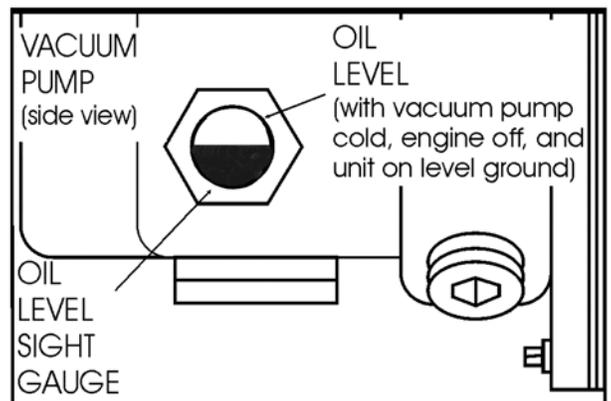
*If not using AEON PD synthetic blower lubricant, use oils with rust and oxidation inhibitors, anti-foam additives and the viscosity's listed on the chart on the next page.*

1. Check the oil level **daily** to assure the proper level. **PROPER LEVEL** cannot be overemphasized. Too little oil will ruin bearings and gears. Too much oil will cause overheating. Use the illustration as a guide when adding oil.

2. To prevent rust from building up inside the vacuum pump (if moisture exists) we have provided a lubrication cup on the front of the unit.

First run the unit at least **1 minute** to remove any moisture from the vacuum pump. Next, fill the lubrication cup with WD-40, or a similar lubricant, for **5 seconds** while the unit is running and the vacuum inlets are sealed. Do this at the end of **each working day**.

3. Drain, flush and replace oil **every 1500 hours or**



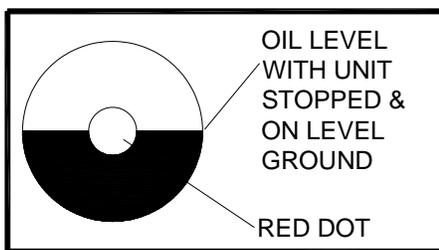
**yearly, whichever comes first.** Change oil more frequently if inspection so indicates. With AEON PD synthetic lubricant, perform the oil change maintenance **every 4500 hours or every 2 years, whichever comes first.**

# MAINTENANCE

## WATER PUMP

Refer to the Water Pump Operation and Service Manual for specific instructions.

1. Check the crankcase oil level **daily** to assure the proper level. Use the illustration as a guide when checking the oil level. If the level has dropped, check for the source of leakage and repair.
2. Use the provided dipstick. Remove black cap with attached dipstick. Oil level should be between marks on the dipstick. You may also use the site glass located on the non-shaft side of the pump.



3. Change the crankcase oil with Interpump oil (P/N 791106) after the **first 50 hours** of operation. Drain and refill the crankcase oil **every 500 hours** thereafter.
4. Other approved oil SAE 15W-40 equivalents are: Mobil and Shell Super, Castrol CWX, and Helix Super.

## VACUUM INLET FILTER (IN WASTE TANK)

1. The vacuum filter in the waste tank should be removed and cleaned **daily**. If this is done, the filter will last for a long period of time.

## VACUUM RELIEF VALVE

While the unit is running at full RPM, block the air flow at the vacuum inlet connection and read the vacuum gauge. If adjustment is required, shut the unit down and adjust the vacuum relief valve locking nut tension. Start your unit and read the vacuum gauge. Repeat this process until the relief valve opens at 13" Hg.

## VACUUM PUMP DRIVE BELTS

To tighten the vacuum pump belts:

1. Loosen the four screws which hold the vacuum pump mount in place.
2. Loosen the 6 nuts at the vacuum muffler outlet to heat exchanger box and loosen the bolt at the back of the machine connecting the muffler bracket to the frame.
3. Turn the adjusting bolts until the proper belt tension is achieved (1/2" deflection in the center of the belt, halfway between the pulleys).
4. Retighten all bolts previously loosened at the vacuum muffler.

**NOTE: When adjusting belt tension, make certain that the engine shaft and vacuum pump shaft remain parallel, and the belt tension is equal throughout the belt width.**

5. After adjusting, re-tighten the four screws which hold the vacuum pump mount in position. Check belt alignment with straight-edge.

### ⚠ CAUTION:

**Make certain that when you re-torque these screws, that you use a clockwise pattern and continue until proper torque is achieved.**

Torque values		
Component	Inch/lbs	Foot/lbs
Rear Engine Pulley	480	40
Front Engine Pulley	300	25

6. Check for pulley groove wear, clean belts and pulley grooves, check for worn belts, proper belt tension, and pulley alignment after the **first 25 hours** and then again at **100 hours**. Check for belt ride in the groove.

## WATER PUMP DRIVE BELT

To tighten the water pump belt:

1. Loosen the nuts which hold the water pump mount to base.
2. Adjust the position of the belt tension adjusting bolt until the proper belt tension is achieved. (1/2" deflection in the center of the belt, halfway between the pulleys).
3. While checking the alignment, tighten the nuts which hold the water pump mount to base.

## FLOAT VALVE (WATER BOX)

The float valve should only be adjusted if the water box is overflowing or the water level in the box is lower than 5-1/2".

1. If the box is overflowing, remove, and check the float valve for debris or damage.

**NOTE: If the float ball has any water inside it must be replaced.**

### CAUTION:

**When replacing float ball, DO NOT over-tighten, as the rod can puncture the ball. Make sure to tighten the nuts on the rod.**

2. Disassemble the valve and check the piston and seat for damage, replace if needed. See the "Illustrated Parts Listing" for a parts break-down.

## WASTE TANK STRAINER BASKET

The strainer basket located inside the waste tank should be removed and cleaned whenever it is full of debris. This should be done on at the end of each job.

## Y-STRAINER (OUTLET)

Inspect the Y-strainer **after the first week** of running the unit by unscrewing the screen and remove any accumulated debris. Inspect the strainer again at **2 and 4 weeks**.

The Y-strainer should then be inspected **every month**. However, if the Y-strainer has a frequent build-up of debris it should be inspected and cleaned more often.

## CHECK VALVE (OUTLET)

Inspect the check valve when rebuilding the chemical pump or as needed. Remove and disassemble the check valve. Check the Teflon seat for debris or abnormal wear. Clean or replace seat if needed.

**NOTE:** Improper seating of the check valve poppet, damaged spring, or o-rings will cause poor operation of the chemical system.

For the procedure, see the "General Service Adjustments" section in this manual for details.

## CHEMICAL PUMP

Rebuild the chemical pump **every 500 hours**. This involves changing the diaphragm and check valves.

For the procedure, see the "Chemical Pump" section in this manual for details.

**NOTE: Inspect chemical filter daily.**

## CHEMICAL AND SIMULATOR VALVE

Examine the packing nut on the chemical selector valve, heat bypass valve, and chemical metering valve **every 200 hours**. Keeping these valve packings properly adjusted will eliminate possible leakage from the valve stems and add to overall valve life.

For the procedure, see the "General Service Adjustments" section in this manual for details.

## MAINTENANCE

### NITROGEN ACCUMULATOR

The nitrogen accumulator is pressurized to 250 PSI and must be replaced periodically. The accumulator cannot be repaired or recharged. We recommend replacement every 1000 hours of use.

### PRESSURE REGULATOR

Lubricate the o-rings **every 50 hours**. Use o-ring lubricant Part #05-008035.

For the procedure, see the "General Service Adjustments" section in this manual for details.

### VACUUM HOSES

To assure maximum hose life, we recommend that the hoses be washed out with clean water at the end of each **working day**.

### HIGH PRESSURE HOSES

Inspect your high pressure hoses for wear after the **first 100 hours** of use. Inspect **every 25 hours thereafter**. If hoses show any signs of damage or impending rupture, **replace the hose**.



**DO NOT attempt to repair high pressure hoses! Repairing high pressure hoses may result in severe burns and serious injury!**

***All high pressure hoses must be rated for 3000 PSI at 250°F. Thermoplastic hoses do not meet these specifications and should not be used. Severe burns and injury may result if the hoses do not meet these requirements.***

### OPTIONAL WASTE PUMP-OUT

**At the end of each work day**, make certain that you remove any debris or sediment which may be inside the waste pump by pumping fresh water through the pump.

### TEMPERATURE BALANCE ORIFICE

Weekly maintenance of the temperature balance orifice is required for proper machine operation.

1. Unscrew nozzle cap from the connector body.
2. Remove the adapter, orifice plate, and strainer.

3. Clean any debris from the strainer and orifice plate.
4. Reassemble as shown in Parts Section - Solution Outlet.

### ENGINE COOLANT REPLACEMENT

Annually the coolant in the Prochem machine should be replaced. This coolant is an integral part of the heating system and needs to be maintained as any other working part of the system. We recommend that this procedure be accomplished by the following steps.

#### DRAINING COOLANT:

1. Add 7/16" hose or a 1/4" plastic hose into the radiator drain petcock. Turn counter clockwise to open and drain coolant. After draining approximately 1/2 gallon, open bleed petcock in heli-coil to assure that heli-coil drains also. Allow the coolant to completely drain.

***NOTE: Be sure that used coolant is collected in a proper container and disposed of in accordance with local laws.***

2. After draining is complete, close both the radiator and heli-coil petcocks. Draining is complete.

#### REPLACING COOLANT:

1. Fill radiator with 70/30 anti-freeze water mix.
2. Start unit and run on first notch.
3. As the unit warms up, maintain a full radiator with a 70/30 mix.
4. Open petcock slightly on heli-coil to allow any trapped air to escape. When coolant runs out of heli-coil, close petcock.
5. Fill radiator with 70/30 coolant mix.
6. Re-install radiator cap.
7. Shutdown unit.

Check radiator overflow bottle. Add coolant to proper "cold" level.

**GENERAL SERVICE ADJUSTMENTS**



**USE EXTREME CAUTION while servicing while machine is running. The high-speed mechanical parts as well as high temperature components may result in severe injury, severed limbs, or fatality.**

**ENGINE SPEED**

1. This unit uses a governor to set and maintain engine speed. The engine speed is adjusted by shifting the throttle adjustment controller located on the front panel.
2. The throttle adjustment lever is attached to an internal governor. The governor has internal weights that apply pressure to a shaft with an extending arm. Attached to the arm is the carburetor linkage, adjusting engine speed.  
**NOTE:** Units are pre-set at the factory.
3. Engine RPM should drop approximately 50 RPM on high and low speed when the vacuum inlets are covered.



**DO NOT attempt to adjust without a tachometer and NEVER adjust the engine above 2700 RPM (Full Load). Permanent damage may occur.**

**HIGH ALTITUDE OPERATIONS**

Altitude compensation kit is applied for EPA and CARB certified engines only. EPA and CARB emission regulations require the ultimate users of non-road SI engines, as their obligation, to adjust the emissions by installing the appropriate genuine altitude compensation kit. The engine manufacturer must provide such kit when the engine is operated at an altitude that exceeds the standard level, as guaranteed by the engine manufacturer. For this purpose, KUBOTA prepared an engine altitude compensation kit described below. The ultimate users of the SI engines must comply with the regulations through the installation of the appropriate altitude compensation kit for the altitude range where the engine will be operated.

Altitude Compensation Kit	Applicable Altitude Ranges
Original carburetor (with 0m Kit)	0 m ↔ 700 m 0 ft ↔ 2300 ft
1000 m compensation kit	300 m ↔ 1700 m 1000 ft ↔ 5600 ft
2000 m compensation kit	1300 m ↔ 1700 m 4300 ft ↔ 8900 ft

Prepare for the users who have lost original carburetor's jet.

Altitude compensation kit part number: Contact your local KUBOTA dealer and specify your engine type and engine Serial No.

Consult your local KUBOTA dealer for further information on the altitude compensation kit.

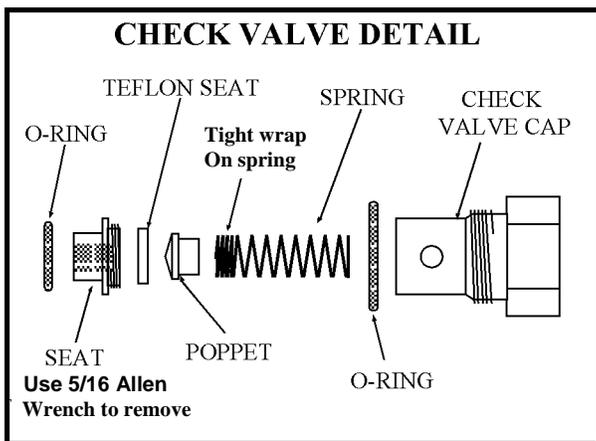
**CONSULT YOUR LOCAL KUBOTA DEALER FOR FURTHER INFORMATION ON THIS PROCEDURE.**

## MAINTENANCE

### CHECK VALVE (SOLUTION OUTLET)

Inspect the check valve whenever doing service on the chemical pump or if flow problems occur in the chemical system:

1. Remove the check valve. Be sure the small o-ring for the seat comes out with the check valve.
2. Remove the seat, using a 5/16" Allen wrench.
3. Check the Teflon seat for debris or wear. Clean or replace Teflon seat if needed.
4. Clean the poppet and spring, inspect for wear or damage, and replace as needed.
5. Re-assemble the check valve. Start the seat by hand, tighten using a 5/16" Allen wrench. **DO NOT** over-tighten seat.



