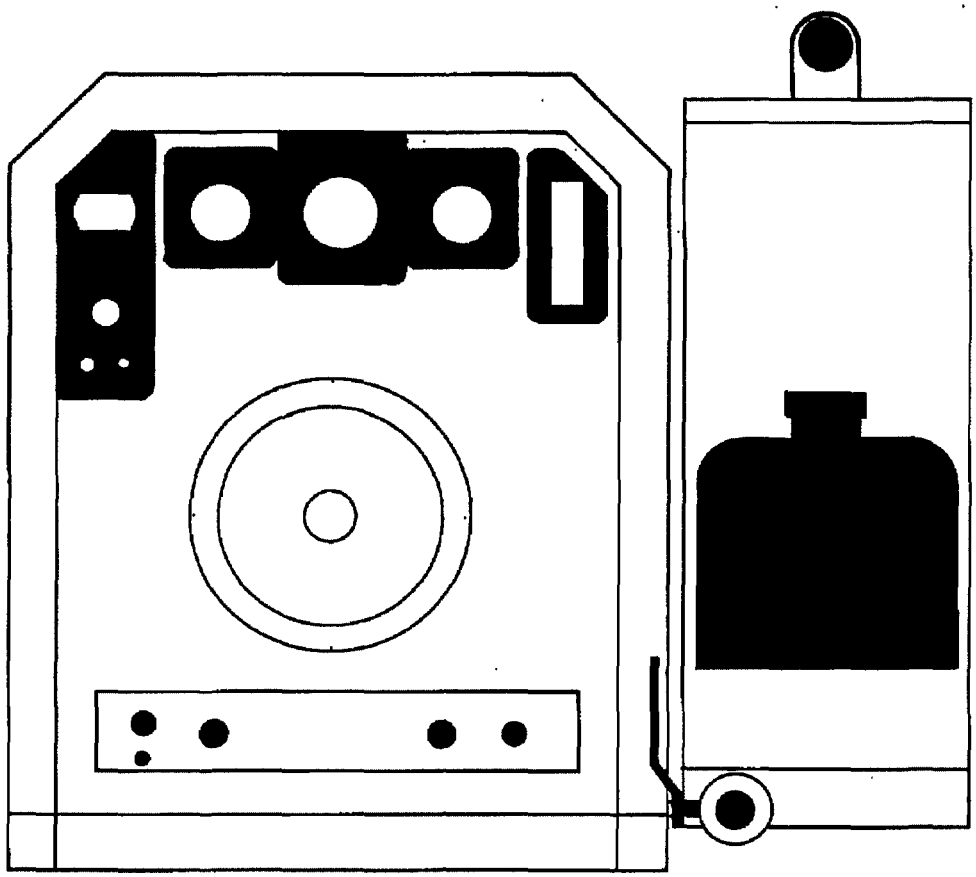
OWNER'S MANUAL

AquaCat 3·9



HYDRAMASTER Corporation

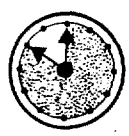
LIST OF PHOTOS

HOURS

Monday -- Friday
8:00 am To 5:00 pm
PACIFIC STANDARD TIME


PST


ROCK MT.


CENTRAL


EASTERN

TELEPHONE NUMBERS

(206) 775-7272 General Offices
(206) 775-7276 Parts Department
(206) 775-7275 Service/Warranty
(206) 771-7156 FAX

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LIST OF ILLUSTRATIONS

TABLE OF CONTENTS

GENERAL INFORMATION

This manual contains installation and operation instructions as well as information required for proper maintenance, adjustment and repair of this unit. Since the first and most important part of repair work is the correct diagnosis of the trouble, a general trouble shooting section and component manual troubleshooting charts have been included for your convenience.

Unlike a garden tractor, lawn mower or cement mixer, all having one or two functions to perform, the truck-mounted carpet cleaning plant has many functions to perform simultaneously.

* Engine has to run at a consistent RPM.
* Vacuum has to pull air and dirty water back from cleaning site.
* Water pump provides stable pressure at proper water flow for cleaning.
* Chemical has to be injected into the water stream at the right concentration.
* Heater must maintain proper heat.
* Vacuum tank must store dirty water until drained.

As you can see, it is not just a turn key operation with one thing to worry about, **Does It start?!**

◆ WARNING ◆

The manufacturer uses this symbol throughout the manual to warn of possible injury or death.

◆ CAUTION ◆

This symbol is used to warn of possible equipment damage.

HOURS	TELEPHONE NUMBERS	
Monday -- Friday	(206) 775-7272	General Offices
8:00 am To 5:00 pm	(206) 775-7276	Parts Department
PACIFIC STANDARD TIME	(206) 775-7275	Service/Warranty
	(206) 771-7156	FAX

HOW THE SYSTEMS WORK

THE AQUACAT 3.9 SYSTEM WORKS AS FOLLOWS:
The AquaCat 3.9 High Performance Heat Exchanger system is a highly engineered cleaning plant, designed by HydraMaster Corp. The system utilizes a dynamic heating system comprised of two separate exhaust heat exchangers for capturing "free heat".

Water is fed into the machine at tap pressure. It is combined automatically with cleaning solution as it enters the mix tank. The solution is then picked up by the high pressure pump and pressurized to the desired level. The solution then travels to the bypass assembly where it is distributed out to the wand and back into the machine. The solution going back into the machine splits flow and travels through the two exhaust heat exchangers. After being heated, the solution returns to the mix tank where it is picked up by the pump again.

When the cleaning solution reaches a pre-set temperature, it is released from the system and directed to the recovery tank, then cool water enters the system to regulate the temperature.

There is no guess work in the manufacture of these highly advanced cleaning plants, likewise, there must be none in preparing it to get the job done in the field. It is the purpose of this manual to help you properly understand, maintain and service your cleaning plant. Follow the directions carefully and you will be rewarded with years of profitable trouble-free operation.

It is imperative that no section be overlooked when preparing for operation of this equipment.

AQUACAT MACHINE SPECIFICATIONS

FRAME: 21" W, 56" L, 28" H. Steel with baked-on epoxy finish.

WEIGHT: 500 lbs. complete.

COWLING: Steel with baked-on Epoxy finish.

ENGINE: 16 HP Briggs & Stratton V-Twin, steel sleeved cylinders, ducted.

IGNITION: Magneto key start, solid state ignition.

HI-PRESSURE PUMP: Tri-Plex piston -- Cat 290 -- 3.5 GPM -- 1200 PSI -- @ 1200 RPM.

VACUUM BLOWER: 3LFS Sutorbilt w/12 HG safety relief.

CHEMICAL SYSTEM: Electro-mechanical, flow meter controlled.

HEATER: 2 stainless steel exhaust heat exchangers.[shell and tube for engine and blower heat]

INSTRUMENTS: 0-1000 High pressure gauge, Temperature gauge, Vacuum gauge, Hour meter, Chemical flow meter, Ignition switch.

RECOVERY TANK: 70 gallon marine grade aluminum, epoxy finish.

CLEANING WAND: Stainless steel 11" with heat cover handle, and forward guide handle.

HI-PRESSURE HOSE: 1/4" High-temperature lined/vinyl covered, safety orange with brass quick connects.

VACUUM HOSE: 2" Reinforced safety orange.
1 1/2" reinforced safety orange.

STANDARD EQUIPMENT: Power console, Sound suppression package, Level temperature exchange heater, Vacuum recovery tank, Carpet cleaning wand, Chemical jug, Chemical jug holder, Owners Manual, 100 '- 2" vacuum hose, 10'-1 1/2" vacuum hose, 100' Super-flex solution hose, 10'-1 1/2" drain hose, Battery box with holder, Fuel system kit, Van decal, Van installation kit.

DESIGN CHANGES: This information is accurate at the time of printing. However, the design and specifications of HydraMaster equipment are subject to continued change and refinement.

PLACEMENT OF UNIT IN VEHICLE

THERE ARE TWO RECOMMENDED UNIT PLACEMENTS:

A. SIDE DOOR: Most installations are side door. This provides rear access for accessories and hoses as well as unobstructed access to component/ working side of machine, thus making it a bit easier to perform maintenance and/or repair without removing unit from the truck.

B. REAR DOOR: Although this location partly limits working access, it does direct the noise away from the cleaning site. Some cleaners in the colder areas prefer this location because it puts the weight mass over the rear wheels for better traction in ice and snow. Rear mounting requires the unit to be slid to the right side as far as possible. This not only provides adequate working space on the component side of the unit but also makes better weight distribution inside the van (engine and component weight line up over drive shaft). Also, it is physically easier to load unit into rear door due to height of van bed.

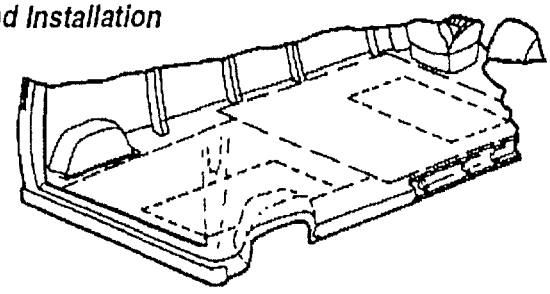
◆ CAUTION ◆

Ensure that machine is well secured to the floor of van with hardware supplied. Sudden or crash stop will cause machine to slide forward,... all 500 lbs. worth! Protect yourself and the machine. ***SECURE IT!***

TRUCK PREPARATION ILLUSTRATION

FIRST, cover the truck bed with 5/8" plywood using metal screws to secure it as shown.