**NOTE: Improper seating of the check valve poppet, damaged spring or o-rings will cause poor operation of the chemical system.**

6. Lubricate the o-rings with o-ring lubricant Part #05-008035 and reinstall.

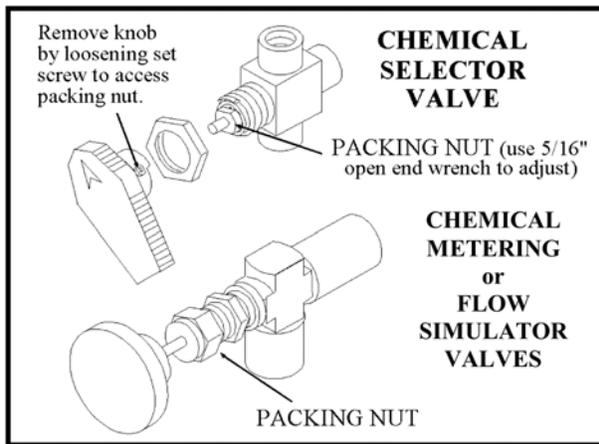
### CHEMICAL PUMP

The only repairs which the chemical pump may require is the replacement of the diaphragm or check valves. To replace the diaphragm, unscrew the cover from the body. When replacing the diaphragm, lubricate the outer edges of the diaphragm with o-ring lubricant Part #05-008035 and reassemble. To replace the check valves, unscrew the check valve caps. Replace the check valves and reassemble, using new o-rings.

**DO NOT** attempt to re-use o-rings once the check valves have been removed. See the "Illustrated Parts Listing" for a parts break-down on the chemical pump.

## PACKING NUT ADJUSTMENT FOR CHEMICAL METERING AND CHEMICAL SELECTOR VALVES

Examine the packing nut on the chemical metering, flow simulator, and chemical selector valves for proper tension every **200 hours**. When turning the knob, there should be a small amount of resistance. If not, slightly tighten the packing nut. **DO NOT** over-tighten. Keeping the valve packings properly adjusted will eliminate possible leakage from the valve stems and add to overall valve life.



## PRESSURE REGULATORS

The pressure regulators serve only to hold locked up water pressure at a preset point and to bypass this water back to the water box.

## PRESSURE REGULATOR

To adjust:

1. With your unit running, close the cleaning tool. Check the pressure gauge. Open the tool valve. We recommend setting the pressure regulator so that the pressure gauge reads 350 PSI with the tool valve **open**.

When the tool valve is opened, there is an approximate drop of 100 PSI in pressure. **If there is a pressure drop greater than 100 PSI, it may be necessary to lubricate the o-rings in the pressure regulator.**

2. If the pressure regulator requires adjustment, turn the adjusting knob (while observing the pressure gauge on the control panel) until the desired pressure is obtained.

## ADDING/DRAINING ENGINE COOLANT

Use a 70:30 coolant to water ratio in this unit's cooling system. **NOTE:** See the "Maintenance Chart" for specific details.

1. To drain the coolant, remove the radiator cap and turn the lower engine radiator draincock counter-clockwise.

## TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
<p>Loss of water pump pressure.</p> <p>With the cleaning tool open, the water pressure gauge reads below the normal operating pressure.</p>	Water supply is turned off or the float valve is stuck or improperly adjusted. NOTE: This may also cause the water pressure switch to disengage pump.	Turn the water supply on or up. Check for kinks in the water supply hose. Examine the float valve and adjust or replace.
	Water pump inlet supply line is plugged or drawing air. NOTE: This may also cause the water pressure disengage pump.	Examine the water inlet filter inside the water box. Remove accumulated debris and replace if required. Check for suction leaks and loose clamps or fittings. Tighten any loose fittings or clamps. Replace any ruptured hose(s).
	Improper engine speed	Using a tachometer, check the engine speed. Full throttle engine speed is 2400 RPM. Idle engine speed is 900 RPM. Refer to the "engine Speed" section for instructions on how to re-adjust.
	Pressure regulator o-rings are dry.	Lubricate o-rings, using o-ring lubricant Part #05-008035.
	Pressure regulator has worn o-rings	Check o-rings. If necessary, replace.
	Pressure regulator is dirty, stuck open, or improperly adjusted.	Clean or repair regulator. Adjust to working pressure. Lubricate o-rings, using o-ring lubricant Part #05-008035.
	Low pump volume. (Measure the amount of water being returned to the water box from the pressure regulator. It should fill a gallon container about every 17 seconds).	Examine the check valves, plunger cups, and cylinder head on the water pump. Repair, whenever required (refer to the water pump service manual).
	Defective water pressure gauge.	Replace gauge
	Orifice (spray nozzle) in the cleaning tool is worn, defective, or wrong size.	Replace Nozzle or change nozzle size.
	Debris clogging water lines or water inlet disconnect.	Clean or replace as needed.
Belts loose or broken	Re-tension or replace as needed.	
<p>Loss of solution volume at cleaning tool orifice.</p> <p>Water gauge reads normal.</p>	Plugged orifice and/or screen in the cleaning tool.	Unplug or replace orifice and/or screen
	Internal block between the pressure regulator manifold and the outlet Y-strainer, or the Y-strainer screen is clogged	Inspect all lines, remove accumulated debris which is blocking proper flow. Replace any defective hoses. Remove, inspect, and clean the Y-strainer screen. De-scale unit and install a water softener, if necessary.
	Outlet check valve is plugged	Examine the check valve, remove any debris
	Defective quick-connect on one or more of the high pressure hoses.	Replace defective quick-connects(s) on high pressure hoses(s).
	Cleaning tool valve is malfunctioning.	Repair or replace valve.
	Hose inner lining is constricted.	Remove restriction or replace hose.

## TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
<p>Loss of vacuum</p> <p>While cleaning, the vacuum is not up to specification. Engine RPM is normal.</p>	Vacuum gauge is giving an improper reading.	Examine the tubing between the vacuum relief valve and the vacuum gauge and remove any blockage.
	Vacuum hose(s) is damaged, causing a suction leak.	Inspect hose(s), repair or replace.
	Waste tank gaskets not sealing properly, not positioned properly	Inspect the gasket. Repair seal or replace Re-position lid(s).
	Plugged vacuum hose or vacuum plumbing between vacuum inlet and strainer basket.	Unplug vacuum hose or inlet plumbing.
	Waste tank filter or strainer basket is plugged.	Clean or replace filter. Clean strainer basket.
	Loose vacuum pump drive belts.	Tighten the drive belts
	Waste tank drain valve is damaged or left open, causing a vacuum leak.	Drain the waste tank. Close drain valve, if open. Remove the dump valve and, after inspecting, replace the defective components.
	Vacuum relief valve requires adjustment or has a vacuum leak due to damaged diaphragm.	Re-adjust the vacuum relief valve. If the vacuum does not increase, remove and inspect the relief valve diaphragm. If damaged, replace
	Vacuum exhaust heat exchangers are plugged with lint.	Remove and clean.
	Vacuum pump is worn out.	Replace the vacuum pump.
<p>Loss of chemical</p> <p>With the cleaning tool valve open, no chemical</p>	Chemical pump is improperly primed.	Refer to chemical pump priming instructions.
	The strainer at the inlet end of the chemical inlet line is clogged	Unclog the strainer. If damaged, replace.
	Suction leak in the inlet line leading into the chemical pump.	Inspect inlet lines and flow meter for damage and replace, if required.
	Chemical pump check valve(s) is clogged	Remove any debris from the chemical check valve(s). Replace chemical check valve(s) or seals, if necessary.
	Chemical prime/on-off valve or chemical metering valve is defective.	Replace valve(s).
	Chemical pump diaphragm is ruptured.	Disassemble the chemical pump and replace the damaged diaphragm.
	Defective cylinder in the water pump.	Measure the pump volume. If the pump volume is less than normal, refer to "Loss of Pump Volume" in the Troubleshooting section in this manual.
<p>Chemical flow meter indicates flow with the tool valve closed</p>	External leak in chemical piping	Tighten fittings. Re-apply thread sealant where required. If any fittings are damaged, replace.
	Outlet check valve is full of debris or damaged, not allowing it to close properly	Close the chemical valve on the instrument panel. If the flow meter does not indicate flow, remove debris or replace check valve, if necessary.
	Chemical pump diaphragm is ruptured	Close the chemical valve on the instrument panel. If the flow meter still indicates flow, replace the chemical pump diaphragm.
	Internal leak in chemical valve causing continual flow through prime tube returning to container.	Tighten valve packing nut (see "General Service Adjustments" section in this manual). Replace valve, if necessary.

## TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Water pump does not engage	Solution pump circuit breaker has been tripped	Check the solution pump circuit breaker on the control panel. Press the circuit breaker reset button.
	Defective electrical connection in the console wiring or defective switch.	Examine switch, electrical connections, and wiring. Repair any defective connections. If there is power going to the switch but not going out, replace the defective switch.
	Water pump has not been activated	Turn solution pump switch to on.
	Defective water pump clutch.	If there is power in the switch, but not power at the clutch, replace the defective wire. If there is power at the clutch, replace the defective switch.
	Loose or broken water pump belts.	Tighten or replace belts.
Engine will not start The engine does not turn over	Main circuit breaker on the control panel has been tripped.	After inspecting the unit to determine the cause of the tripped circuit breaker, press the reset button.
	Loose or corroded battery.	Clean, tighten, or replace the battery terminals.
	Dead battery.	Recharge or replace battery.
	Defective ignition switch.	Test ignition switch for power going into the switch. If there is power going in but NO power going out, replace the switch.
	Defective starter motor.	Test the starter motor. If necessary replace.
	Vacuum pump seized.	Refer to Sutorbilt Service & Repair Manual.
Starter turns over engine, but will not start	Waste tank is full.	Empty the waste tank.
	Engine temperature has exceeded 240°F, triggering the high temperature switch to shut the unit down.	Determine the cause of overheating before restarting the unit. See "Excessive Heating" in the "Troubleshooting" section of this manual.
	Defective fuel pump.	Replace the fuel pump.
	Loose or broken wires leading to waste tank float switch.	Repair or replace any broken electrical connections.
	Defective float switch in the waste tank.	Check switch for proper operation, replace as necessary.
	Oil pressure switch (located on engine), anti-diesel solenoid (located on engine), high temperature switch (located on engine).	Test these components. If any are defective, replace. Consult the Kubota Engine Operation and Maintenance Manual.

## TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Starter turns over engine, but will not start	Engine is malfunctioning	Refer to Kubota Engine Operation and Maintenance Manual.
Engine stops running While doing normal cleaning, the engine stops running	Engine is out of gasoline	Add gasoline to the fuel tank.
	Waste tank is full	Empty waste tank.
	Main or engine circuit breaker on the control panel has been tripped.	After inspecting the unit to determine the cause of the tripped circuit breaker, press the reset button.
	Engine coolant temperature has exceeded 240°F, triggering the high temperature switch to shut the unit down.	Determine the cause of the overheating before restarting the unit. Refer to the Kubota Engine Operation and Maintenance Manual.
	Defective fuel pump.	Replace fuel pump.
	Defective float switch inside the waste tank.	Check switch for proper operation. Replace as necessary.
	Defective 240°F engine coolant high-temperature shutdown switch.	Test switch. If necessary, replace.
	Oil pressure gauge on engine has shut down, due to insufficient oil pressure.	Refer to the Kubota Engine Operation and Maintenance Manual. <b>DO NOT</b> restart the engine until the cause is determined and corrected.
	No ignition in the engine or engine is malfunctioning.	Refer to the Kubota Engine Operation and Maintenance Manual.
Excessive heating	Flow restriction caused by hard water scaling.	Descale unit, repair or replace damaged plumbing components as necessary. Install water softener.
	Not enough water flow.	Check jet size of tool.
Heat exchanger leaks  <b>NOTE: The exhaust heat exchanger will produce water condensation discharge at times during normal operation. DO NOT confuse this with a leak.</b>	Engine/vacuum exhaust heat exchangers are damaged from frozen water.	Inspect heat exchangers for leaks. Visually inspect for damage. Pressure check after removing from the unit. (Maximum test pressure 1200 PSI).
Loss of temperature  The heat output of the unit is LESS than normal.	Temperature relief valve on water box is stuck open.	Clean temperature relief valve and test. Replace, if necessary.
	Engine RPM is low.	Reset engine RPM.
	Defective temperature gauge.	Test gauge and sensor. Replace failed component.
Automatic waste pump is malfunctioning or not operating normally  <b>NOTE: When replacing either the pump or float switch, use new electrical connectors and heat shrink. Inspect connection for watertight seal.</b>	Defective waste pump float switch.	Replace float switch.
	Broken diaphragm.	Replace diaphragm.
	Weak battery.	Charge or replace battery if needed. Check charging station.
	Pump-out circuit breaker on control panel has been tripped.	After inspecting waste pump to determine the cause of the tripped circuit breaker, press the reset button.

**NOTES:**

# ***APEX DIESEL***

# IMPORTANT SAFETY INSTRUCTIONS

When using this machine, basic precautions must always be followed, including the following:

## READ ALL INSTRUCTIONS BEFORE USING THIS MACHINE.

### **WARNING:**

These symbols mean **WARNING** or **CAUTION**. Failure to follow warnings and cautions could result in fatality, personal injury to yourself and/or others, or property damage. Follow these instructions carefully!

### **CAUTION:**

**Read the operator's manual before installing or starting this unit.** Failure to adhere to instructions could result in severe personal injury or could be fatal.

**Operate this unit and equipment only in a well-ventilated area.** Exhaust fumes can cause severe injury or fatality. **DO NOT** run this unit in an enclosed area. **DO NOT** operate this unit where the exhaust may enter any building doorway, window, vent, or opening of any type.

**Diesel fuel is flammable and requires special storage.** Ensure all diesel fuel use and storage meets local, state, and federal requirements. Never utilize an ether spray to assist starting. Severe engine damage will result.

**This unit must be operated with the vehicle or trailer doors open in order to ensure adequate engine ventilation.**

**DO NOT operate engine if diesel fuel is spilled.** Avoid creating any ignition until the diesel has been cleaned up.

**DO NOT place hands, feet, hair, or clothing near rotating or moving parts.** Avoid any contact with moving parts! Rotating machinery can cause injury or fatality.

**Never operate this unit without belt guards.** The high speed moving parts, such as belts and pulleys, should be avoided while this unit is running. Severe injury, damage, or fatality may result.

**DO NOT service this unit while it is running.** The high-speed mechanical parts as well as high temperature components may result in severe injury or severed limbs.

**Never touch electrical wires or components while the engine is running.** They can be sources of electrical shock.

**Engine components can get extremely hot from operation.** To prevent severe burns, **DO NOT** touch these areas while the engine is running - or immediately after the engine is turned off.

**DO NOT touch the exhaust system while this unit is running.** Severe burns may result.

**Before servicing this unit, allow it to "cool down."** This will prevent burns from occurring.

***Water under high pressure at high temperature can cause burns, severe personal injury, or fatality. Shut down machine, allow to cool down, and relieve system of all pressure before removing valves, caps, plugs, fittings, filters, and bolts.***

**DO NOT leave the vehicle engine running while operating this unit.**

**Dangerous Acid, Explosive Gases!** Batteries contain sulfuric acid. To prevent acid burns, avoid contact with skin, eyes and clothing. Batteries produce explosive hydrogen gas while being charged. To prevent a fire or explosion, charge batteries only in well ventilated areas. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries.

Before disconnecting the negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or fuel vapors are present. When disconnecting the battery, **ALWAYS** disconnect the negative (-) terminal **FIRST**.

**DO NOT smoke around the unit.** Fumes may accumulate and be ignited. The battery is also extremely flammable. This will prevent possible explosions.

**DO NOT damage the vehicle in any manner during installation.** When routing fuel lines **DO NOT** place the hose in any location where damage may occur to the hose or vehicle. Avoid any contact with moving parts, areas of high temperature, brake lines, fuel lines, muffler, catalytic converter, or sharp objects.

**DO NOT cut or splice any of the vehicle fuel lines during fuel line installation.** This may result in fuel leaks and potentially dangerous conditions. There is no fuel solenoid shut off on this unit. Use only the provided fuel hose for fuel lines. When traversing the vehicle floor with fuel lines, always use a bulkhead adapter. This will prevent leakage and ensure that the hose is not punctured by vehicle vibration abrasion.

**DO NOT exceed your vehicle's weight limit.** The console with waste tank and accessories weighs approximately 1160 lbs. Make certain to account for any additional accessories in your weight and balance calculations. Make certain that the vehicle has the correct axle rating. This will prevent unsafe vehicle driving conditions.

**We require high-back seats on all vehicles in which units are to be installed for head and neck protection.** We recommend using a metal partition between the seats and equipment.

**DO NOT operate this unit without the water supply attached and turned on.** The water pump and other vital components may be seriously damaged if this unit is permitted to operate dry without water.

***DO NOT operate this unit without the filter installed in the waste tank.***

**Keep your vehicle work area clean.** Wands, stair tools, and other accessories must be securely fastened before driving the vehicle.

**All high pressure hoses must be rated for 3000 PSI at 250°F.** Thermoplastic hoses do not meet these specifications and should not be used. Severe burns and injury may result if the hoses do not meet these requirements.

**The winterizing loop hose assembly, Part #10-805380, is for winterizing use only.** If used improperly, live steam may escape from this hose, causing it to whip around. Burns or injury may result.

**Make certain that you receive complete training by the distributor from whom you purchased this unit.**

**This unit uses high pressure and temperature. Improper or irresponsible use may result in serious injury.**

**Do not modify this unit in any manner.** Improper modification can cause severe personal injury or fatality.

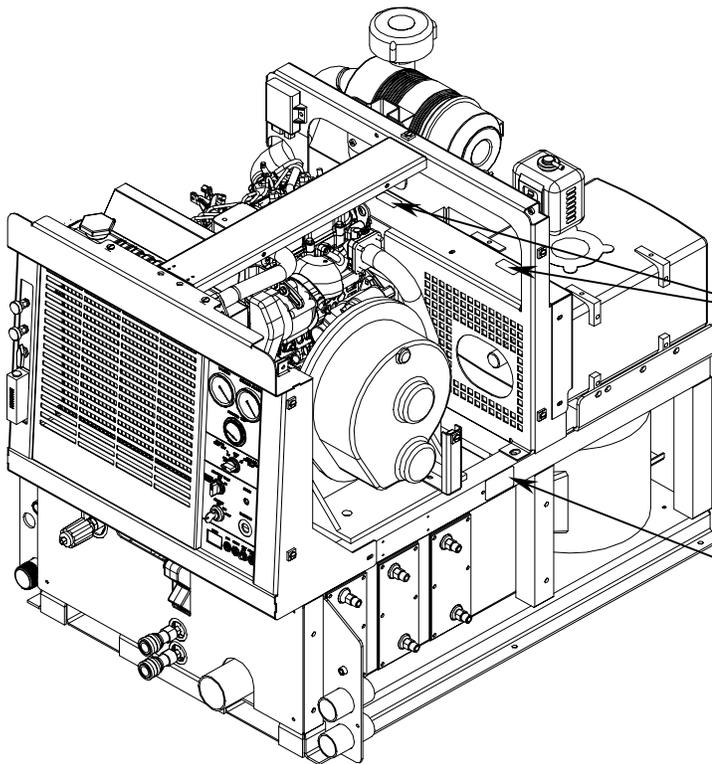
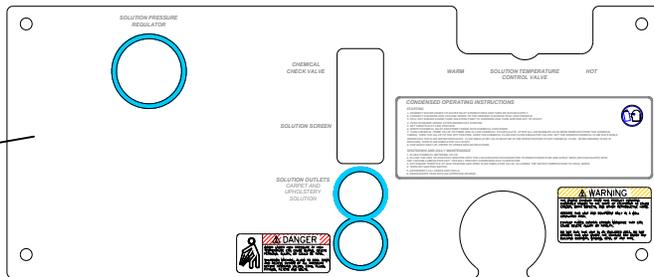
**CALIFORNIA PROPOSITION 65 WARNING:** Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

# HAZARD INTENSITY LEVEL

The following **WARNING LABELS** are found on your cleaning unit . These labels point out important **Warnings** and **Cautions** which should be followed at **all** times. Failure to follow warnings and cautions could result in fatality, personal injury to yourself and/or others, or property damage. Follow these instructions carefully! **DO NOT** remove these labels.

**NOTE:** If at any time the labels become illegible, promptly replace them.

Front panel decal  
Part # 791103



(2) Warning labels required  
Warning label  
Part # 500769



Caution label  
Part # 500770

**TECHNICAL SPECIFICATIONS**

<b>ITEM</b>	<b>DIMENSION/CAPACITY</b>
Engine speed	2850 rpm (high speed) Water Pump ON 1300 rpm (idle speed) Water Pump OFF.
Water pump rpm	1000 rpm
Vacuum pump rpm	2600 rpm
Water flow rate	4.15 GPM (maximum)
Water pump pressure	1000 PSI (maximum)
Vacuum relief valve	13" Hg
Waste tank capacity	80 gallons
Console weight	910 lbs.
Console weight (with waste tank & waste tank accessories)	1160 lbs. (1830 lbs. If waste tank is full)
<b>TORQUE VALUES</b>	
Engine front pulley	300 inch lbs      25 foot/lbs
Vacuum pump hub	300 inch/lbs      25 foot/lbs
Engine rear pulley	480 in//lbs      40 foot/lbs

**JET SIZING:**

Recommended floor tool tip sizing not exceed a total of ".06". Using larger jet sizes on your cleaning unit may reduce cleaning temperatures.

Example:      Tri-jet wand uses three 9502 jets (95° spray angle w/ .02 orifice).  
                  02 x 3 = 06

When using two floor tools while cleaning with this unit, it is recommended that each tool tip size does not exceed a total of ".045".

Example:      Tri-jet wand uses three 95015 jets (95° spray angle w/ .015 orifice).  
                  015 x 3 = 045.....045 x 2 tools = 09

Upholstery tool jet size:                      80015  
Stair tool jet size:                              9502

# OPERATION

## INSTALLATION REQUIREMENTS DEALER RESPONSIBILITY

**NOTE:** Your distributor from whom you purchased this mobile cleaning unit is responsible for the correct installation of this machine. The dealer is also responsible for initial training of your operators and maintenance personnel in the proper operation and maintenance of this unit.

1. The unit should **NOT** be mounted in any motor vehicle of less than **3/4 ton capacity**.

### CAUTION:

The console with waste tank and accessories must **NOT** exceed the vehicle's axle weight limit.

2. If mounting in a trailer, make certain that the trailer is rated for the total weight of the **UNIT AND TRAILER**. Electric or hydraulic brakes should be provided, and a strict compliance with any State and Federal vehicle laws must be maintained.
3. The vehicle tires should have a load rating above the combined vehicle and unit weight.
4. We do not recommend using flooring materials that absorb water. This could result in rust and corrosion of the vehicle floor.
5. Padding under rubber floor mats should be removed before installing this unit.
6. We highly recommend using a drip tray under the console (Part #790552).
7. If using a trailer, the console should be positioned so that it balances properly with respect to the axle. Ten percent (10%) of the overall unit weight should be on the tongue.

**Example:** If loaded trailer weight is 2,000 lbs., tongue weight needs to be a minimum of 200 lbs. to tow properly.

## FUEL REQUIREMENTS

Use diesel fuel **ONLY**.

### WARNING:

**NEVER** use a starting fluid (i.e. ether) to assist in starting engine. Severe engine damage will result.

## ENGINE OIL REQUIREMENTS

### 1. LUBRICATING OIL

With the emission control now in effect, the CF-4 and CG-4 lubricating oils have been developed for use of a low sulfur fuel on on-road vehicle engines. When an off-road vehicle engine runs on a high-sulfur fuel, it is advisable to employ the CF, CD or CE lubricating oil with a high total base number. If the CF-4 or CG-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals.

API service classification: above CD grade.  
Ambient temperature: below 35°C (95°F).

Lubricating oil recommended when a low-sulfur or high-sulfur fuel is employed.

O: Recommendable X: Not recommendable

Lubricating Oil Class	Fuel		Remarks
	Low-Sulfur	High-Sulfur	
CF	O	O	TBN $\geq$ 10
CF-4	O	X	
CG-4	O	X	

### 2. CHANGING INTERVAL OF ENGINE OIL AND OIL FILTER CARTRIDGE.

Engine	Engine oil	50 Hrs (Initial)
		100 Hrs
D902-E	Oil filter cartridge	200 Hrs

**CHEMICAL REQUIREMENTS**

This cleaning unit, due to its chemical injection pump design, can be used with a variety of water-diluted chemical compounds (either acidic or alkaline), depending on the job to be done. However, to obtain optimum results with this unit, we recommend using the PROCHEM line of chemicals. For information on using the cleaning compounds, refer to the PROCHEM chemical manual.

**WATER REQUIREMENTS**

Hard water deposits will adversely affect the plumbing and heat exchange systems on this unit. The map below will give you an idea of where areas of high water hardness may occur. However, any water supply obtained from a well is almost always hard water and a water softener will be needed to protect your equipment.

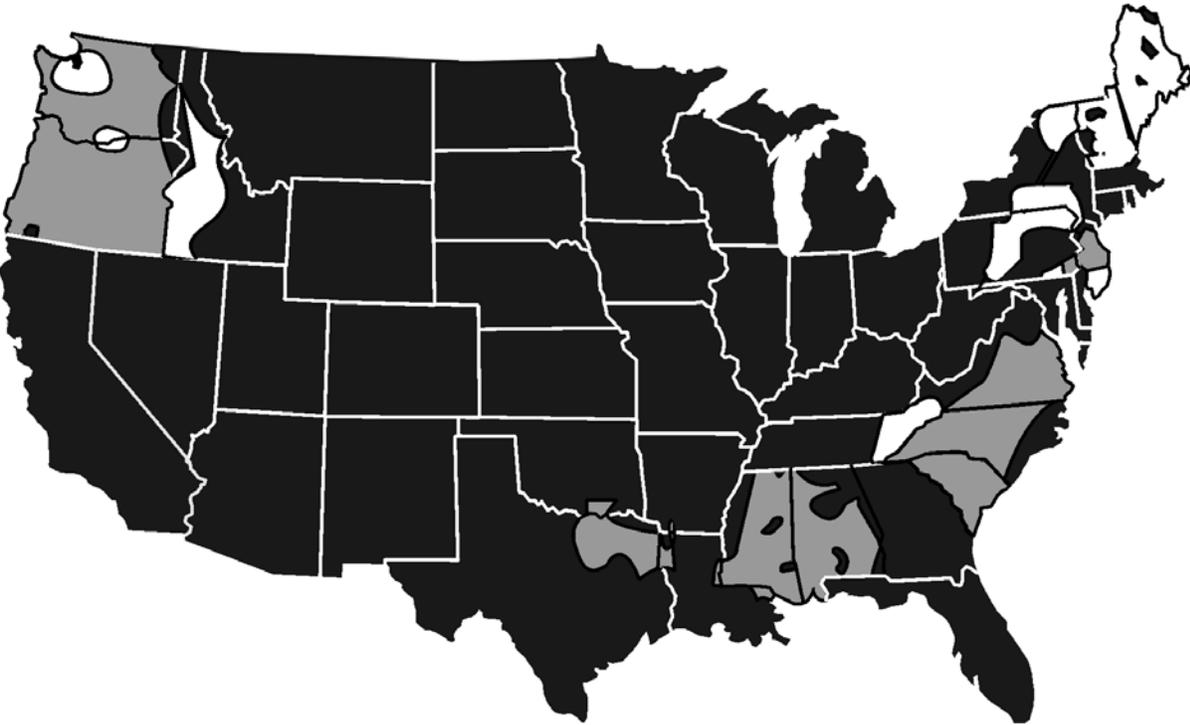
**NOTE: Equipment malfunction or component failure caused by hard water scaling is NOT covered under the warranty.**

If you are operating this unit in an area where the unit will be using water in which the hardness exceeds 3-1/2 grains, we highly recommend a suitable water softener be installed. If using a water softener, it must have a five (5) GPM (or greater) flow capacity without any hose constrictions.