Plywood Installation



Select the appropriate color astroturf to match your van and cover the plywood and staple in place. A standard van requires a piece 6 feet by 12 feet.

Astroturf SALES REPRESENTATIVE'S

RESPONSIBILITY

ACCEPTANCE OF SHIPMENT:

1. If unit shows any outward signs of damage, do not sign the delivery receipt until you have closely inspected the unit and noted any damage on the delivery receipt. Have the freight company representative acknowledge the damage by signing the notation of damage on the delivery receipt.

2. The salesman from whom you purchased your unit is responsible for supervising the correct installation of the unit in your vehicle and thoroughly training you in its operation, maintenance and precautions.

CORRECT INSTALLATION INCLUDES: Installation of through-floor fittings for gasoline fuel lines; securing them with bolts or tie down cleats; connecting all gasoline lines; connecting battery; checking pump, vacuum blower and engine oil levels, prior to starting unit; starting unit to check engine to see that all systems function normally; also checking all hoses, wands, etc., for correct operation.

TRAINING SHALL INCLUDE: Thorough review of the operation manual with purchaser; instruction and familiarization in: how to correctly start up and shut down unit; how to correctly clean with the unit; how, where and how often to check and change component oil levels; how the unit's systems work; how to troubleshoot the unit; how to do basic repairs; safety precautions and their importance; freezing damage and how to avoid it and a thorough review of the unit warranty and warranty procedures.

TRUCK PREPARATION

The manufacturer recommends the installation of plywood flooring covered with poly propylene backed astroturf (do not use rubber-backed) in the vehicle prior to installation of machine. This provides a 'metal-to-cushion' mounting rather than metal to metal, provides insulation and makes an attractive van interior. Astroturf should be color keyed to van interior.

Materials Needed:

1. 2 sheets 4x8x5/8" exterior plywood
2. 6'x12' piece of commercial astroturf
3. 16 - 1 1/2" sheet metal screws
4. 1 quart marine adhesive (optional)
5. 1 staple hammer w/1/2" staples

(See illustration for correct placement of plywood flooring)

PURCHASER'S RESPONSIBILITY

PRIOR TO ARRIVAL OF UNIT:

1. Install 5/8" exterior plywood flooring in vehicle and cover with artificial turf.
2. *Purchase heavy duty 42-60 amp hour battery and have battery 'slow' charged if new. If battery is not fully charged damage can occur to the engine charging regulator.*

◆ WARNING ◆

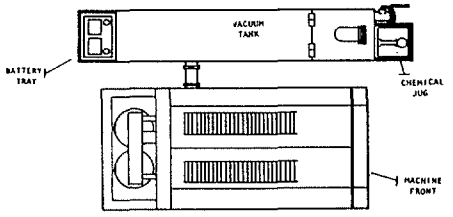
READING OF OWNERS MANUAL: It is the purchaser's responsibility to read the unit operation manual and to familiarize himself with the information contained therein. **Special attention should be paid to all CAUTIONS and WARNINGS.**

MACHINE INSTALLATION

There are two locations to place the machine, in the side door or in the rear door, as mentioned in the section titled "Placement of Unit." The standard way to configure the unit is, as shown in the illustration, with the recovery tank beside the unit. An alternative method, not shown, would be to put the recovery tank behind the unit. (The standard machine does not come with enough hardware to allow for mounting of the tank behind the machine. If this configuration is chosen please contact HydraMaster for more information.)

HydraMaster recommends that the exhaust for the machine be piped through the floor of the vehicle. It is important that the machine be placed as close to the door as possible so that outside air can be pulled into the engine for proper cooling.

Machine Configuration



◆ WARNING ◆

It is recommended by the manufacturer that the exhaust from the front of the machine be vented down under the truck to prevent carbon monoxide from entering the job site. ***Always park the truck so the exhaust is blowing away from the job site.***

◆ WARNING ◆

Never operate this machine with a portable propane tank or a portable gas can inside the truck, doing so increases the risk of a fire or explosion.

Mount a fire extinguisher just inside the rear or side door for emergencies.

HARD WATER AREA MAP

The quality of water varies greatly throughout the United States and influences the reliability and efficiency of equipment in direct proportion to its level of hardness. The map below defines areas which compromise fluid related components such as hoses, fittings, heaters, pumps, valves and water cooled engines.

Cleaning efficiency and equipment life is increased, chemical use decreased and the appearance of cleaned carpets enhanced when water softeners are incorporated in hard water areas. Manufacturer strongly urges the use of water softener units in areas exceeding 3 1/2 grains per gallon. Using the legend as a reference, determine the quality of water in your area and take action immediately should it be necessary. Water Softener Hook-up Water HardnessWATER SOFTENER
Many areas of the country have an excess of minerals in the water which results in what is commonly called "hard water". These minerals tend to adhere to the insides of heater coils and other parts of the machines causing damage and a loss of cleaning effectiveness.

Reports from several of our machine users commending the results of the use of water softeners in conjunction with their machines prompts us to recommend the procedure to everyone in a "hard water" area.

SPARE PARTS RECOMMENDATION

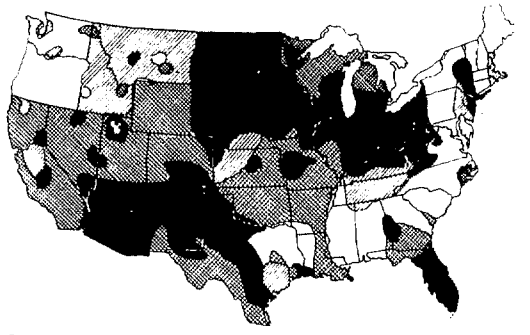
Because your truck-mounted unit is capable of generating several hundred dollars per day, down-time on the unit can be very expense. In order to minimize such down-time, it is strongly recommended by the manufacturer that you purchase and keep in your truck the parts listed below.

PARTS ORDERS

To expedite your parts needs, please call your sales representative. In most instance, he either stocks or has access to parts through a regional service center. In the event parts are unavailable locally, contact the factory and coordinate your needs. If this becomes necessary, always indicate the method of shipment you desire, i.e. UPS. Blue Label, Air Freight, Air Express, etc. HydraMaster Parts Department. Phone (206) 775-7276.

PART NO.	DESCRIPTION		QTY.
106-030	Engine spark plug		2
049-012	Round air cleaner	BobCat	1
049-038	Square engine air cleaner	AquaCat	1
049-014	Engine oil filter		1
078-015	Flow meter kit		1
078-024	Wand valve plunger kit		1
078-034	Pressure bypass valve kit		1
076-005	Spray jet 8006E		1
076-003	Spray jet 8004E		1
049-028	Recovery tank filter bag		2
049-023	Screen, garden hose		6
078-004	Cat 290 hot cup kit AquaCat		1
052-050	440 Male quick connect		1
052-051	440 Female quick connect		1
052-052	660 Male quick connect		1
052-053	660 Female quick connect		1
010-020	Belt pump drive Ax-25		1

HARD WATER AREA MAP



START UP

1. Perform daily/periodic maintenance as specified in this Owners Manual (page 36).
2. Connect all required hoses.
3. Connect cleaning tool to length of hose required to perform cleaning.

◆ CAUTION ◆

4. Mix tank must be full prior to ignition.

5. Start engine (choke as required). Engine is at operating speed (recommended -3000 RPM). Allow warm-up period of 2-5 minutes.
6. Spray wand to void all air from system. When the mix tank begins a fill cycle, the chemical flow meter may be adjusted to your desired setting.

NOTE: Chemical flow meter set at 5 GPH is a 1 to 30 mix ratio and 10 GPH is 1 to 15 ratio. When flow meter is set at 10 GPH, you will be using what most chemical manufacturers recommend at 5 GPH.

7. Run machine for several minutes under load (8 to 10" HG) until desired temperature is acheived.

8. Commence cleaning operation.

NOTE: Recommended carpet cleaning pressure is 250-300 PSI.

SHUT DOWN

1. Remove vacuum hose.
2. Flush clear water through chemocal system for 10 seconds (vinegar should be rinsed through system weekly). Turn off chemical flow meter.
3. Turn on cleaning tool to flush chemical from unit hoses and cleaning tool.

NOTE: If freeze guard is necessary, perform steps 1 & 2 of freeze guard procedure at this time (page 32).