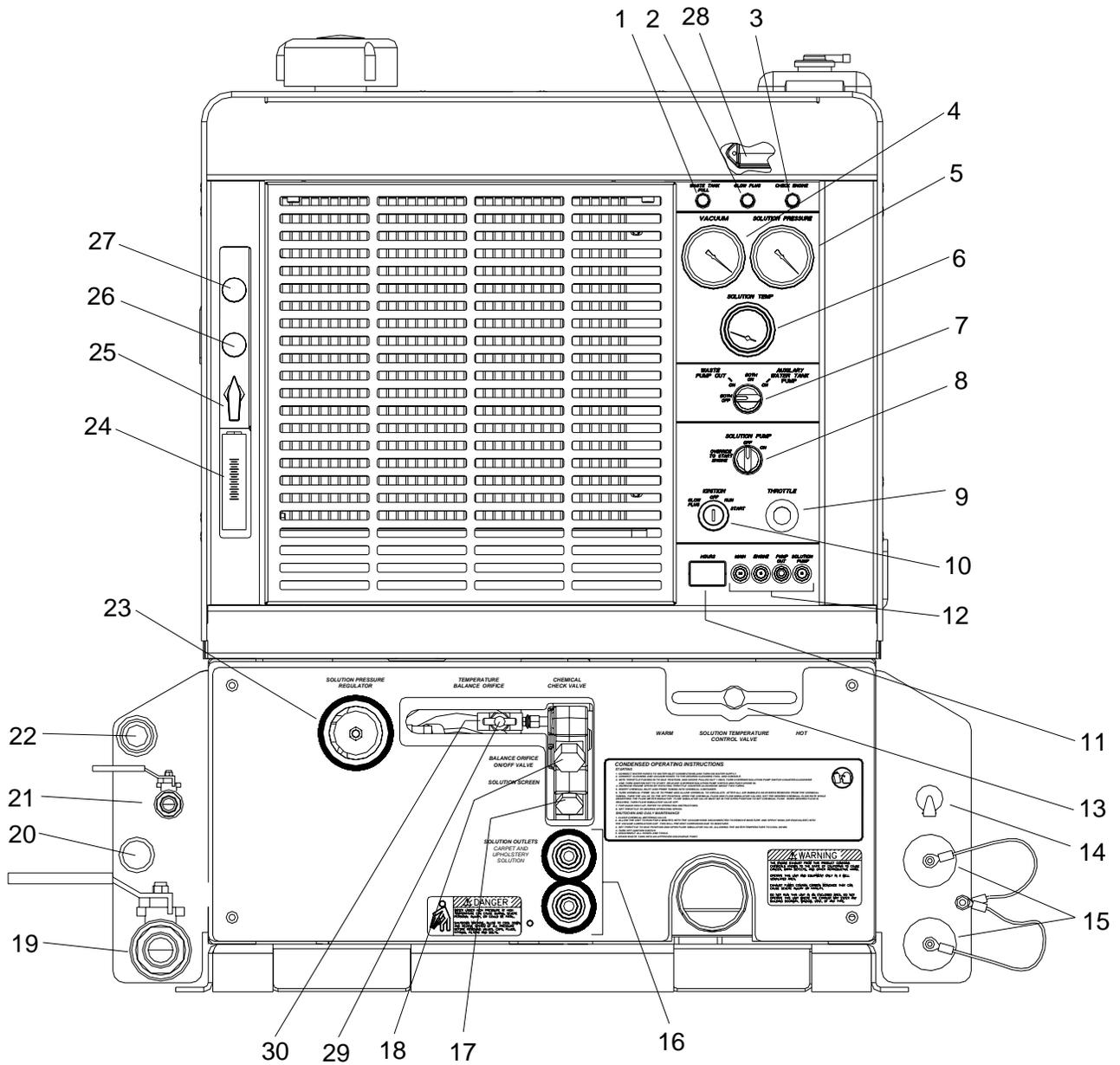
Using a water softener will reduce maintenance and decrease down time caused by hard water scaling. It will also allow cleaning chemicals to be more effective in lower concentrations

If you require a water softener, PROCHEM has a model to meet your needs. Please contact your nearest distributor for information, price, and availability.

**HARD WATER MAP**



# COMPONENTS



## 1. WASTE TANK FULL INDICATOR LIGHT

This indicator light is activated when the waste tank is full. When lit the unit will shutdown protecting the equipment from damage. This also indicates that the waste tank must be emptied before the unit can be brought back in service.

**NOTE: Never dispose of waste water in storm drains, water ways or on ground areas. Always dispose of waste in accordance with local, state and federal laws.**

## 2. GLOW PLUG INDICATOR

After turning the ignition switch counterclockwise this indicator lamp illuminates during glow plug warm up. When light goes out, engine is ready for start.

## 3. ENGINE HIGH TEMPERATURE SHUTDOWN INDICATOR

This light when activated signals an over heat condition with the engine. When this occurs, troubleshooting is required.

## 4. VACUUM GAUGE

This gauge indicates in inches of mercury how much vacuum the system is producing at any given time.

## 5. SOLUTION PRESSURE GAUGE

This gauge registers the amount of pressure in the system.

## 6. SOLUTION TEMPERATURE GAUGE

This gauge measures the temperature of the cleaning solution as it exits the machine.

## 7. WASTE PUMPOUT AND AUXILIARY WATER PUMP SWITCH

This four-position switch is for activating the waste pumpout device. It also serves to activate the fresh water transfer pump. For turning on pumps, rotate clockwise. For turning off pumps, rotate counter clockwise.

## 8. SOLUTION PUMP SWITCH

This switch serves to energize the magnetic clutch to turn the water pump on or off. Turn clockwise for activating the pump and counter clockwise for deactivating the pump.

## 9. THROTTLE

This serves to set the speed of the engine by rotating the throttle knob counterclockwise to increase, clockwise to decrease. The cable has a collar lock, which serves to lock in a given speed.

## 10. KEY SWITCH

The key switch controls the power for the machine. To turn the machine on, rotate the key counterclockwise to energize the glow plugs and hold. This will illuminate the green glow plug lamp. When the glow plug lamp goes out the engine is ready to start. Turn solution pump switch counterclockwise to override and hold. Turn key switch clockwise until engine starts and release. Wait 5 seconds then release override switch. To stop engine rotate key to OFF position.

## 11. HOUR METER

The hour meter records the number of hours the unit has run. This serves as a time recorder for servicing the machine.

## 12. CIRCUIT BREAKERS

These serve to protect the circuits from electrical spike and over loads and protects wires from damage and fire.

## 13. SOLUTION TEMPERATURE CONTROL VALVE

This valve enables additional heat exchangers to contribute more heat to the system if necessary. By rotating the lever to the right it adds more heat, by rotating to the left it removes heat.

## COMPONENTS

### 14. OIL CUP

The oil cup allows lubricant spray to reach the vacuum blower.

### 15. VACUUM INLETS

The vacuum inlets serve as connecting point for vacuum hoses.

### 16. SOLUTION OUTLETS

The solution outlets are the connecting point for the high pressure cleaning hoses. These outlets are quick disconnects that allow hoses to be plugged into the unit.

### 17. SOLUTION SCREEN

The solution screen is located on the front of the machine. The function of this screen is to trap foreign particles from exiting the machine and plugging the orifices of the cleaning tools. This screen is part of the machine maintenance cleaning.

### 18. CHEMICAL CHECK VALVE

The chemical check valve allows chemicals to enter the system and travel in a singular direction to the wand. The chemical check valve prevents chemicals from traveling up-stream into the solution system of the unit.

### 19. WASTE OUTLET

This valve allows the waste tank to be emptied. Turning clockwise opens the valve.

### 20. WASTE PUMPOUT

This auxiliary pump serves to empty the waste collection tank automatically. A float located inside the tank automatically turns off and on when the solution level reaches certain points.

### 21. WARM WATER OUTLET

The warm water outlet allows the cleaning technician to drain hot water from the water box for mixing chemical.



**Water from this valve is hot.**

### 22. WATER INLET

This quick connect allows the water supply hose to be connected to the unit.

### 23. PRESSURE REGULATOR

This pressure regulating valve allows the water pressure circuit to be adjusted by turning the handle clockwise the pressure will increase, by turning counter clockwise the pressure will decrease.

### 24. FLOW METER

The flow meter is a gauge to indicate how much liquid chemical is being introduced in the water system. The quantity can be increased by turning the chemical flow knob counter clockwise.

### 25. CHEMICAL PRIME CONTROL VALVE

This valve allows the chemical to circulate through the chemical system with little or no restriction. It also purges out air that may be trapped in the lines and cavities of the chemical pump. By turning the valve clockwise the injection system is enabled.

### 26. CHEMICAL METERING VALVE

The chemical metering valve regulates the amount of chemical that is injected into the system. Clockwise rotation of the knob closes the valve. Counter clockwise rotation opens the valve, allowing more chemical to enter the system.

### **27. FLOW SIMULATOR VALVE**

This valve allows solution to move through the machine and chemical to be injected simulating the cleaning process. This allows the operator to set the chemical flow level without connecting tools to the machine. It is also useful in troubleshooting. The valve is turned off by rotating the knob clockwise and opened by turning the knob counter clockwise.

### **28. PANEL LIGHT**

This light is useful if the machine is used in a poorly lit area or night use. It is helpful in reading the instruments and gauges.

### **29. TEMPERTURE BALANCE ORIFICE SHUTOFF VALVE**

The temperature balance orifice shutoff valve allows the operator to increase solution temperature during two wand operation. This should only be closed during two wand operation.

### **30. TEMPERATURE BALANCE ORIFICE**

The temperature balance orifice helps to balance and stabilize the solution temperature within the system.

## **OPERATION**

### **WATER PUMPING AND HEAT TRANSFER SYSTEM**

Cold water enters the console through the water inlet. When the water box is full the valve will automatically shut off.

Water then flows from the water box, through a strainer, into the water pump where it is pumped to the pressure regulator manifold where the pressure regulator provides and maintains the desired pressure setting.

The pressure regulator manifold includes a nitrogen charged accumulator which helps reduce pressure spikes from the pump.

A certain amount of water is by-passed from the pressure regulator due to over pumping capacity of the water pump. Water that is not called for in the cleaning process is channeled through a heat exchanger box into the first heater core from the front of the unit. This bypass water may circulate several times through the bypass heat exchanger allowing the water to be pre-warmed.

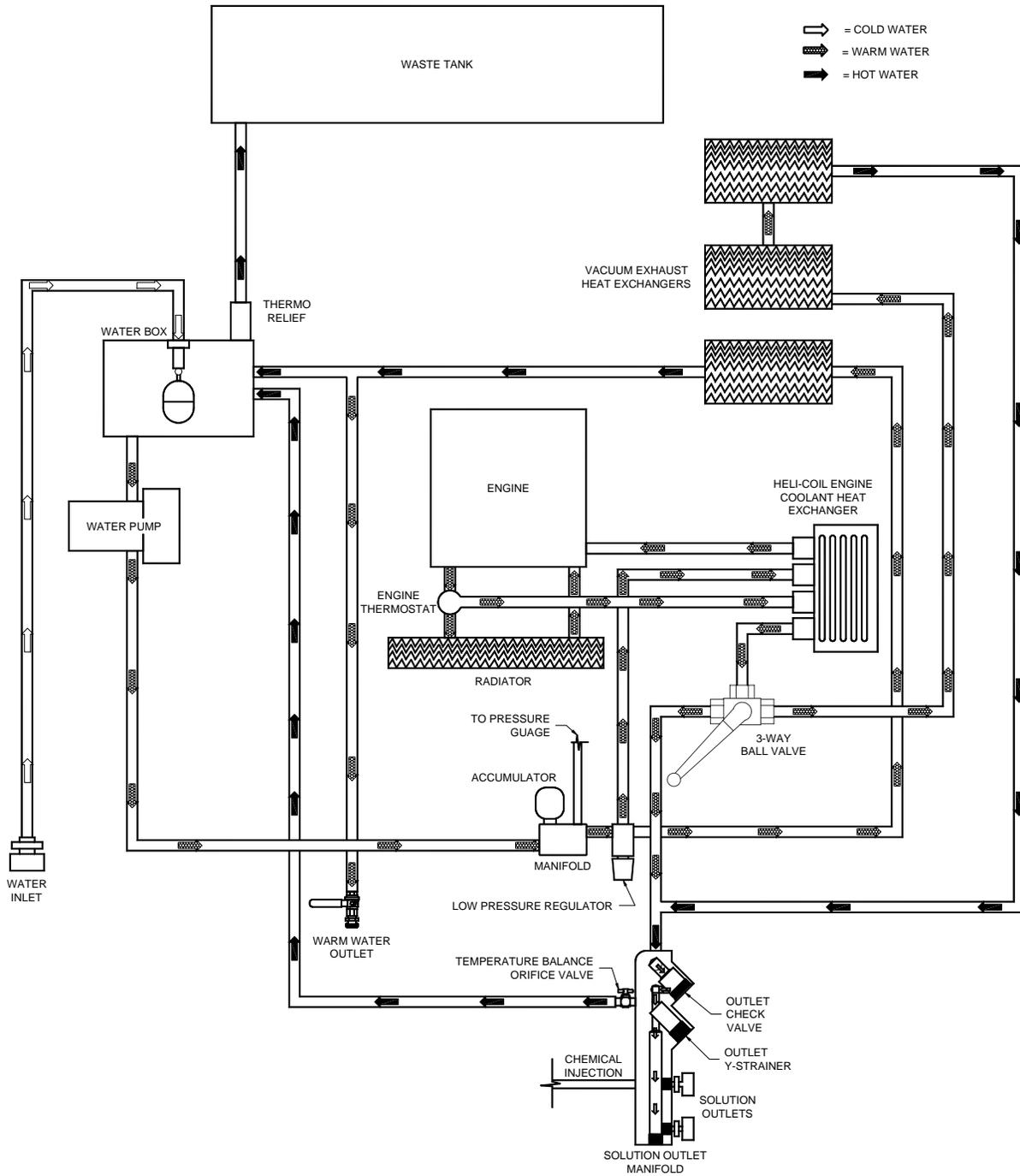
The next stage of heating and water flow is to the helicoil, when water is called for in the cleaning process it flows to the helicoil under pressure. Heat from the engine coolant is exchanged to the cleaning solution through a series of spiraled copper tubing. This allows the engine coolant to travel in a counter rotating direction to the cleaning water during the exchange process creating a very efficient transfer of heat out of the engine and into the cleaning solution.

The third stage of plumbing and heat exchange takes place in the 2nd heater core located in the heater box. This is the hottest point of the gases coming from the vac pump and the engine. These hot gases are forced through heater core #2 creating the third stage of heat transfer to the cleaning solution.

Finally, the hot solution passes to the outlet manifold where cleaning chemicals are injected from the chemical pulse pump. This manifold serves as a temperature sensing point and a connecting point for the high-pressure hoses. Also a check valve is located in this outlet manifold prohibiting chemicals from backing up into the system.

The cleaning solution then passes through high-pressure hoses and is distributed by the cleaning tool to a surface that is being cleaned, completing the water pumping and heating cycle of the cleaning unit.

SINGLE SYSTEM WATER FLOW DIAGRAM  
LOW PRESSURE



# OPERATION

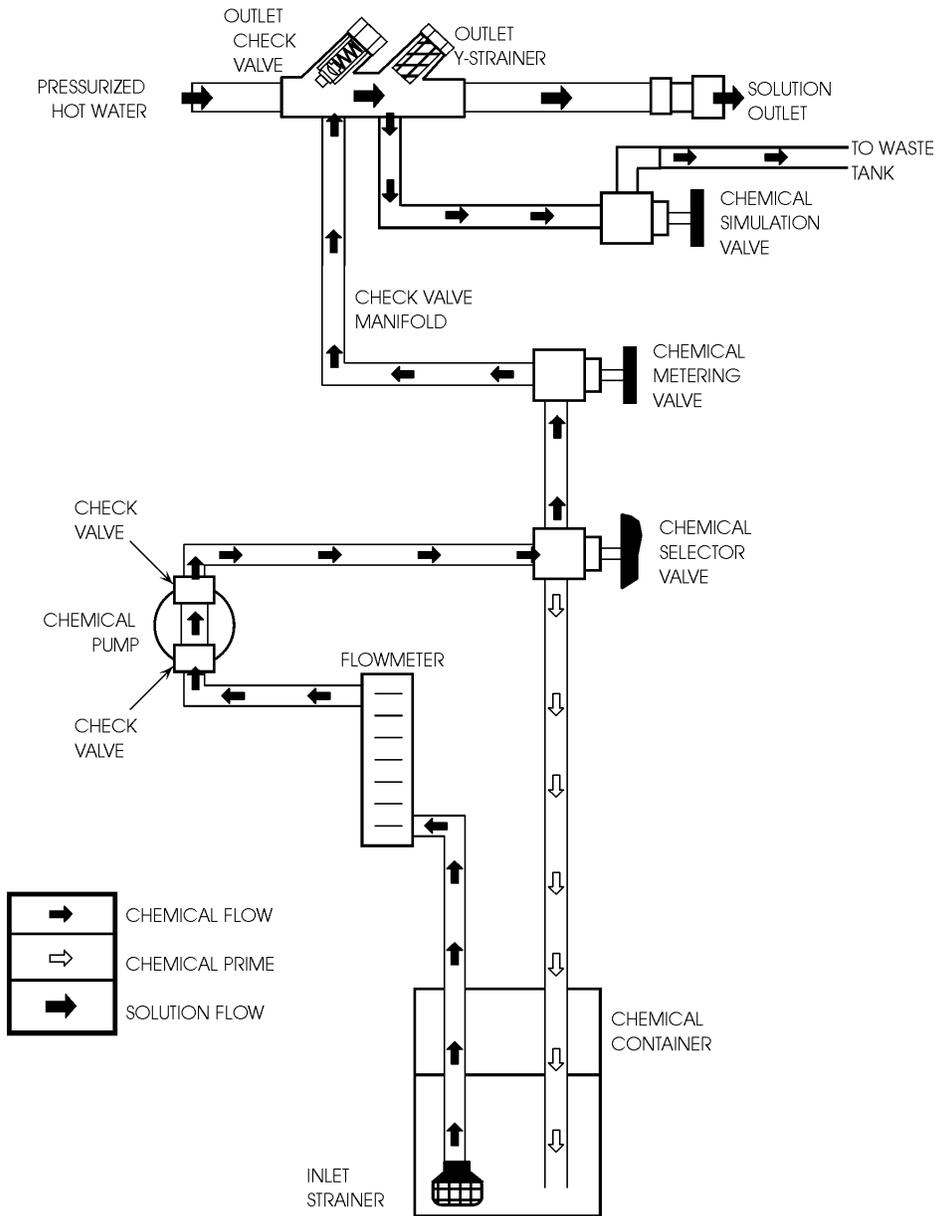
## CHEMICAL INJECTION SYSTEM

The chemical injection system is unique in that it utilizes the pressure spikes generated by the high-pressure water pump to move chemical into the main pressure stream. The high pressure spikes move the diaphragm in the chemical pulse pump forcing small amounts of liquid chemical to be moved in a single direction of flow with the aid of two check valves.

The chemical is picked up from the container and fed through the flow meter to the chemical pulse pump where it is pressurized.

After reaching the chemical pulse pump the chemicals can either go into a bypass loop to purge air from the system or the chemicals can be directed by the chemical selector valve to the metering valve. The metering valve creates an orifice allowing the correct amount of chemical to enter the outlet manifold. The outlet manifold assembly is complete with a check valve that will not allow the chemicals to travel upstream into the plumbing system of the unit.

The chemicals are then mixed with hot pressurized water that make up a solution for cleaning application.

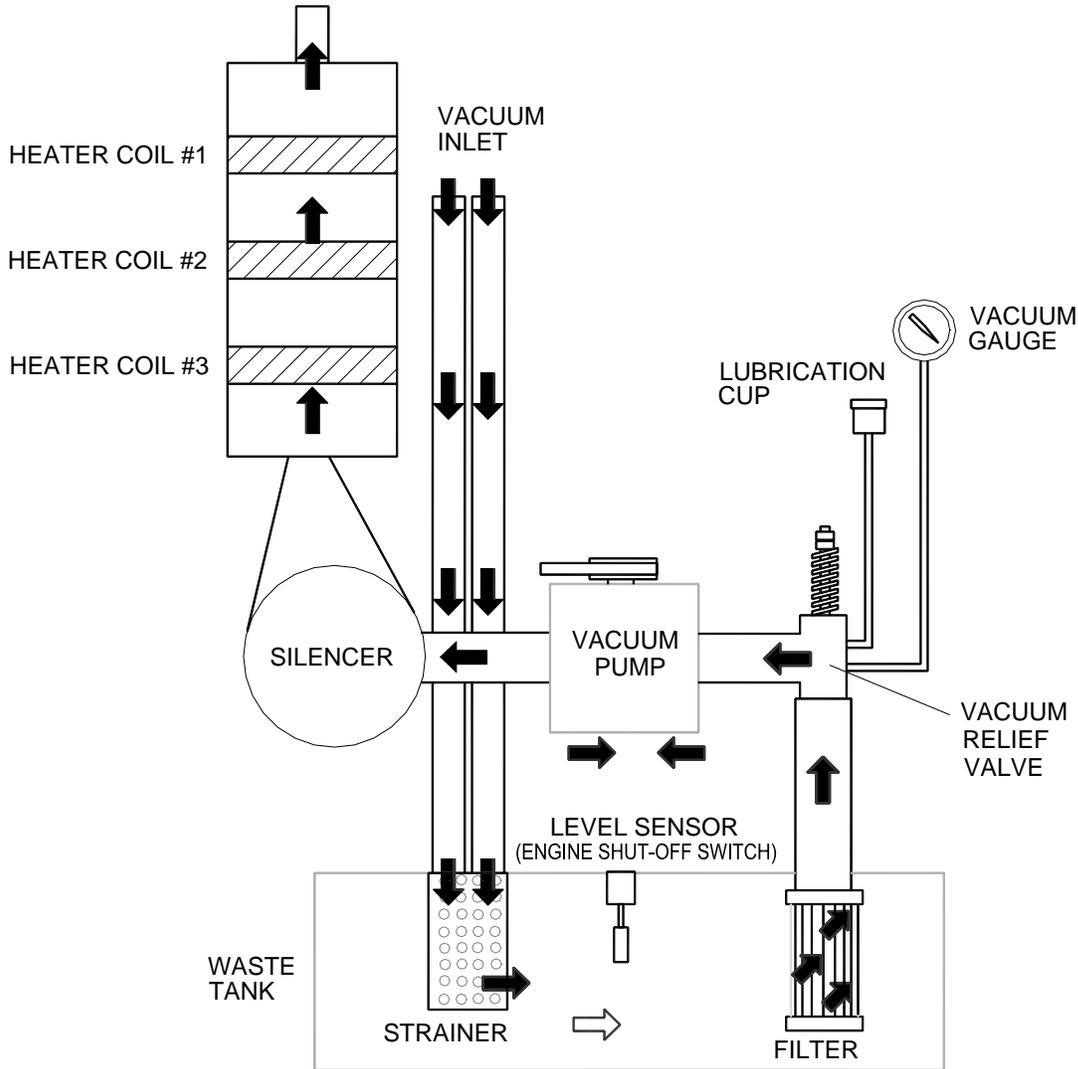


**VACUUM SYSTEM**

The engine turning an air pump generates vacuum. The air is channeled in one side of the vacuum pump, compressed and discharged on the opposite side, creating airflow.

The movement of air is used to do the work necessary for the extraction process. A vacuum nozzle applied to the carpet surface removes moisture, dirt and spent chemicals. These elements are conveyed back to a separating tank utilizing hoses and the force of air. Particles of moisture and dirt are separated in the vacuum tank using a series of changes in direction and velocity. The air is then filtered and rushes into the vacuum pump.

The vacuum pump compresses and heats the incoming air. The hot discharged air is forced down stream into a silencer for noise abatement. After exiting the silencer, this hot air is mixed with hot air and gases from the engine. This mixture of hot air and gases are then forced through 3 radiators serving as heat collectors. Heat from the engine and vacuum pump is then transferred into the plumbing system raising the water temperature for better cleaning.



# OPERATION

## PRE-RUN INSPECTION

**NOTE:** Operation of this unit is simple. However, only trained personnel should proceed.

### **WARNING:**

Operate this unit and equipment only in a well-ventilated area. Exhaust fumes contain carbon monoxide which is an odorless and deadly poison that can cause severe injury or fatality. **DO NOT** operate this unit where the exhaust may enter any building doorway, window, vent, or opening of any type.

## CHECK FOR ADEQUATE FUEL

Check the fuel tank to be certain there is adequate fuel to complete the job. This unit uses approximately .95 to 1.18 gallons of fuel per hour, depending on the speed setting.

## REMOVE TOOLS FROM VEHICLE

Remove any **tools** or **hoses** from the van which you will require.

## WATER SUPPLY CONNECTION

**NOTE:** Before connecting your water hose to the supply faucet, flush out the faucet until the water is free of any debris. Flush out any debris which may be in your water inlet hose.

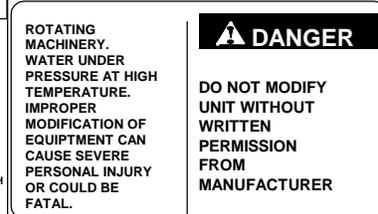
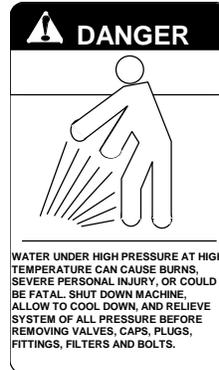
1. Connect the **water supply hose** to the **water inlet** quick-connect at the left front of the console. Connect the hose to the water supply faucet.

**NOTE:** Never use your waste pump outlet hose as a water inlet hose. Use only clean hoses for water inlet.

2. Turn the **water supply faucet** on. The water will fill the **water box**.

## HIGH PRESSURE HOSE

Before starting the unit, connect the **pressure hose(s)** to the **outlet connection(s)** at the front of the unit. Connect the **cleaning tool(s)** to the **pressure hose(s)**.



## VACUUM HOSE

Connect the **vacuum hose(s)** to the **vacuum inlet** connection(s) at the front of the unit. Connect the other end of the **vacuum hose(s)** to the **cleaning tool(s)**.

## PRIMING THE CHEMICAL PUMP

1. Connect water hose to water inlet connection and turn on water supply.
2. Connect cleaning and vacuum hoses to the desired cleaning tool and console.
3. Insert chemical inlet and prime tubing into chemical container.
4. Turn ignition switch counterclockwise until glow plug light goes off. Turn solution pump switch to override, and turn ignition key clockwise to start.
5. Set throttle to low speed.
6. Fill chemical container and inspect chemical filter.
7. Turn chemical prime valve to prime and allow chemical to circulate. After all air bubbles have been removed from chemical tubing, turn the valve to the horizontal (off) position and open the chemical metering valve, and the simulation valve. Set the desired chemical flow rate while observing the flow meter indicator. Simulator valve must be in the open position to set chemical flow. When desired flow is reached turn simulator valve off.
8. Set throttle to maximum position with vacuum ports blocked off for improved unit heat up.

## WASTE PUMP (OPTIONAL)

1. If your unit is equipped with an automatic waste pump, connect one end of a garden hose to the pump-out connection on the console and the other end to an appropriate waste disposal.
2. Turn the pump-out switch on the control panel to the ON position. The waste pump will operate automatically throughout the cleaning operation.