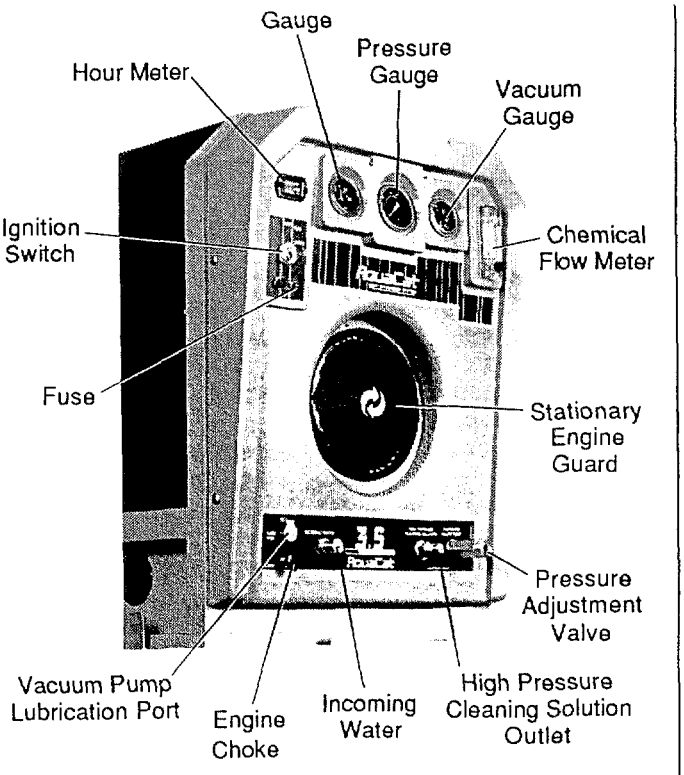
6. At this time, the blower should be lubricated with LPS 1.
7. Shut engine down.
8. Drain vacuum tank. Vacuum filter should be cleaned prior to mobilization of van.

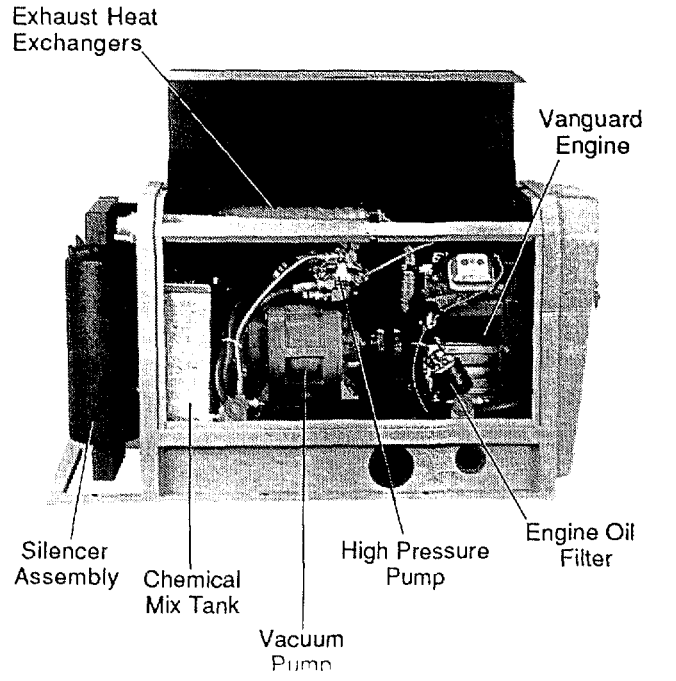
NOTE: If freeze guard is necessary, perform steps 3-4 of freeze guard procedure at this time.

Flood Damage Work

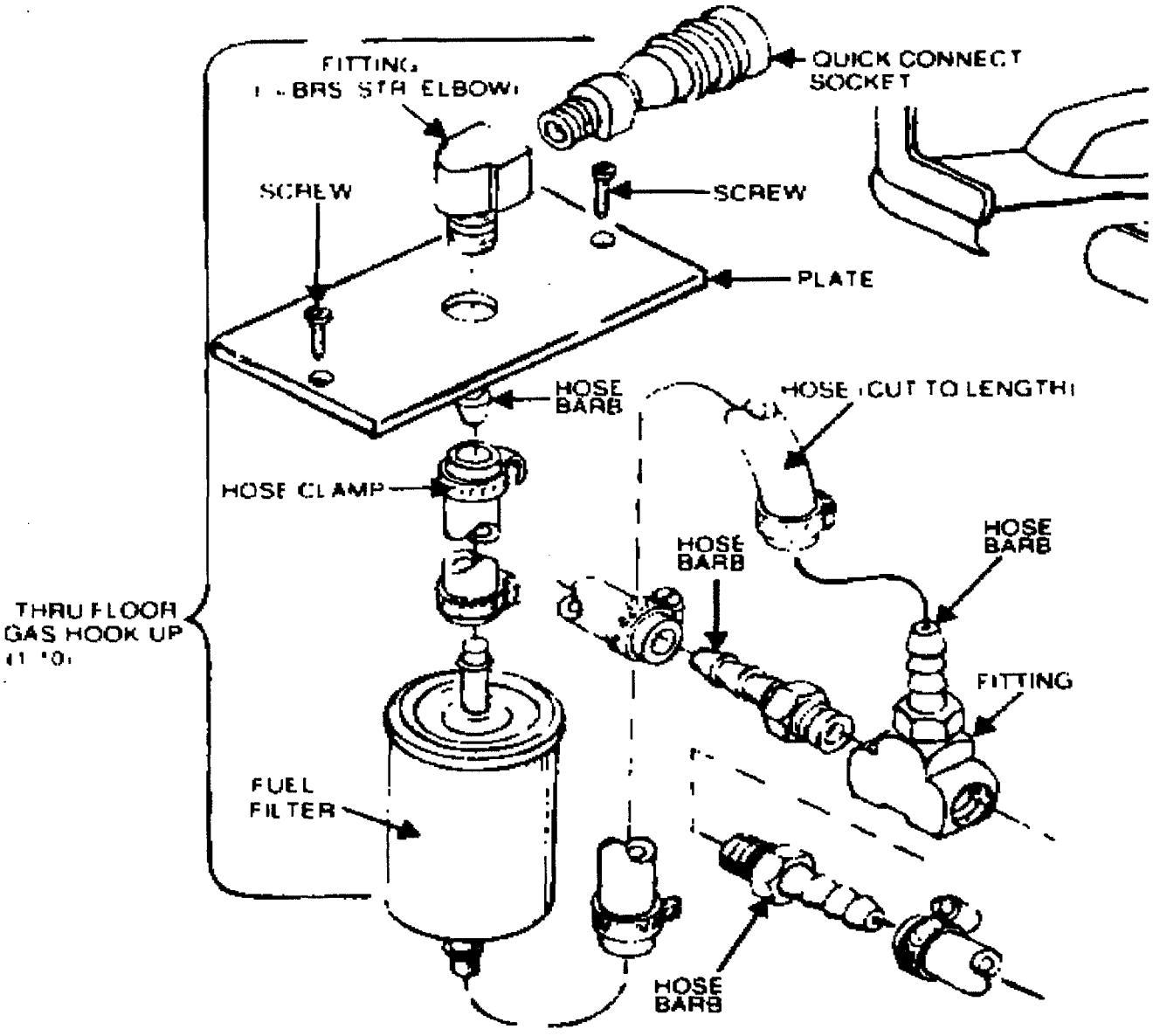
◆ CAUTION ◆

Caution must be exercised to prevent the water pump from overheating during long periods of vacuum work such as water damage





Thru-Floor Gas Hook-up and Installation



The relatively low cost of a water softener service is more than made up for in the increased life of machine parts and continued cleaning efficiency. The water softener will also increase the effectiveness of the cleaning chemical being used, therefore, less chemical will be needed.

Contact a water softener distributor in your area for information on the rental of a simple water treatment unit to carry in your truck. Be sure to change the water softener in accordance with the capability of the softener. Example: If the softener will treat 900 gallons of water and machines uses an average of 30 gallons per hour of use, and an average of 5 hours a day, would be 150 gallons a day. 5 days would equal 750 gallons of water, therefore, the softener would be changed every 6 working days for maximum softening.

WASTEWATER DISPOSAL ADVISORY

There are laws in most communities prohibiting the dumping of recovered "gray" water from carpet cleaning in any place but a sanitary treatment system.

This cleaning rinse water, recovered into your unit's vacuum tank, contains materials such as detergents, which must be processed before being safe for streams, rivers and reservoirs.

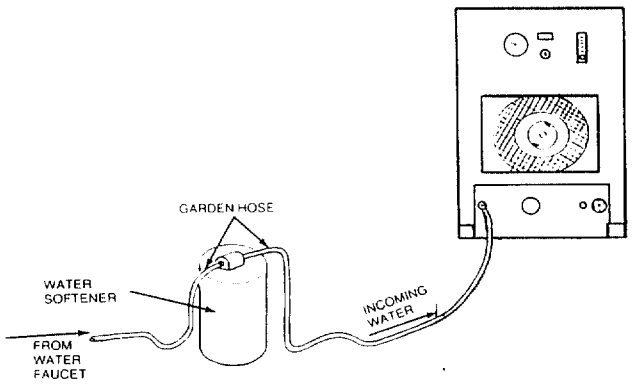
IN ACCORDANCE WITH THE EPA, STATE AND LOCAL LAWS, DO NOT DISPOSE OF WASTEWATER INTO GUTTERS, STORM DRAINS, STREAMS, RESERVOIRS, ETC.

In most cases, an acceptable method of wastewater disposal is to discharge into a municipal sewage treatment system after first filtering out solid material such as carpet fiber. Access to the sanitary system can be obtained through a toilet, laundry drain, carwash drain, RV dump, etc. Permission should first be obtained from any concerned party or agency.

One disposal method which usually complies with the law is to accumulate the wastewater and haul it to an appropriate dump site. Another solution to the disposal problem is to equip yourself with an Automatic Pump-Out System. These systems are designed to remove wastewater from the extractor's recovery system and actively pump the water through hoses to a suitable disposal drain. Properly designed, they will continuously monitor the level of wastewater and pump it out simultaneously to the cleaning operation. The hidden benefit of this process is that the operator doesn't have to stop his cleaning to empty the recovery tank. HydraMaster makes an A.P.O. System available which can be ordered with new equipment or installed later.