We recommend that you use a 3/4" I.D. water hose as a waste pump outlet hose. DO NOT use a hose smaller than 5/8" I.D.

NEVER use your automatic waste pump outlet hose as a water inlet hose.

 **WARNING:** NEVER dispose of waste in storm drains, water ways, or on ground areas. Always dispose of waste in accordance with Local, State, and Federal laws.

Once you have completed steps 1 through 8, proceed with the cleaning operation. Your unit should be in the correct throttle position for your cleaning operation or extracting. A float switch located inside the waste tank will automatically shut down the unit when it reaches its full capacity. When this occurs, empty the waste tank before continuing.

## CLEANING

Observe the following guidelines, while cleaning:

1. Before proceeding make sure the nozzles are functioning properly.
  - a. To check, hold the wand about one foot above the surface to be cleaned and open the wand valve. A full spray should be observed from the cleaning nozzles.
  - b. If the nozzles are not showing a full spray pattern, adjust nozzles for proper pattern, clean, or replace nozzles, if required.
2. Normally chemical is applied on the push stroke of the wand when cleaning and vacuuming is done on the pull stroke. For heavily soiled carpets the wand may be used in a scrubbing manner, apply chemical in both push and pull strokes. Always finish up an area with a vacuum stroke.
3. When cleaning, keep the working opening (mouth) flat on the surface being cleaned. Keep the wand moving when the valve is open.
4. The unit will automatically shut-down when the waste tank is full. This will prevent water being drawn into the vacuum pump. If shut-down occurs, empty the waste tank before proceeding.

## OPERATION

### UPHOLSTERY CLEANING

Upholstery tool, part #78513

1. Set temperature as desired and slow down the engine speed to minimize excess heat.
2. Use one (1) "80015" spray tip in tool.

### SHUTDOWN AND DAILY MAINTENANCE

1. Close chemical metering valve.
2. Allow the unit to run for 2 minutes with the vacuum hose disconnected to remove moisture. Spray WD40 (or equivalent) into the vacuum lubrication cup for 5 seconds. This will prevent corrosion due to moisture.
3. Set engine throttle at idle position and allow the water temperature to cool down, unitizing the simulator valve in the open position to bleed off residual hot water left in the system.
4. Turn off ignition switch.
5. Disconnect all hoses and tools.
6. Drain waste tank.

### PERSONAL PROTECTIVE EQUIPMENT

Ensure that proper Personal Protective Equipment (PPE) is used during the operation of

#### CAUTION:

this equipment. Failure to use proper PPE could result in injury. Ensure required ventilation and/or breathing apparatuses are used with a chemical injection system. Check with your chemical vendor for proper safety requirements.

### DE-FLOODING OPERATIONS

De-flooding operations involve removal of water from carpet and flooring. This differs from normal cleaning operations in that no water or solution is required. An automatic waste pump-out is highly recommended for all de-flooding operations due to the large amount of water removal often required.

1. Move the temperature selection valve from the "hot" position to the "warm" position.
2. Adjust pressure regulator to set pressure at 100 psi.
3. Turn temperature balance orifice valve to open.
4. Allow solution temperature to cool below 160 deg F.
5. Begin de-flooding operation.

### FREEZING PROTECTON

#### CAUTION:

If the unit is exposed to freezing weather the water in the unit may freeze, causing **SERIOUS DAMAGE** to the unit. To avoid this, the following is recommended during the cold weather season.

When the unit is not in use, always park it in a heated building.

While in operation, avoid long shutdowns as the unit provides heat while running. Shut it down just prior to leaving for the next job.

If a heated building is not available, we recommend that you winterize the unit with anti-freeze. At present, it is only possible to winterize units, which do not have an auxiliary water tank. Units with auxiliary water tanks must be stored in a heated building when not in use.

### WINTERIZING YOUR UNIT

1. Shut off the water supply. Disconnect the **water inlet hose** from the front of your console.
2. Connect all **high pressure hoses and tools** that may have water in them.
3. Start the unit and turn water pump on. Open the tool valve until water pressure drops and water stops flowing.
4. Fill the water box with approximately two gallons of 100% glycol base anti-freeze.
5. Turn the **solution pump override switch** to the override position and start the unit. Turn the **solution pump switch** ON.
6. Open the tool valve until anti-freeze begins to come out of the tool. Recover **ALL** anti-freeze that comes out of the tools into an approved container. We strongly recommend that you re-cycle and re-use the anti-freeze.

Repeat this procedure with all the remaining tools. After all tools and pressure hoses have been filled with anti-freeze, disconnect and store them.

7. Turn the **solution pump switch** OFF. Attach the **winterizing loop hose** with attachment, Part #10-805380, to the solution outlet connection and the water inlet connection. Turn the **solution pump switch** ON.

Allow the unit to run for approximately 3 minutes with the winterizing loop hose attached.

8. Prime the chemical system with 50/50 anti-freeze/water mix. Insert the chemical inlet and prime discharge tubes into the anti-freeze container. Turn the chemical valve to PRIME until anti-freeze begins to flow out of the prime hose.
9. Now turn the chemical valve and flow simulator valves to the open position, making certain that the flow meter indicates flow and that all anti-freeze drains out of the chemical hose into an approved container, after 30 seconds, turn off both valves.

After completing these procedures, shut the unit down. The unit is now winterized.

## OPERATION

### REMOVING ANTI-FREEZE FROM THE UNIT

1. Connect one end of the **winterizing loop hose** to the solution outlet connection. Place the other end of the loop hose, without the attachment, into an approved container.
2. Start the unit. Allow the anti-freeze to flow into the container until flow stops.
3. Fill the water box with fresh water and repeat step #2.
4. Connect the **water inlet hose** to the water inlet connection on the console. Turn the water supply on.
5. Connect all **solution hoses and any tools** which require purging of anti-freeze to the solution outlet connection(s).
6. Open the tool valves and drain the anti-freeze into an approved container until the flow is clear and all anti-freeze is purged from the tools and hoses.

7. Place the chemical prime hose into the approved container. Submerge the chemical inlet hose in water. Turn the **chemical valve** to the PRIME position until clear water comes through the prime hose, and then remove the prime hose from the container.

Turn the **chemical valve** to the ON (CHEMICAL) position. This will allow water to flow into the other side of the system.

Once all of the anti-freeze is removed, the unit is ready to use.

Eventually, the anti-freeze in your storage container will become diluted with water. If the anti-freeze level drops below 50% of the total, dispose of it and start with fresh 100% anti-freeze.



**When disposing of used anti-freeze, observe local laws and regulations. Do not drain onto the ground or into storm drainage systems**

# MAINTENANCE

## SERVICE SCHEDULE

<b>Engine</b>	Daily	Check engine oil level. *** Fill to proper level
<b>Engine</b>	Daily	Check coolant level in overflow bottle
<b>Vacuum Pump</b>	Daily	Spray WD-40 in lubrication cup at front of console for 5 sec.
<b>Water Pump</b>	Daily	Check oil level.** Fill to proper level
<b>Solution Inlet Tube Strainer</b>	Daily	Check strainer for blockage, remove any debris
<b>Vacuum Inlet Filter (In Waste Tank)</b>	Daily	Clean filter, inspect, replace if damaged
<b>Vacuum Hoses</b>	Daily	Wash out with clean water
<b>Automatic Waste Pump</b>	Daily	Inspect and remove any debris or sediment
<b>Chemical Filter</b>	Daily	Inspect daily
<b>Vacuum Pump</b>	Daily	Check oil level. Fill to proper level
<b>Water Box Float Valve</b>	Weekly	Check for proper seating and shut-off
<b>Water Pump Inlet Filter</b>	Weekly*	Check for debris and clean
<b>Battery</b>	Weekly*	Check for proper fluid level. Fill with distilled water only
<b>Solution Outlet Y-Strainer</b>	Weekly*	Inspect and remove any debris or blockage
<b>Temperature Balance Orifice</b>	Weekly	Remove, check, and clean
<b>Heater Cores</b>	100 hrs	Check and clean
<b>High Pressure Hoses</b>	100 hrs	Inspect for damage or impending damage
<b>Pressure Regulators</b>	100 hrs	Lubricate o-rings
<b>Engine</b>	100 hrs	Change engine oil***
<b>Engine</b>	100 hrs	Check fan belt tightness
<b>Battery</b>	100 hrs*	Clean battery terminals
<b>Engine</b>	200 hrs	Change oil filter***
<b>Float Valve Seal</b>	200 hrs	Replace seal
<b>Engine</b>	200 hrs	Service air cleaner elements*
<b>Engine</b>	200 hrs	Check radiator hoses and clamp tightness
<b>Fuel Pump</b>	200 hrs	Check hose connections
<b>Flow Simulator And Chemical Valves</b>	200 hrs	Inspect and/or adjust packing nuts

\* Or as often as required

\*\* Change water pump crankcase oil after the first 50 hours

\*\*\*Change engine crankcase oil and filter after the first 50 hours

\*\*\*\*Perform drive belt, pulley and hub maintenance after the first 25 hours of operation, and then again at 100 hours

\*\*\*\*\*If using AEON PD synthetic lubricant, 4500 hours or every 2 years, whichever comes first

# MAINTENANCE

## SERVICE SCHEDULE

<b>Water Pump</b>	500 hrs	Change oil**
<b>Pulley Set Screws &amp; Hub Cap Screws</b>	500 hrs	Check for proper torque valves. Re-torque, if required****
<b>Drive Pulley</b>	500 hrs	Inspect, clean and check for pulley groove wear****
<b>Drive Pulley</b>	500 hrs	Check pulley alignment****
<b>Drive Belts</b>	500 hrs	Inspect and clean****
<b>Drive Belts</b>	500 hrs	Check belt tension****
<b>Chemical Pump &amp; Check Valves</b>	500 hrs	Replace diaphragm and check valves.
<b>Check Valve (Solution Outlet)</b>	1000 hrs	Inspect, clean, and repair, if needed.
<b>Vacuum Pump</b>	1500 hrs	Drain, flush, and replace oil *****
<b>Engine</b>	Yearly	Flush radiator and change engine coolant.
<b>Engine</b>	Yearly*	Replace air cleaner element.
<b>Nitrogen Accumulator</b>	Yearly*	Replace Accumulator.
<b>Waste Tank Filters/Strainers</b>	Yearly	Check for damage and blockage. Replace if needed.
<b>Engine</b>	2 years	Replace radiator hoses and hose clamps.
<b>Battery</b>	2 years	Replace.

\* Or as often as required

\*\* Change water pump crankcase oil after the first 50 hours

\*\*\*Change engine crankcase oil and filter after the first 50 hours

\*\*\*\*Perform drive belt, pulley and hub maintenance after the first 25 hours of operation, and then again at 100 hours

\*\*\*\*\*If using AEON PD synthetic lubricant, 4500 hours or every 2 years, whichever comes first

## **KEY CHECKPOINTS**

***NOTE: Initiation of a planned preventative maintenance program will assure that your unit has optimum performance, a long operating life, and a minimal amount of "down" time.***

## **ENGINE COOLANT SYSTEM (RADIATOR) MAINTENANCE**

Your engine radiator coolant system is an important part of the power plant operation. In addition, this heat exchange system is used to provide heat for cleaning operations is also highly dependent on the engine coolant system. Follow the recommended coolant system maintenance in the Maintenance Schedule in this manual and your engine owner's manual. Refer any additional questions to your dealer.

## **EXTERNAL FUEL PUMP MAINTENANCE**

The power plant for unit receives fuel from the main fuel tank of your van/truck. An external fuel pump that provides this fuel is located on the underside of the van/truck. Loose fittings and hose connections will cause your unit to perform poorly. Follow the recommended fuel pump maintenance in the Maintenance Schedule in this manual. Refer any additional questions to your dealer.

## **SOLUTION SUPPLY SYSTEM MAINTENANCE**

The chemical supply system pulls chemicals from your chemical bottle utilizing a pump that works off the water pump pulsing. Any clogged filters or loose connections will result in a chemical supply system malfunction or a malfunction at the cleaning tool. Maintenance of the solution outlet check valve and strainer are vital to effective cleaning operation and minimal unit downtime. Additionally, the hoses related to supplying water and chemical to the outlet manifold are under high pressures and experience thermal expansion and contraction. Periodic inspections of these hoses for tears, cracks, and failing connectors are necessary to avoid unwanted leaks. To keep your solution supply system functioning properly, follow the chemical pump and solution outlet maintenance in the Maintenance Schedule in this manual. Refer any additional questions to your dealer.

## **HEAT EXCHANGER SYSTEM MAINTENANCE**

The heat exchange system in your unit transfers energy between the unwanted heat of the power plant and the solution supply system of the unit. The heat transfer of this system is highly dependent on the surface area contact in the heat exchanger cores located in the heat exchanger box. This surface area amount is adversely minimized when the supplied water is not softened to recommended levels. Hard water will result in scaling on the inside walls of the heat exchanger tubes. It is recommended that you use a dealer approved water softener to avoid premature heat exchanger core failure. Contact your local dealer for advice on the water hardness levels in your area.

Additionally, the heat exchanger tubes are very sensitive to freezing conditions. As the water freezes during cold conditions, it expands in the heat exchanger tubes and causes damage. Often the tubes are cracked and require the replacement of the heat exchanger core. Refer to the Freeze Protection instructions section in this manual. Refer any additional questions to your dealer.

Proper heat exchanger core cleaning is vital to maintaining high performance operation. Diesel exhaust residue can quickly build up on the exterior of heat exchanger cores. Ensure you follow the service schedule requirements for cleaning.

## **VACUUM PUMP MAINTENANCE**

The total function of the unit is based around the performance of the vacuum pump. Heat transfer used to raise the temperature of the solution is gained from the air drawn by the vacuum pump and solution is removed from the carpet with the vacuum suction of the vacuum pump. General maintenance actions for the vacuum pump as listed in this manual are vital to prolonged vacuum pump operations. Daily lubrication of the pump is required to avoid seizure of the system. Also, waste tank filters and strainers must be maintained to prevent unwanted debris from entering the vacuum pump.

## MAINTENANCE

### WARNING:

**DO NOT service this unit while it is running. The high-speed mechanical parts as well as high temperature components may result in severe injury, severed limbs, or fatality.**

**NOTE: Use the hour meter as a guide for coordinating the maintenance schedule.**

## ENGINE

1. Check the engine oil level **daily**, when in use. Make certain that proper oil level is maintained. **NEVER** overfill.
2. Change the break-in oil after the first **50 hours** of operation. Thereafter, change oil every **100 hours** of operation. **USE ONLY KUBOTA BRAND OIL FILTERS. USING ANY OTHER TYPE OIL FILTER WILL VOID YOUR ENGINE WARRANTY.**

**Oil Recommendation.** Use high-quality detergent oil of at least API (American Petroleum Institute) service class CD or higher.

Changing interval of engine oil and oil filter cartridge.

D902-E	Engine Oil	50 Hrs (Initial)
		100 Hrs
	Oil Filter Cartridge	200 Hrs

### Lubricating Oil

With the emission control now in effect, the CR-4 and CG-4 lubricating oils have been developed for use of a low-sulfur fuel on on-road vehicle engines. When an off-road vehicle engine runs on a high-sulfur fuel, it is advisable to employ the CF, CD or CE lubricating oil with a high total base number. If the CF-4 or CG-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals.

API service classification: above CD grade.  
Ambient temperature: below 35°C (95°F).

Lubricating oil recommended when a low-sulfur or high-sulfur fuel is employed.

O: Recommendable X: Not recommendable

Lubricating Oil Class	Fuel		Remarks
	Low-sulfur	High-sulfur	
CF	O	O	TBN $\geq$ 10
CF-4	O	X	
CG-4	O	X	

3. Re-torque the manifold and exhaust tube nuts, cylinder head bolts after the **first 200 hours** of use.
4. Clean the air cleaner element every **200 hours**. Replace the element yearly.
5. Check the engine idle RPM every **200 hours** and adjust, if necessary. **NEVER** adjust engine RPM without a tachometer. Refer to Kubota Engine Operation and Service Manual.
6. Check the coolant level in the radiator overflow container **daily**. If no coolant is seen, remove the cap and add coolant. Change the coolant with a 50/50 coolant to water ratio every **1000 hours**.
7. Replace the in-line fuel filter **yearly**.

**NOTE: For additional engine service information, obtain a "Kubota Service and Repair Manual" from any authorized Kubota Service Center. If service or repair is required, contact an authorized Kubota Service Center. You will need to provide the serial number of the engine.**

## VACUUM PUMP

Refer to the Vacuum Pump Operation and Service Manual for specific instructions.

**Lubrication:** We recommend that you use AEON PD Synthetic Blower Lubricant in the vacuum pump for all operating temperatures. AEON PD is formulated especially for positive displacement blower service to provide maximum blower protection at any temperature. One filling of AEON PD will last a minimum of 3 times longer than a premium mineral oil.

**NOTE: AEON PD (Part# 05-008039) is the oil which PROCHEM puts in the vacuum pump at the factory. Topping off or adding petroleum oil to synthetic oil is NOT recommended.**

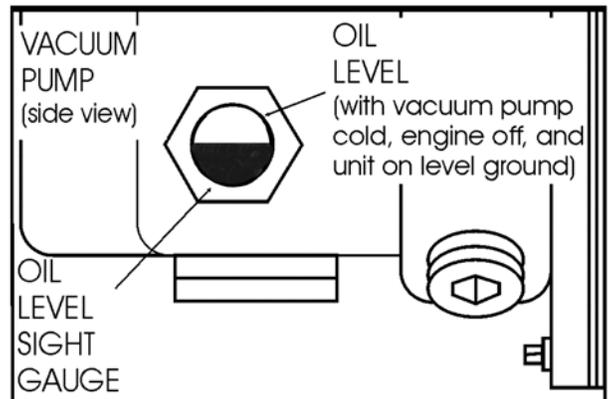
*If not using AEON PD synthetic blower lubricant, use oils with rust and oxidation inhibitors, anti-foam additives and the viscosity's listed on the chart on the next page.*

1. Check the oil level **daily** to assure the proper level. **PROPER LEVEL** cannot be overemphasized. Too little oil will ruin bearings and gears. Too much oil will cause overheating. Use the illustration as a guide when adding oil.

2. To prevent rust from building up inside the vacuum pump (if moisture exists) we have provided a lubrication cup on the front of the unit.

First run the unit at least **1 minute** to remove any moisture from the vacuum pump. Next, fill the lubrication cup with WD-40, or a similar lubricant, for **5 seconds** while the unit is running and the vacuum inlets are sealed. Do this at the end of **each working day**.

3. Drain, flush and replace oil **every 1500 hours or**



**yearly, whichever comes first.** Change oil more frequently if inspection so indicates. With AEON PD synthetic lubricant, perform the oil change maintenance **every 4500 hours or every 2 years, whichever comes first.**

# MAINTENANCE

## WATER PUMP

Refer to the Water Pump Operation and Service Manual for specific instructions.

1. Check the crankcase oil level **daily** to assure the proper level. Use the illustration as a guide when checking the oil level. If the level has dropped, check for the source of leakage and repair.
2. Use the dipstick or sightglass to check oil level daily. Oil level should be between marks on the dipstick or centered in sightglass.



3. Change the crankcase oil after the **first 50 hours** of operation. Drain and refill the crankcase oil **every 500 hours** thereafter.
4. Other approved oil SAE 15W-40 equivalents are: Mobil and Shell Super, Castrol CWX, Helix Super, and Tellus 100.

## VACUUM INLET FILTER (IN WASTE TANK)

1. The vacuum filter in the waste tank should be removed and cleaned **daily**. If this is done, the filter will last for a long period of time.

## VACUUM RELIEF VALVE

While the unit is running at full RPM, block the air flow at the vacuum inlet connection and read the vacuum gauge. If adjustment is required, shut the unit down and adjust the vacuum relief valve locking nut tension. Start your unit and read the vacuum gauge. Repeat this process until the relief valve opens at 13" Hg.

## VACUUM PUMP DRIVE BELTS

To tighten the vacuum pump belts:

1. Loosen the four screws which hold the vacuum pump mount in place.
2. Loosen the 6 nuts at the vacuum muffler outlet to heat exchanger box and loosen the bolt at the back of the machine connecting the muffler bracket to the frame.
3. Turn the adjusting bolts until the proper belt tension is achieved (1/2" deflection in the center of the belt, halfway between the pulleys).
4. Retighten all bolts previously loosened at the vacuum muffler.

**NOTE: When adjusting belt tension, make certain that the engine shaft and vacuum pump shaft remain parallel, and the belt tension is equal throughout the belt width.**

5. After adjusting, re-tighten the four screws which hold the vacuum pump mount in position. Check belt alignment with straight-edge.

### CAUTION:

**Make certain that when you re-torque these screws, that you use a clockwise pattern and continue until proper torque is achieved.**

Torque values		
Component	Inch/lbs	Foot/lbs
Rear Engine Pulley	480	40
Front Engine Pulley	300	25

6. Check for pulley groove wear, clean belts and pulley grooves, check for worn belts, proper belt tension, and pulley alignment after the **first 25 hours** and then again at **100 hours**. Check for belt ride in the groove.

## WATER PUMP DRIVE BELT

To tighten the water pump belt:

1. Loosen the nuts which hold the water pump mount to base.
2. Adjust the position of the belt tension adjusting bolt until the proper belt tension is achieved. (1/2" deflection in the center of the belt, halfway between the pulleys).
3. While checking the alignment, tighten the nuts which hold the water pump mount to base.

## FLOAT VALVE (WATER BOX)

The float valve should only be adjusted if the water box is overflowing or the water level in the box is lower than 5-1/2".

1. If the box is overflowing, remove, and check the float valve for debris or damage.

**NOTE: If the float ball has any water inside it must be replaced.**

### CAUTION:

**When replacing float ball, DO NOT over-tighten, as the rod can puncture the ball. Make sure to tighten the nuts on the rod.**

2. Disassemble the valve and check the piston and seat for damage, replace if needed. See the "Illustrated Parts Listing" for a parts break-down.

## WASTE TANK STRAINER BASKET

The strainer basket located inside the waste tank should be removed and cleaned whenever it is full of debris. This should be done on at the end of each job.

## Y-STRAINER (OUTLET)

Inspect the Y-strainer **after the first week** of running the unit by unscrewing the screen and remove any accumulated debris. Inspect the strainer again at **2** and **4 weeks**.

The Y-strainer should then be inspected **every month**. However, if the Y-strainer has a frequent build-up of debris it should be inspected and cleaned more often.

## CHECK VALVE (OUTLET)

Inspect the check valve when rebuilding the chemical pump or as needed. Remove and disassemble the check valve. Check the Teflon seat for debris or abnormal wear. Clean or replace seat if needed.

**NOTE:** Improper seating of the check valve poppet, damaged spring, or o-rings will cause poor operation of the chemical system.

For the procedure, see the "General Service Adjustments" section in this manual for details.

## CHEMICAL PUMP

Rebuild the chemical pump **every 500 hours**. This involves changing the diaphragm and check valves.

For the procedure, see the "Chemical Pump" section in this manual for details.

**NOTE: Inspect chemical filter daily.**

## CHEMICAL AND SIMULATOR VALVE

Examine the packing nut on the chemical selector valve, heat bypass valve, and chemical metering valve **every 200 hours**. Keeping these valve packings properly adjusted will eliminate possible leakage from the valve stems and add to overall valve life.

For the procedure, see the "General Service Adjustments" section in this manual for details.

## MAINTENANCE

### NITROGEN ACCUMULATOR

The nitrogen accumulator is pressurized to 250 PSI and must be replaced periodically. The accumulator cannot be repaired or recharged. We recommend replacement every 1000 hours of use.

### PRESSURE REGULATOR

Lubricate the o-rings **every 50 hours**. Use o-ring lubricant Part #05-008035.

For the procedure, see the "General Service Adjustments" section in this manual for details.

### VACUUM HOSES

To assure maximum hose life, we recommend that the hoses be washed out with clean water at the end of each **working day**.

### HIGH PRESSURE HOSES

Inspect your high pressure hoses for wear after the **first 100 hours** of use. Inspect **every 25 hours thereafter**. If hoses show any signs of damage or impending rupture, **replace the hose**.



**DO NOT attempt to repair high pressure hoses! Repairing high pressure hoses may result in severe burns and serious injury!**

***All high pressure hoses must be rated for 3000 PSI at 250°F. Thermoplastic hoses do not meet these specifications and should not be used. Severe burns and injury may result if the hoses do not meet these requirements.***

### OPTIONAL WASTE PUMP-OUT

**At the end of each work day**, make certain that you remove any debris or sediment which may be inside the waste pump by pumping fresh water through the pump.

### TEMPERATURE BALANCE ORIFICE

Weekly maintenance of the temperature balance orifice is required for proper machine operation.

1. Unscrew nozzle cap from the connector body.
2. Remove the adapter, orifice plate, and strainer.

3. Clean any debris from the strainer and orifice plate.
4. Reassemble as shown in Parts Section - Solution Outlet.

### ENGINE COOLANT REPLACEMENT

Annually the coolant in the Prochem machine should be replaced. This coolant is an integral part of the heating system and needs to be maintained as any other working part of the system. We recommend that this procedure be accomplished by the following steps. Be sure unit is off and engine is cool.

#### DRAINING COOLANT:

1. Insert a 1/4" plastic hose into the radiator drain petcock. Turn counterclockwise to open and drain coolant. After draining approximately 1/2 gallon, open bleed petcock in heli-coil to assure that heli-coil drains also. Allow the coolant to completely drain. Also drain engine block from under the governor.

***NOTE: Be sure that used coolant is collected in a proper container and disposed of in accordance with local laws.***

2. After draining is complete, close all the engine, radiator and heli-coil petcocks. Draining is complete.

#### REPLACING COOLANT:

1. Fill radiator with 50/50 anti-freeze/water mix.
2. Start unit and run at idle.
3. As the unit warms up, maintain a full radiator with a 50/50 mix.
4. Open petcock slightly on heli-coil to allow any trapped air to escape. When coolant runs out of heli-coil, close petcock.
5. Fill radiator with 50/50 coolant mix.
6. Re-install radiator cap.
7. Shutdown unit.

Check radiator overflow bottle. Add coolant to proper "cold" level.

## GENERAL SERVICE ADJUSTMENTS

### **WARNING:**

**USE EXTREME CAUTION while servicing while machine is running. The high-speed mechanical parts as well as high temperature components may result in severe injury, severed limbs, or fatality.**

## ENGINE SPEED

1. This unit uses a governor to set and maintain engine speed. The engine speed is adjusted by pulling the throttle cable out to maximum travel for high speed operation. For lower temperature or vacuum setting, rotate knob clockwise two turns or as needed to obtain desired temperature and vacuum settings.

### **CAUTION:**

**DO NOT attempt to adjust without a tachometer and NEVER adjust the engine above 2850 RPM (No Load). Permanent damage may occur.**

## HIGH ALTITUDE OPERATIONS

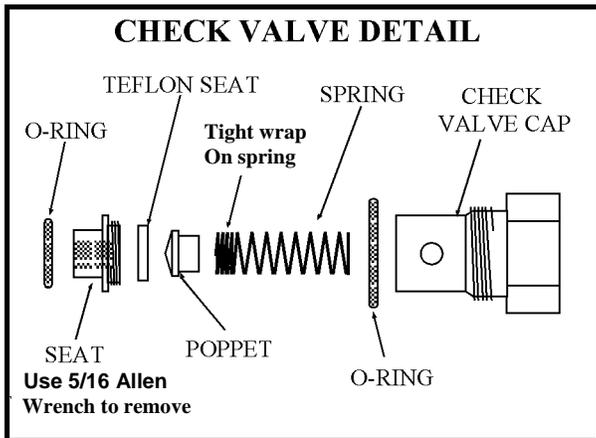
CONSULT YOUR LOCAL KUBOTA DEALER FOR FURTHER INFORMATION ON THIS PROCEDURE.