The penalties for non-compliance can be serious. Always check local laws and regulations to be sure you are in compliance.

WATER SOFTENER HOOKUP



OPERATION PRECAUTIONS

MACHINE ADJUSTMENTS

Although this unit has been factory adjusted, it may require additional adjustments to achieve optimum performance; i.e. altitude may require carb adjustment and ambient temperatures may require heat control adjustment. When required, consult an authorized representative.

◆ CAUTION ◆

ENGINE COOLING

Units employing air cooled engines must not be enclosed within a van with doors and windows closed. Excessive temperatures within the engine will result in premature engine failure and a compromise of applicable warranty.

◆ CAUTION ◆

LEVEL OPERATION

During operation, van or trailer must be parked on level ground not to exceed + or -10°. Failure to insure proper leveling may prevent proper internal lubrication of engine, vacuum and/or high pressure components.

◆ CAUTION ◆

FREEZE PROTECTION

Mother nature gives little warning as to her cold spells. Therefore, protecting this equipment from freezing will save costly down-time. Placing an electric heater in the truck or parking the truck indoors, will help to insure against freezing.

◆ WARNING ◆

HOT SURFACES

During the operation of this equipment many surfaces on the machine will become very hot. When near the van for any reason care must be taken not to touch any hot surface, such as heater, engine, exhaust, etc.

◆ WARNING ◆

NO SMOKING

It is unsafe to smoke in or around the vehicle.

◆ WARNING ◆

MOVING PARTS

Never touch any part of the machine that is in motion, severe bodily injury may result.

◆ WARNING ◆

CARBON MONOXIDE

*This unit generates toxic fumes. Position the vehicle so that the fumes will be directed **AWAY** from the job site.*

***DO NOT PARK** where exhaust fumes can enter a building through open doors or windows, air conditioning units or kitchen fans.*

◆ WARNING ◆

TOXIC FLUMES

Do not occupy the vehicle when the cleaning equipment is operating. Toxic fumes may accumulate inside a stationary vehicle.

WATER & CHEMICAL SYSTEMS

WATER/CHEMICAL FLOW OPERATION

This electro-mechanical system has been designed to be simple and trouble free. Incoming water flows first through the Solenoid Control Valve (1) (see illustration on next page) and the low pressure Chemical Injector (2) which are both mounted on the exterior of the mix tank. As the water passes through the Chemical Injector, it is automatically proportioned with a predetermined quantity of detergent. The Mix Tank (3) is equipped with two different float switches, the Water Level Float (4) responds to the level in the tank and will maintain the proper volume of solution to be reserved for the water pump. The secondary, Low Water Float switch (5) is a safety switch that is designed to protect your system from sudden or unexpected loss of water supply. If, for example, the water source at the house were turned off, the water level of the mix tank would drop, activating the secondary switch, which automatically disengages the system and prevents the water pump from running dry.

The desired chemical injection ratio may be obtained by an adjustment of the Chemical Flow Meter (6) during the fill cycle of the mix tank. Water must be flowing into the mix tank in order to adjust the chemical mix. The chemical will flow from the Chemical Jug (7) to the Chemical Flow Meter, then to the Chemical Injector where it is proportioned into the Mix Tank at the desired chemical setting.

NOTE: With this unique chemical system, the chemical flow is proportioned only during the filling cycles of the Mix Tank, not during the direct spraying of the wand. Therefore, it is possible that as your wand is spraying, you may have no chemical flow. Also, the converse is true in that you may not be spraying your wand, but if the mix tank is in a filling cycle, your Chemical Flow Meter may be active at the desired flow rate.

The chemical proportioning system will mix chemical with water at a 1 to 30 ratio when the Flow Meter is set at 5 GPH, or a 1 to 15 ratio when the Flow Meter is set at 10 GPH.

(continues, next page)

AQUACAT WATER FLOW

At this point in the flow, solution (water with chemical) will now be siphoned from the bottom of the Mix Tank to the inlet of the Water Pump (8). In the pump the water is pressurized and then discharged through a rubber pulsation hose down to the pressure relief valve (9). From the pressure relief valve the water is automatically distributed to the cleaning wand and bypassed back to the mix tank, depending on water usage at the wand.

As the water travels back toward the mix tank from the pressure relief valve it flows through two exhaust heat exchangers which heat the cleaning water.

CHEMICAL SYSTEM MAINTENANCE

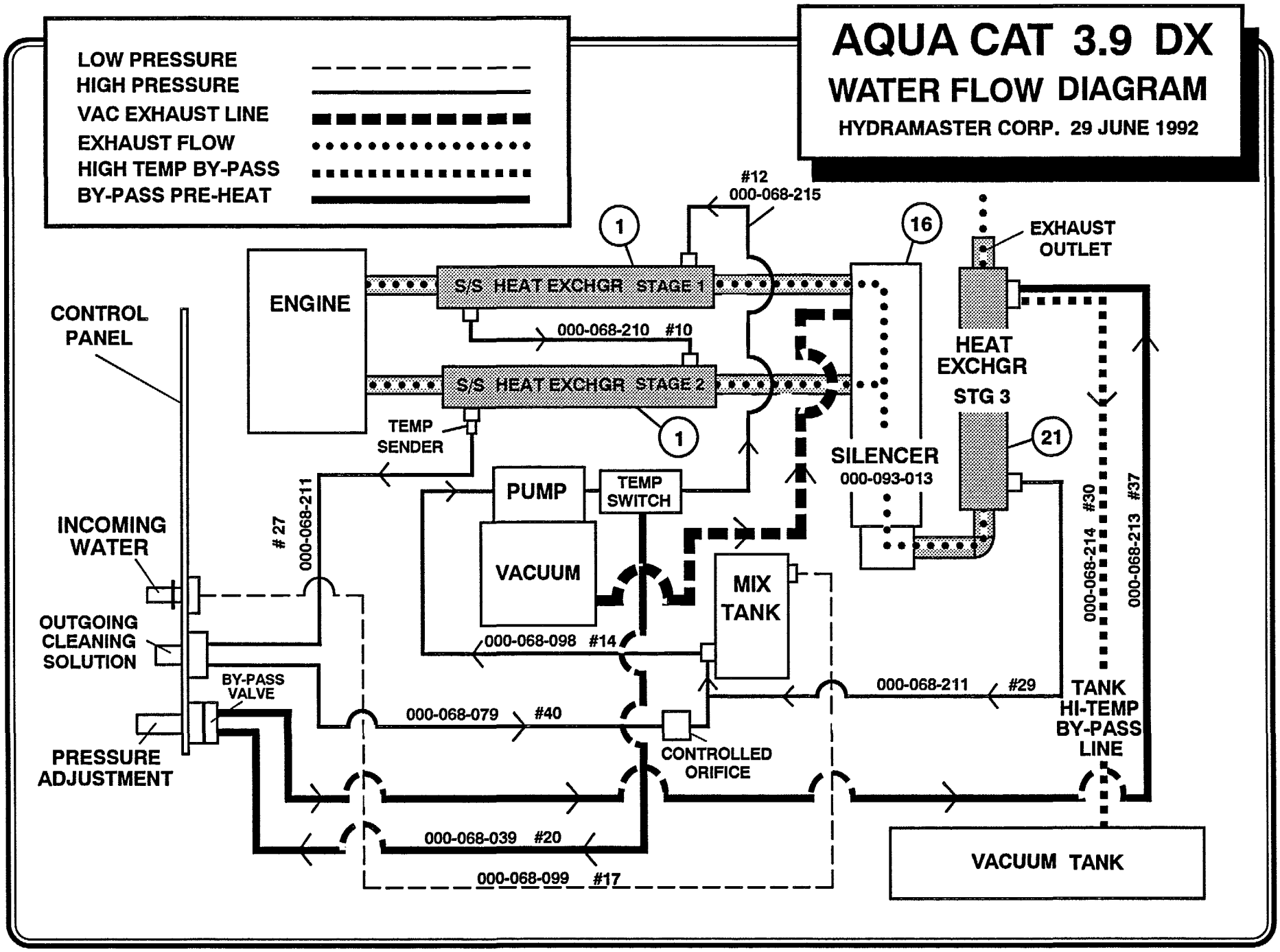
The chemical lines may need to be flushed with vinegar periodically to prevent abnormal chemical build-up. This flushing may be done by removing the clear plastic hose from the Chemical Jug and inserting it into a one quart container of vinegar. This should be done with the Chemical Flow Meter setting on 10 GPH and the Water Heater "off". Simply spray water from the wand until the quart of vinegar is exhausted, the repeat the process with one quart of clear water to void all lines of vinegar.

CHEMICAL TANK TROUBLE SHOOTING GUIDE

PROBLEM: Little or no chemical flow
Solution
Check that hoses at the Mix Tank (3) are secure. Check that the hose from the top of the Flow Meter (6) to the Chemical Injector (2) is secure with no kinks or leaks. Check that the adjusting cap on the side of the injector is not screwed all the way in. Check the s/s check valve inside the injector for chemical build-up and proper operation. Check the hose from the bottom of the Flow Meter to the Chemical Jug (7) for kinks, cracks, or bubbles.
Check the screen on the end of the hose which goes into the Chemical Jug. To check this screen for proper function, remove it from the plastic hose. If you cannot blow through it, then rinse it out with vinegar.
Check the Chemical Flow Meter (6) for obstructions or a sticking float.
Is incoming water pressure less than 30 PSI?
Cracked or defective Chemical Flow Meter (6)?
Check the filter screen in the Solenoid Control Valve (1).

PROBLEM: Inability to adjust chemical with the Flow Meter
Solution
Debris lodged behind teflon seat in Flow Meter valve.
Teflon seat on the valve stem may be loose. If deteriorated, replace O-Ring.
Insufficient water pressure. Locate new source.

AQUA CAT 3.9 DX
WATER FLOW DIAGRAM
HYDRAMASTER CORP. 29 JUNE 1992



PROBLEM: Mix Tank Overflows

Solution

Float switch (4) in the mix tank not moving freely, or defective.

To Check Switch: With a 12 volt test light and the float in the 'up' position, there should be power through the switch.

To Check Relay: First, check wiring against diagram. With 12 volt test light and the float switch (4) in the 'up' position, there should **NOT** be power at the solenoid valve. With the float switch in the 'down' position, there ***should*** be power at the solenoid valve.

Solenoid valve defective: Remove solenoid valve, disassemble and inspect diaphragm for cracks or tears.

PROBLEM: Mix Tank Does Not Keep Up With Water Output

Solution:

Check incoming water pressure. Check garden hose quick connect assembly screen.

Check garden hoseand/or feed hose to the mix tank for clog, kinks or blockage. Float switch (4) in mix tank hanging up (not moving freely). Check filter screen in Solenoid valve (1).

CAT PUMP MODEL 290 OPERATING INSTRUCTIONS

Products described hereon are covered by one or more of the following U.S. patents: 3558244, 3652188, 3809508, 3920356, and 3930756

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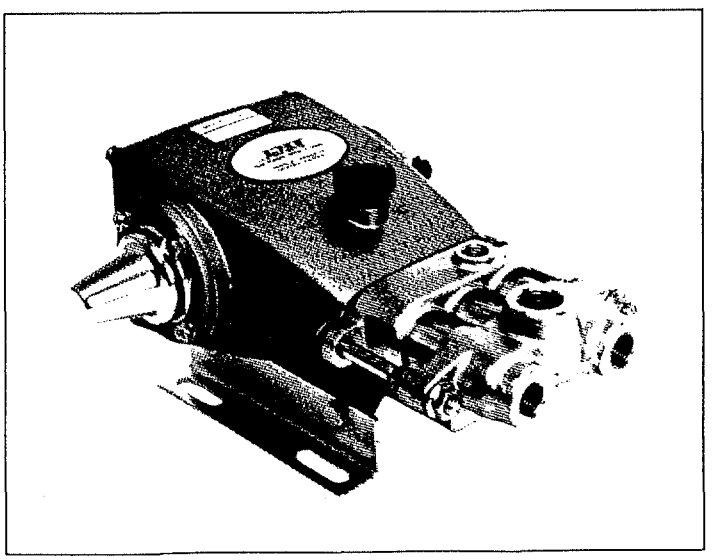
SPECIFICATIONS

Volume	3.5 GPM (13 L/M)
Discharge Pressure	1200 PSI (83 BAR)
Maximum Inlet Pressure	- 8.5 to + 40 PSI (-0.6 to + 2.8 BAR)
RPM	1200
Bore	0.787" (20mm)
Stroke	0.472" (12mm)
Crankcase Capacity	10 oz. (.3 L)
Inlet Port (1)	1/2" NPT (1/2" NPT)
Chemical Injection Port (1)	1/4" NPT (1/4" NPT)
Discharge Ports (2)	3/8" NPT (3/8" NPT) (1):1/2" NPT (1/2" NPT)
Pulley Mounting	Either side (Either side)
Shaft Diameter	0.650" (16.5mm)
Weight	12.1 lbs. (5.5 kg)
Dimensions	10.77"x9.06"x5.14" (273.5x230x130.5mm)



GENERAL INFORMATION FOR CAT PUMP REPAIR

As you remove your discharge manifold, there is a set of 3 check valves (which usually fall out during dismantling). If the surfaces of these check valves are dirty, or show signs of chemical build-up, it is probable that they would remain open causing pressure loss or pulsation. Upon inspecting the valves, make sure that the teflon button in the valve spring retainers are still intact. Also examine the discharge manifold. Look for problems such as cracks, chemical buildup or warping due to freezing. If this discharge manifold is warped, it will cause the check valves to stick and will result in loss of pressure.

The Cat pump cups are often the source of pressure loss. Upon inspection they may appear melted or torn, but often they will look good. Replace them anyway. There is no sure method of visually inspecting the cups. HydraMaster recommends changing cups whether they look good or not.

Anytime your pump is being dismantled, HydraMaster recommends replacement of all 'o' rings and seals. This is merely a convenience to the customer to make sure that the Cat pump is in top operating condition.

The Prrrrrm-A-Lube seals located within the intake manifold will allow air to enter the pump if they are worn. Again, it is difficult to visually pinpoint a defective Prrrrrm-A-Lube seal. Replace them all.

Repairing of Cat pumps is not a difficult task. However, before dismantling make sure you have the proper parts required.

1 - short (or hot) cut kit
3 - Prrrrrm-A-Lube seals
6 - piston sleeve 'o' rings
1 - bottle Cat oil

Read instructions thoroughly, supplied in the Cat pump manual prior to dismantling and follow directions as stated. Oil all seals thoroughly prior to installation. (Remember, a newly scarred seal is no better than one you just took out.)

SERVICING DISCHARGE VALVES & VALVE SEATS

DISMANTLING

1. Loosen the 2 (M8) locking nuts approximately one turn.
2. Then remove the 2 (M8) flange nuts.
3. Grasp the discharge manifold with 3 fingers on the underside and tap with a soft mallet to remove.
4. Valve assemblies will remain with the manifold. Invert manifold and discharge valve assemblies should fall out.
5. Inspect discharge valves for wear or ridges. (Spherical valves due to their shape must be replaced when worn.)

REASSEMBLY

1. Place retainer in manifold chamber.
2. Next insert spring into center of retainer.
3. Place valve over spring with spherical (mooned) side up.
4. Next insert the valve seat.
5. Position manifold back onto pump.

NOTE: Exercise caution when inserting cylinders into manifold to avoid damaging cylinder o-rings.

6. Replace flange nuts on studs and hand tighten both sides. Then torque each side to 125 inch pounds.
7. Hand tighten locking nut.

◆ CAUTION ◆

When restarting the pump, check to see that there is no cylinder motion as this will cause premature failure of the cylinder o-rings. Center cylinder motion can be eliminated by switching with one of the end cylinders.

SERVICING THE PUMPING SECTION

DISMANTLING

1. Remove discharge manifold as described in the last section.
2. Slip cylinders out of inlet manifold. **NOTE:** Identify cylinders so they will be replaced in their original position (front to back).
3. Remove cotterpin, nut, and washer.
4. Next remove piston retainer, spacer, and piston assembly.
5. Remove inlet valve

REASSEMBLY

1. Examine inlet valve surface and reverse if damaged (both sides are lap surfaces).
2. Examine piston assembly for clean inlet surface. If damaged, replace and lubricate.

NOTE CUP INSTALLATION: Wipe cup inserter lightly with oil. Slip backup ring onto piston. Force cup over inserter and square with all surfaces. Faulty cup installation causes premature failure.

3. Next replace piston spacer and retainer.
4. Slip washer onto rod, screw on nut and torque to 60 inch pounds.

NOTE: *ALWAYS REPLACE WITH NEW COTTERPIN.*

5. Examine cylinder walls for scoring or etching. These conditions will cause premature wear of your piston assemblies. Replace if worn or damaged.
6. Lubricate cylinder and replace o-rings and backup rings (if defective).
7. Position cylinders in their original order into manifold chambers and carefully slip over rod ends onto the pump.
8. Replace flange nuts on studs and hand tighten both sides. Then torque each side to 125 inch pounds.
9. Hand tighten locking nuts.

SERVICING THE SEALS AND SLEEVES

DISMANTLING

1. Remove discharge manifold and piston assemblies as described.
2. Remove both (M8) locking nuts from studs.
3. With soft mallet, tap inlet manifold loose from crankcase.
4. Place inlet manifold on pair of clearance blocks with crankcase side down and drive out seals.
5. Invert inlet manifold with *CRANKCASE SIDE UP.*
6. Lubricate circumference of new Prrrrrm-A-Lube seals, position in manifold with *GARTER SPRING DOWN* and drive into place.
7. Examine sleeves for scoring or other damage before removing.
8. If worn, grasp sleeve with pliers and pull off.

NOTE: This procedure will mar the sleeve so use only if sleeve is to be replaced.

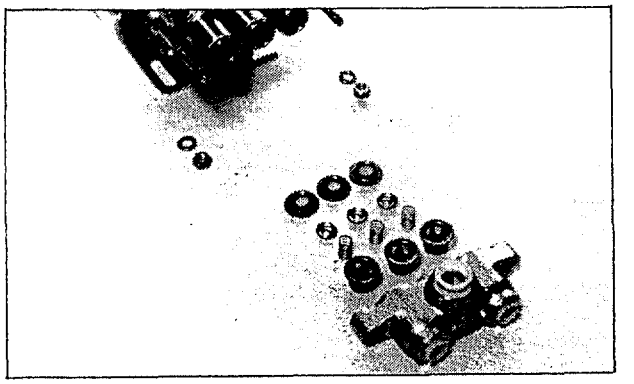
9. Remove o-ring and back-up rings from piston rod.