## MAINTENANCE

### CHECK VALVE (SOLUTION OUTLET)

Inspect the check valve whenever doing service on the chemical pump or if flow problems occur in the chemical system:

1. Remove the check valve. Be sure the small o-ring for the seat comes out with the check valve.
2. Remove the seat, using a 5/16" Allen wrench.
3. Check the Teflon seat for debris or wear. Clean or replace Teflon seat if needed.
4. Clean the poppet and spring, inspect for wear or damage, and replace as needed.
5. Re-assemble the check valve. Start the seat by hand, tighten using a 5/16" Allen wrench. **DO NOT** over-tighten seat.



**NOTE: Improper seating of the check valve poppet, damaged spring or o-rings will cause poor operation of the chemical system.**

6. Lubricate the o-rings with o-ring lubricant Part #05-008035 and reinstall.

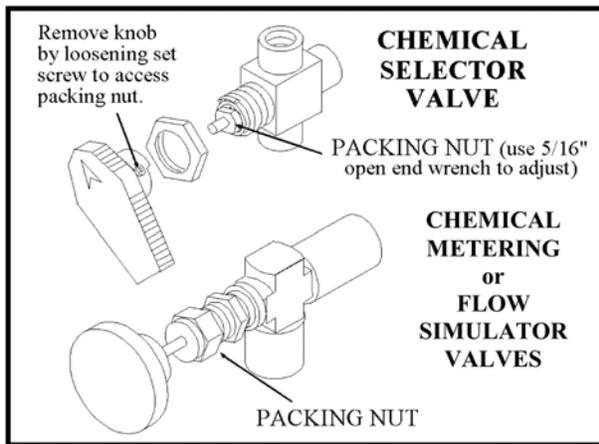
### CHEMICAL PUMP

The only repairs which the chemical pump may require is the replacement of the diaphragm or check valves. To replace the diaphragm, unscrew the cover from the body. When replacing the diaphragm, lubricate the outer edges of the diaphragm with o-ring lubricant Part #05-008035 and reassemble. To replace the check valves, unscrew the check valve caps. Replace the check valves and reassemble, using new o-rings.

**DO NOT** attempt to re-use o-rings once the check valves have been removed. See the "Illustrated Parts Listing" for a parts break-down on the chemical pump.

## PACKING NUT ADJUSTMENT FOR CHEMICAL METERING AND CHEMICAL SELECTOR VALVES

Examine the packing nut on the chemical metering, flow simulator, and chemical selector valves for proper tension every **200 hours**. When turning the knob, there should be a small amount of resistance. If not, slightly tighten the packing nut. **DO NOT** over-tighten. Keeping the valve packings properly adjusted will eliminate possible leakage from the valve stems and add to overall valve life.



## PRESSURE REGULATOR

The pressure regulator serves only to hold locked up water pressure at a preset point and to bypass this water back to the water box.

## PRESSURE REGULATOR

To adjust:

1. With your unit running, close the cleaning tool. Check the pressure gauge. Open the tool valve. We recommend setting the pressure regulator so that the pressure gauge reads 350 PSI with the tool valve **open**.

When the tool valve is opened, there is an approximate drop of 100 PSI in pressure. **If there is a pressure drop greater than 100 PSI, it may be necessary to lubricate the o-rings in the pressure regulator.**

2. If the pressure regulator requires adjustment, turn the adjusting knob (while observing the pressure gauge on the control panel) until the desired pressure is obtained.

## ADDING/DRAINING ENGINE COOLANT

Use a 50/50 coolant to water ratio in this unit's cooling system. **NOTE:** See the "Maintenance Chart" for specific details.

1. To drain the coolant, remove the radiator cap and turn the lower engine radiator draincock counter-clockwise.

## TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
<p>Loss of water pump pressure.</p> <p>With the cleaning tool open, the water pressure gauge reads below the normal operating pressure.</p>	Water supply is turned off or the float valve is stuck or improperly adjusted.	Turn the water supply on or up. Check for kinks in the water supply hose. Examine the float valve and adjust or replace.
	Water pump inlet supply line is plugged or drawing air.	Examine the water inlet filter inside the water box. Remove accumulated debris and replace if required. Check for suction leaks and loose clamps or fittings. Tighten any loose fittings or clamps. Replace any ruptured hose(s).
	Improper engine speed	Using a tachometer, check the engine speed. Full throttle engine speed is 2850 RPM. Refer to the "engine Speed" section for instructions on how to re-adjust.
	Pressure regulator o-rings are dry.	Lubricate o-rings, using o-ring lubricant Part #05-008035.
	Pressure regulator has worn o-rings	Check o-rings. If necessary, replace.
	Pressure regulator is dirty, stuck open, or improperly adjusted.	Clean or repair regulator. Adjust to working pressure. Lubricate o-rings, using o-ring lubricant Part #05-008035.
	Low pump volume. (Measure the amount of water being returned to the water box from the pressure regulator. It should fill a gallon container about every 17 seconds).	Examine the check valves, plunger cups, and cylinder head on the water pump. Repair, whenever required (refer to the water pump service manual).
	Defective water pressure gauge.	Replace gauge
	Orifice (spray nozzle) in the cleaning tool is worn, defective, or wrong size.	Replace Nozzle or change nozzle size.
	Debris clogging water lines or water inlet disconnect.	Clean or replace as needed.
<p>Loss of solution volume at cleaning tool orifice.</p> <p>Water gauge reads normal.</p>	Belts loose or broken	Re-tension or replace as needed.
	Plugged orifice and/or screen in the cleaning tool.	Unplug or replace orifice and/or screen
	Internal block between the pressure regulator manifold and the outlet Y-strainer, or the Y-strainer screen is clogged	Inspect all lines, remove accumulated debris which is blocking proper flow. Replace any defective hoses. Remove, inspect, and clean the Y-strainer screen. De-scale unit and install a water softener, if necessary.
	Outlet check valve is plugged	Examine the check valve, remove any debris
	Defective quick-connect on one or more of the high pressure hoses.	Replace defective quick-connects(s) on high pressure hoses(s).
	Cleaning tool valve is malfunctioning.	Repair or replace valve.
Hose inner lining is constricted.	Remove restriction or replace hose.	

## TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
<p>Loss of vacuum</p> <p>While cleaning, the vacuum is not up to specification. Engine RPM is normal.</p>	Vacuum gauge is giving an improper reading.	Examine the tubing between the vacuum relief valve and the vacuum gauge and remove any blockage. Ensure vent hole is present in black plug.
	Vacuum hose(s) is damaged, causing a suction leak.	Inspect hose(s), repair or replace.
	Waste tank gaskets not sealing properly, not positioned properly	Inspect the gasket. Repair seal or replace Re-position lid(s).
	Plugged vacuum hose or vacuum plumbing between vacuum inlet and strainer basket.	Unplug vacuum hose or inlet plumbing.
	Waste tank filter or strainer basket is plugged.	Clean or replace filter. Clean strainer basket.
	Loose vacuum pump drive belts.	Tighten the drive belts
	Waste tank drain valve is damaged or left open, causing a vacuum leak.	Drain the waste tank. Close drain valve, if open. Remove the dump valve and, after inspecting, replace the defective components.
	Vacuum relief valve requires adjustment or has a vacuum leak due to damaged diaphragm.	Re-adjust the vacuum relief valve. If the vacuum does not increase, remove and inspect the relief valve diaphragm. If damaged, replace
	Vacuum exhaust heat exchangers are plugged with lint.	Remove and clean.
	Vacuum pump is worn out.	Replace the vacuum pump.
<p>Loss of chemical</p> <p>With the cleaning tool valve open, no chemical</p>	Chemical pump is improperly primed.	Refer to chemical pump priming instructions.
	The strainer at the inlet end of the chemical inlet line is clogged	Unclog the strainer. If damaged, replace.
	Suction leak in the inlet line leading into the chemical pump.	Inspect inlet lines and flow meter for damage and replace, if required.
	Chemical pump check valve(s) is clogged	Remove any debris from the chemical check valve(s). Replace chemical check valve(s) or seals, if necessary.
	Chemical prime/on-off valve or chemical metering valve is defective.	Replace valve(s).
	Chemical pump diaphragm is ruptured.	Disassemble the chemical pump and replace the damaged diaphragm.
	Defective cylinder in the water pump.	Measure the pump volume. If the pump volume is less than normal, refer to "Loss of Pump Volume" in the Troubleshooting section in this manual.
<p>Chemical flow meter indicates flow with the tool valve closed</p>	External leak in chemical piping	Tighten fittings. Re-apply thread sealant where required. If any fittings are damaged, replace.
	Outlet check valve is full of debris or damaged, not allowing it to close properly	Close the chemical valve on the chemical panel. If the flow meter does not indicate flow, remove debris or replace check valve, if necessary.
	Chemical pump diaphragm is ruptured	Close the chemical valve on the chemical panel. If the flow meter still indicates flow, replace the chemical pump diaphragm.
	Internal leak in chemical valve causing continual flow through prime tube returning to container.	Tighten valve packing nut (see "General Service Adjustments" section in this manual). Replace valve, if necessary.

## TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Water pump does not engage	Solution pump circuit breaker has been tripped	Check the solution pump circuit breaker on the control panel. Press the circuit breaker reset button.
	Defective electrical connection in the console wiring or defective switch.	Examine switch, electrical connections, and wiring. Repair any defective connections. If there is power going to the switch but not going out, replace the defective switch.
	Water pump has not been activated	Turn solution pump switch to on.
	Defective water pump clutch.	If there is power in the switch, but not power at the clutch, replace the defective wire. If there is power at the clutch, replace the defective switch.
	Loose or broken water pump belts.	Tighten or replace belts.
Engine will not start The engine does not turn over	Main circuit breaker on the control panel has been tripped.	After inspecting the unit to determine the cause of the tripped circuit breaker, press the reset button.
	Loose or corroded battery.	Clean, tighten, or replace the battery terminals.
	Dead battery.	Recharge or replace battery.
	Defective ignition switch.	Test ignition switch for power going into the switch. If there is power going in but NO power going out, replace the switch.
	Defective starter motor.	Test the starter motor. If necessary replace.
	Vacuum pump seized.	Refer to Sutorbilt Service & Repair Manual.
Starter turns over engine, but will not start	Waste tank is full.	Empty the waste tank.
	Engine temperature has exceeded 240°F, triggering the high temperature switch to shut the unit down.	Determine the cause of overheating before restarting the unit. See "Excessive Heating" in the "Troubleshooting" section of this manual.
	Defective fuel pump.	Replace the fuel pump.
	Loose or broken wires leading to waste tank float switch.	Repair or replace any broken electrical connections.
	Defective float switch in the waste tank.	Check switch for proper operation, replace as necessary.
	Oil pressure switch (located on engine), high temperature switch (located on engine).	Test these components. If any are defective, replace. Consult the Kubota Engine Operation and Maintenance Manual.
	Defective fuel shut down solenoid	Test. Replace.

## TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Starter turns over engine, but will not start	Engine is malfunctioning	Refer to Kubota Engine Operation and Maintenance Manual.
Engine stops running while doing normal cleaning, the engine stops running	Engine is out of fuel	Add fuel to the fuel tank.
	Waste tank is full	Empty waste tank.
	Main or engine circuit breaker on the control panel has been tripped.	After inspecting the unit to determine the cause of the tripped circuit breaker, press the reset button.
	Engine coolant temperature has exceeded 240°F, triggering the high temperature switch to shut the unit down.	Determine the cause of the overheating before restarting the unit. Refer to the Kubota Engine Operation and Maintenance Manual.
	Defective fuel pump.	Replace fuel pump.
	Defective float switch inside the waste tank.	Check switch for proper operation. Replace as necessary.
	Defective 240°F engine coolant high-temperature shutdown switch.	Test switch. If necessary, replace.
	Oil pressure switch on engine has shut down, due to insufficient oil pressure.	Refer to the Kubota Engine Operation and Maintenance Manual. <b>DO NOT</b> restart the engine until the cause is determined and corrected.
	Engine is malfunctioning.	Refer to the Kubota Engine Operation and Maintenance Manual.
Excessive heating	Flow restriction caused by hard water scaling.	Descale unit, repair or replace damaged plumbing components as necessary. Install water softener.
	Not enough water flow.	Check jet size of tool.
Heat exchanger leaks  <b>NOTE: The exhaust heat exchanger will produce water condensation discharge at times during normal operation. DO NOT confuse this with a leak.</b>	Engine/vacuum exhaust heat exchangers are damaged from frozen water.	Inspect heat exchangers for leaks. Visually inspect for damage. Pressure check after removing from the unit. (Maximum test pressure 1200 PSI for stainless steel heat exchanger) (Maximum test pressure 100 psi for copper heat exchanger)
Loss of temperature  The heat output of the unit is LESS than normal.	Heat Exchangers are plugged with carbon.	Clean and replace.
	Temperature relief valve on water box is stuck open.	Clean temperature relief valve and test. Replace, if necessary.
	Engine RPM is low.	Reset engine RPM.
	Defective temperature gauge.	Test gauge and sensor. Replace failed component.
Automatic waste pump is malfunctioning or not operating normally  <b>NOTE: When replacing either the pump or float switch, use new electrical connectors and heat shrink. Inspect connection for watertight seal.</b>	Defective waste pump float switch.	Replace float switch.
	Broken diaphragm.	Replace diaphragm.
	Weak battery.	Charge or replace battery if needed. Check charging station.
	Pump-out circuit breaker on control panel has been tripped.	After inspecting waste pump to determine the cause of the tripped circuit breaker, press the reset button.