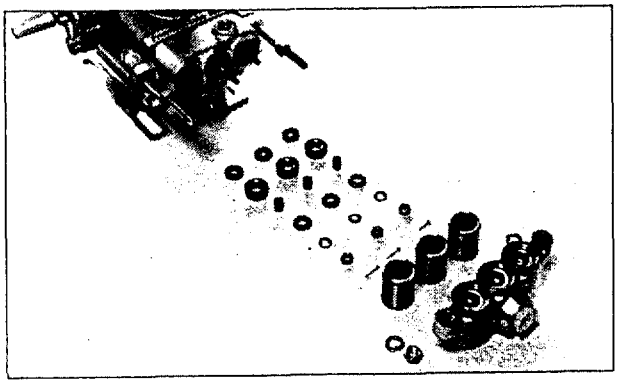
REASSEMBLY

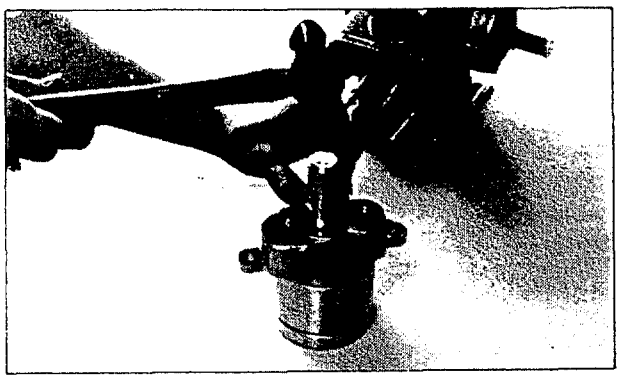
1. Place barrier slinger on rod.
2. Lubricate new o-rings and back-up rings. Install first o-ring in the o-ring groove on the piston rod. Position back-up ring against the shoulder in front of the first o-ring, then the second o-ring. Be careful to avoid damaging the o-rings when slipping them over the piston rod threaded ends.
3. Immerse sleeve in oil carefully twist and push onto rod (machined counter bore end first).
4. Replace seal retainers.
5. Exercise caution when replacing inlet manifold, so the inlet seals are not damaged by the threaded rod ends.
6. Replace locking nuts on studs.
7. Reassemble piston assemblies and discharge manifold as described.

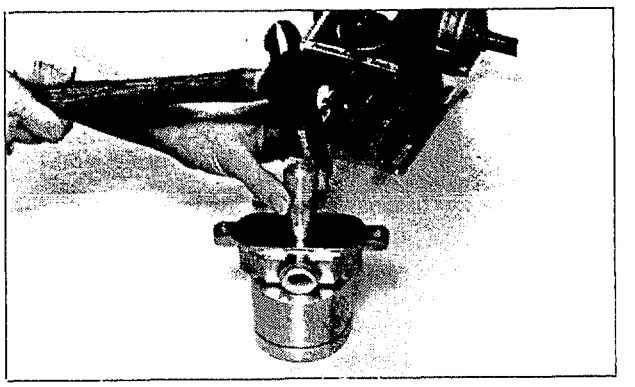
Consult factory for your local distributor for crankcase servicing.

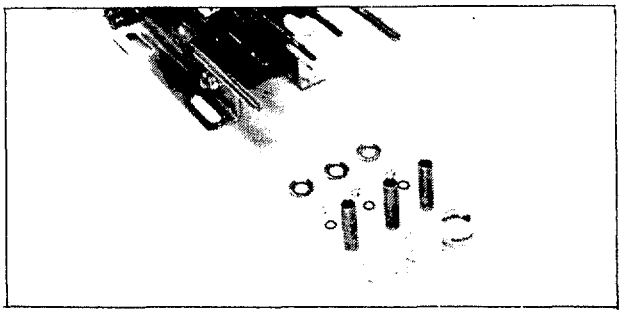
DISMANTLING CAT PUMP



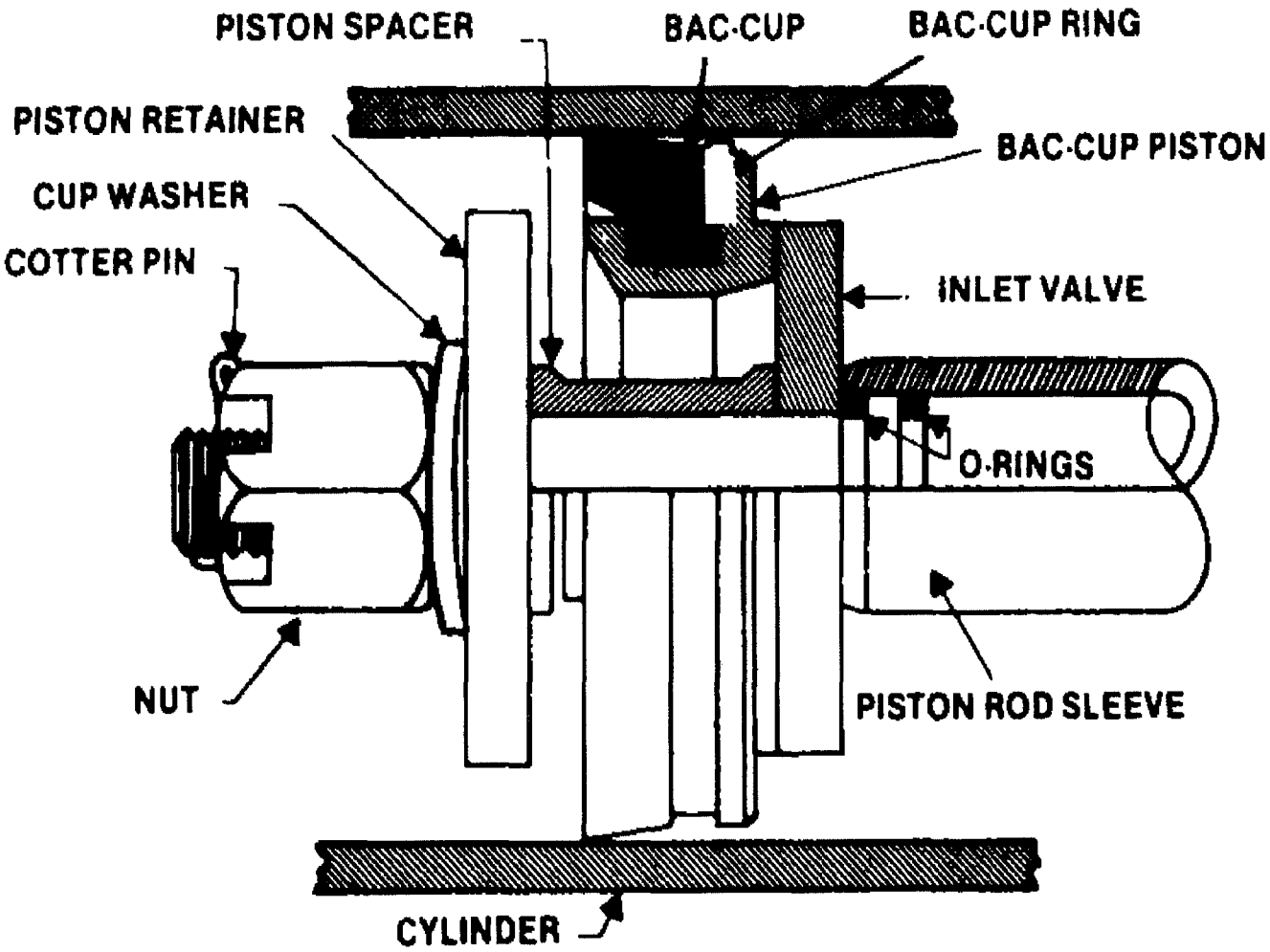








Pumping Section Cut-away



SERVICE KITS

078-001 Cup Kit, BobCat
3 Cup
6 O-Ring, Cylinder
3 Cotterpin
1 Instruction Sheet
1 Cup Inserter

078-004 Hot Cup Kit, AquaCat
3 Cup
6 O-Ring, Cylinder
3 Cotterpin
1 Instruction Sheet
1 Cup Inserter

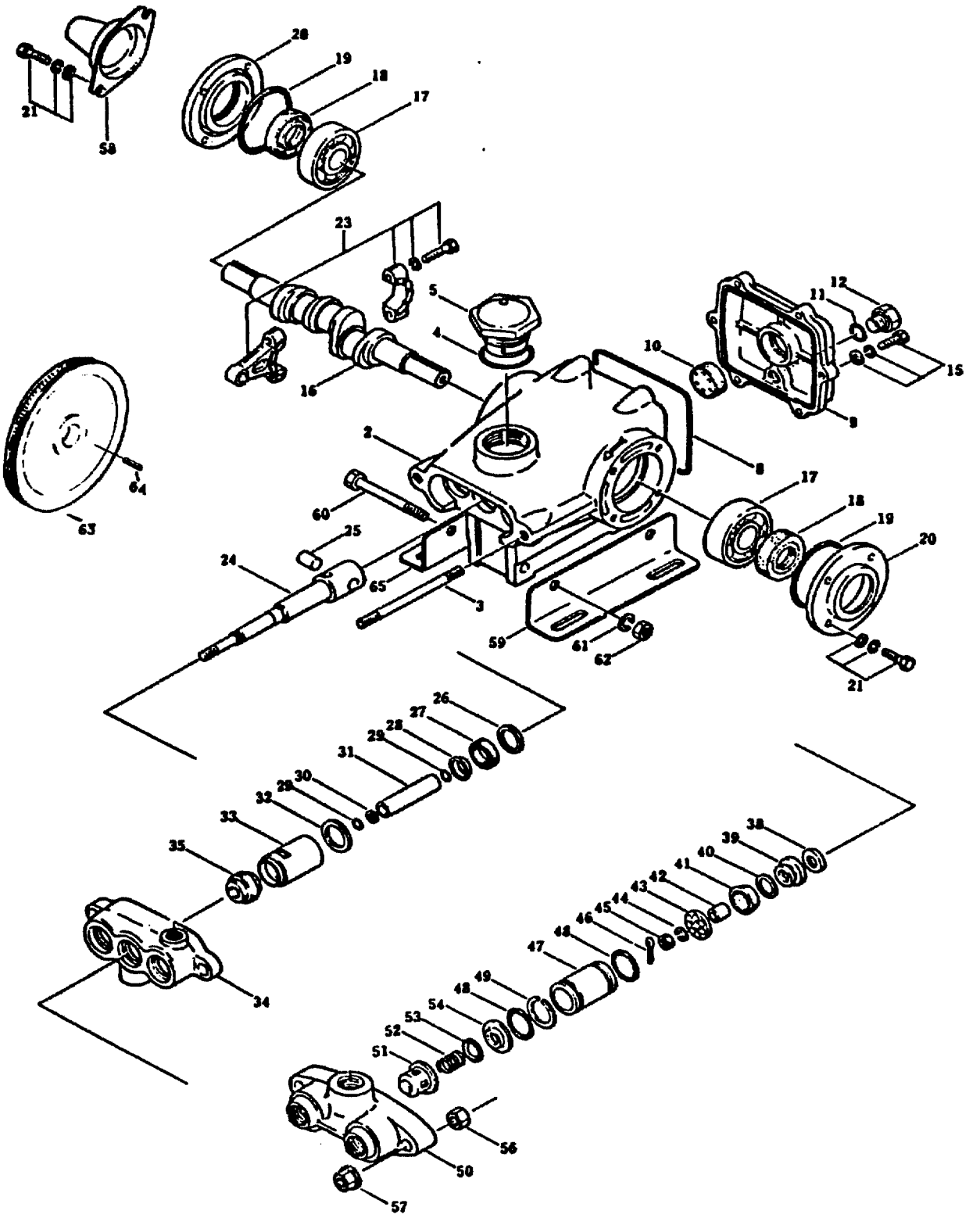
078-003 Seal Kit
3 Prrrrm-A-Lube Seal
3 Cotterpin
2 Abrasive Paper
1 Instruction Sheet

30431 Sleeve and Seal Kit
3 Prrrrm-A-Lube Seal
3 Barrier Slinger
3 Cotterpin
3 Sleeve
6 O-Ring, Sleeve
1 Instruction Sheet

30686 Valve Kit
3 Valve Spring Retainer
3 Valve Spring
3 Valve
3 Valve Seat
3 O-Ring, Cylinder
1 Instruction Sheet

30860 Piston Kit, BobCat
6 O-Ring, Cylinder
3 Back-Up Ring, Cylinder
3 Bac-Cup Piston
3 Bac-Cup Ring
3 Cup
3 Piston Spacer
3 Piston Retainer
3 Conical Washer(M6)
3 Nut (M6)
3 Cotterpin
3 Inlet Valves
1 Instruction Sheet

PISTON MODEL 290 Exploded View



PARTS LIST MODEL 290

ITEM	PART NO.	DESCRIPTION	QTY.
1	20285	O-Ring (Buna-N)	1
2	44274	Crankcase	1
3	156-008	Stud (M8 x 82)	2
4	097-004	O-Ring, oil filler cap	1
5	027-007	Oil filler cap	1
8	43340	O-Ring, crankcase cover	1
9	43339	Crankcase cover	1
10	074-021	Bubble oil gauge	1
11	23170	O-Ring, drain plug	1
12	25625	Drain plug	1
15	92520	Sems comb head screw (M6 x 20)	6
16	43804	Crankshaft	1
17	14487	Rearing	2
18	147-005	Oil seal (Buna-N)	2
19	097-007	O-Ring, oil seal case	2
20	041-021	Oil seal case	2
21	92519	Sems comb head screw (M6 x 16)	8
23	101799	Connecting rod	3
24	101800	Piston rod	3
25	16948	Piston pin	3
26	20017	Seal washer	3
27	147-006	Oil seal	3
28	25327	Barrier slinger	3
29	097-008	O-Ring, sleeve	3
	28771	O-Ring, sleeve (Viton)	3
30	29003	Back-up ring, Sleeve (Teflon)	3
31	29614	Sleeve (29743 Unchromed)	3
32	26854	Seal washer	3
33	138-001	Seal retainer	3
34	25128	Inlet manifold	1
	25635	Inlet manifold - stainless steel	1
35	147-008	Prrrrrm-A-Lube seal	3
35	30325	Prrrrrm-A-Lube seal (Viton)	3

ITEM	PART NO.	DESCRIPTION	QTY.
38	27004	Inlet valve	3
39	30543	Bac-Cup piston	3
40	097-025	Bac-Cup ring (Teflon)	3
41	044-001	Cup (Viton)	3
	43474	Bac-Cup assembly	3
39-41	078-001	BobCat cup kit	
39-41	078-004	AquaCat cup kit	1
42	27983	Piston spacer	3
43	27002	Piston retainer	3
44	27006	Conical washer - s/s (M6)	3
45	27000	Nut - s/s (M6)	3
46	14158	Cotterpin	3
47	045-004	Cylinder (43834 Unch)	3
48	097-012	O-Ring, cylinder (Buna-N)	6
	11377	O-Ring, cylinder (Viton)	6
49	097-024	Bac-Cup ring, cylinder	3
50	090-005	Discharge manifold	1
	25634	Discharge manifold - s/s	1
51	43442	Valve spring retainer	3
52	43360	Valve spring	3
53	43723	Valve	3
54	43434	Discharge valve seal	3
56	81109	Hex nut (M8)	2
57	101804	Hex flange nut (M8)	2
58	108-003	Shaft protector	1
Electric Clutch Assembly			
59	152-005	Tapered sleeve	1
60	077-005	Key, electric clutch	1
61	036-005	6" electric clutch	1
62	143-084	8-30 mm socket head screw	1
63	174-004	Flat washer (5/16 US)	1
64	174-018	Lock washer (5/16 US)	1

CAT PUMP TROUBLE SHOOTING GUIDE

PROBLEM: Pulsation

Cause	*Solution*
Debris in discharge valves of pump.	Clean or replace discharge valves.
Worn Prrrrrm-A-Lube seals.	Replace.
Excessive temperature.	Check pump solenoid.

PROBLEM: Low pressure

Cause	*Solution*
Worn nozzle.	Replace nozzle of proper size.
Belt slippage.	Tighten or replace; use correct belt.
Air leak in inlet plumbing.	Dismantle, reseal, and reassemble.
Relief valve stuck, partially plugged or improperly adjusted; valve seat worn.	Clean and adjust relief valve; check for worn and dirty valve seats. Kit available.
Inlet suction strainer clogged or improper size.	Clean. Use adequate size. Check more frequently.
Worn piston assembly. Abrasives in pumped fluid or serve cavitation. Inadequate water supply.	Install proper filter. Suction at inlet manifold must be limited to lifting less than 20 feet of water or -8.5 PSI vacuum.
Fouled or dirty inlet or discharge valves.	Clean inlet and discharge valve assemblies.
Leaky discharge hose.	Replace worn valves, valve seats.
	Replace discharge hose.

PROBLEM: Pump runs extremely rough, pressure is very low

Cause	*Solution*
Restricted inlet or air entering the inlet plumbing.	Proper size inlet plumbing; check for air tight seal.
Inlet restrictions and/or air leaks. Damaged cup or stuck inlet or discharge valve.	Replace worn cup or cups, clean out foreign material, replace worn valves.
Worn inlet manifold seals. Prrrrrm-A-Lubes.	Replace worn seals.

PROBLEM: Cylinder O-Rings blown next to discharge manifold

Cause	*Solution*
Pressures in excess of rated PSI.	Check for plugged nozzle, closed valves or improperly adjusted bypass valve.
Warped manifold. Freezing.	Replace manifold.

PROBLEM: Leakage at the cylinder O-Rings at the discharge manifold and black, powdery substance in the area of the O-Ring

Cause	*Solution*
Loose cylinders. Cylinder motion caused by improper torque on the discharge manifold.	Retighten. Do not tighten too much or the ears of the manifold will be bowed, causing looseness in the center cylinder.

PROBLEM: Water leakage from under the inlet manifold

Cause	*Solution*
Worn inlet manifold seals. Prrrrrm-A-Lube. Leaking sleeve O-Ring.	Install seals. If piston rod sleeves are scored, replace sleeves and sleeve O-Rings.

PROBLEM: Oil leak between crankcase and pumping section

Cause	*Solution*
Worn crankcase piston rod seals.	Replace crankcase piston rod seals.

PROBLEM: Oil leaking in the area of the crankshaft

Cause	*Solution*
Worn crankshaft seal or improperly installed oil seal.	Remove oil seal retainer and replace damaged gasket and/or seals.
Bad bearing.	Replace bearing.

(continues, next page)

CAT PUMP TROUBLE SHOOTING GUIDE

PROBLEM: Excessive play in the end of the crankshaft pulley

Cause	*Solution*
Worn ball bearing from excessive tension on drive belt.	Replace ball bearing. Properly tension belt.

PROBLEM: Water in crankcase

Cause	*Solution*
May be caused by humid air condensing into water inside the crankcase.	Change oil at 3 month or 500 hour intervals using Cat pump crankcase oil (other approved oil every month or 200 hours).
Leakage of manifold inlet seals and/or piston rod sleeves O-Ring.	Replace seals, sleeves and O-Rings.

PROBLEM: Oil leaking from underside of crankcase

Cause	*Solution*
Worn crankcase piston rod seals.	Replace seals, sleeve and O-Rings.

PROBLEM: Oil leaking at the rear portion of the crankcase

Cause	*Solution*
Damaged or improperly installed oil gauge or crankcase rear cover O-Ring, and drain plug O-Ring.	Replace oil gauge or cover O-Ring, and drain plug O-Ring.

PROBLEM: Oil leakage from drain plug

Cause	*Solution*
Loose drain plug or worn drain plug O-Ring.	Tighten drain plug or replace O-Ring.

PROBLEM: Loud knocking noise in pump

Cause	*Solution*
Pulley loose on crankshaft.	Check key and tighten set screw.
Broken worn bearing.	Replace bearings.

PROBLEM: Frequent or premature failure of the inlet manifold seals

Cause	*Solution*
Scored rods or sleeves.	Replace rods and sleeves.
Over pressure to inlet manifold.	Reduce inlet pressure per instructions.

PROBLEM: Short cup life

Cause	*Solution*
Abrasive material in the fluid being pumped.	Install proper filtration on pump inlet plumbing.
Excessive pressure and/or temperature of fluid being pumped.	Check pressures and fluid inlet temperature; be sure they are within specified range.
Over pressure of pumps.	Reduce pressure.
Running pump dry.	Do not run pump without water.
Front edge of piston sharp.	Replace with new piston.

PROBLEM: Strong surging at the inlet and low pressure on the discharge side

Cause	*Solution*
Foreign particles in the inlet or discharge valve or worn inlet and/or discharge valves.	Check for smooth lap surfaces on inlet and discharge valve seats. Discharge valve seats, and inlet valve seats may be lapped on a very fine oil stone; damaged cups and discharge valves cannot be lapped but must be replaced.

HIGH PRESSURE PUMP TROUBLE SHOOTING GUIDE

PROBLEM: Loss of pressure

Cause/Solution

1. Clogged filter screen in garden hose quick connect coupler.
   A. Remove and clean or replace filter.
2. Low water pressure at source.
   A. Determine rate of flow and select an alternative source of supply if water pressure is inadequate.
3. Defective or blocked check valves in high pressure pump cylinder head.
   A. Dismantle cylinder head and replace or clean applicable check valve.
4. Delaminated, kinked or clogged hose between the mix tank and the high pressure pump.
5. Defective pressure relief valve or debris in pressure relief valve. **NOTE:** The high pressure bypass valve is designed to fully close when the cleaning tool is turned on. Any foreign matter collecting on the piston will prevent full closure of the valve and allow a portion of the water to continue to circulate instead of being routed to the cleaning tool. To correct this situation, the bypass valve must be dismantled and cleaned (refer to illustration provided for bypass dismantling).
   A. Dismantle and clean pressure relief valve as shown in illustration.
   B. Replace defective or worn out bypass cup.
   C. Replace bypass valve.
6. Defective or worn cups.
   A. Remove and replace piston cups as defined by pump section of this manual.
7. Loose drive belt for high pressure pump.
   A. Readjust belt as required or replace if defective.

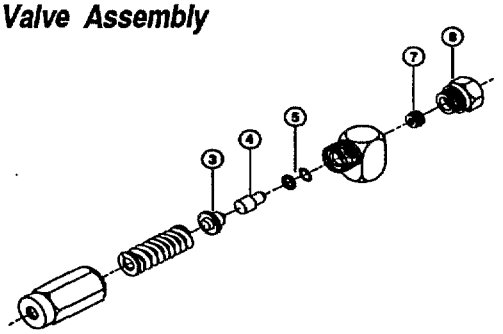
PROBLEM: Insufficient or excessive water flow

Cause/Solution

1. Worn out spray jet. **NOTE:** Cleaning tools designed to spray a constant flow of 1 1/2 GPM will average 1 gallon of flow per minute in actual working situations since flow is not continuous. An average flow of 1 GPM results in 6000 gallons of flow for every 100 hours of unit operation. Spray tips are capable of consistent flow rates for approximately 20,000 gallons. They should be replaced therefore approximately every 350 hours. Worn spray jets allow a greater average rate of flow thus reducing desired temperature levels.
   A. Remove and replace spray jet.

2. Reduction of flow.
   A. Due to increased length of solution hose. **NOTE:** For every 50 feet of hose beyond 100 feet in total length, a measurable loss of flow is experienced. This condition is a result of the increased friction experienced by the water as it passes through the hose. Therefore, it is necessary to increase the pressure at the machine 40 PSI for every additional 50 feet of cleaning solution hose over 100 feet.

Bypass Valve Assembly



BYPASS PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	QTY.
3	000-105-101	Thrust plate, Bypass valve	1
4	000-105-102	Piston plate, Bypass valve	1
5	000-078-101	Kit, seal for Bypass valve	1
7	000-148-004	Seat & O-Ring, Bypass valve	1
8	000-097-005	O-Ring, Bypass valve fitting	1

VACUUM SYSTEM

INFORMATION

The vacuum blower incorporated in this machine is a positive displacement lobe type, manufactured by Cooper Industries. The performance and life of this unit is greatly dependent on the care and proper maintenance it receives.

Because of the close tolerances between the lobes and housing of the vacuum blower, solid objects entering the inlet will damage the internal lobes, gears and bearing or direct drive coupler.

To prevent this, a stainless steel filter screen has been placed at the vacuum inlet inside the vacuum recovery tank. This stainless steel screen is finger tight and should be removed for cleaning weekly.

◆ CAUTION ◆

When machine is being run for test purposes and the vacuum inlet on top of machine is open, caution should be used.

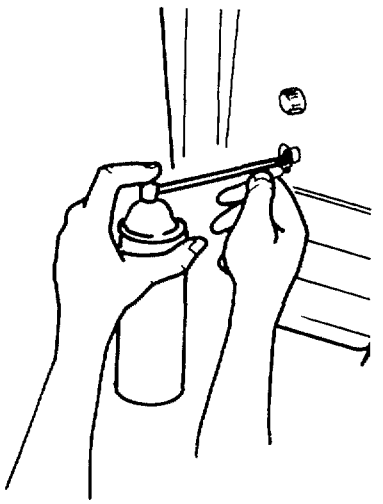
To protect the vacuum blower from overloading and damaging itself, there is a vacuum relief system installed on the vac tank. When the vacuum tank inlet is completely sealed off, a maximum of 12 HG will be attained. A hole on the top blower pipe elbow acts as the lubrication point. At the end of each day, LPS 1 or Pennzguard should be sprayed in before shutting down the machine. See blower lubrication illustration. If you fail to lubricate the vacuum blower daily, rust deposits and moisture will decrease the life of the vacuum blower.

Read the vacuum blower manual carefully for proper oil change and grease application. The maintenance log may differ slightly from the manual, but the truck-mounted carpet cleaning machine application is very demanding of the vacuum blower and therefore it should be maintained more regularly.

◆ CAUTION ◆

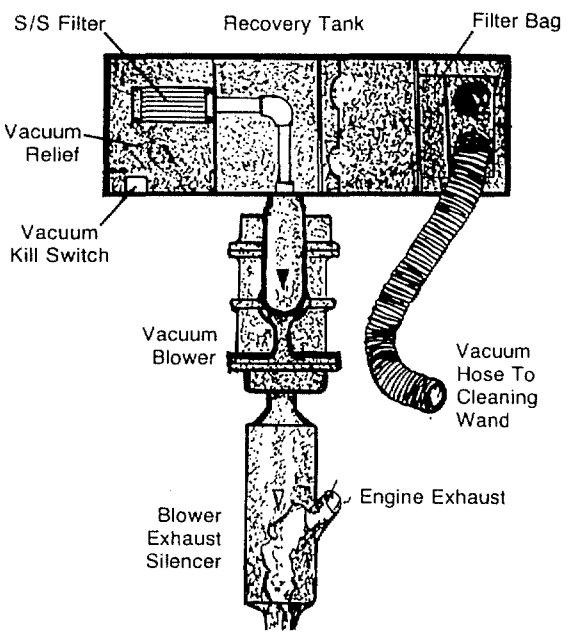
NOTE: *Vacuum tank is protected from overflowing by a vacuum tank, float kill switch. This switch is not activated by foam, only by liquid.*

Blower Lube Port



Spray lubricant into blower lube port for 3 to 5 seconds, then immediately shut off machine. Use only LPS 1 moisture displacing lubricant.

Vacuum Flow

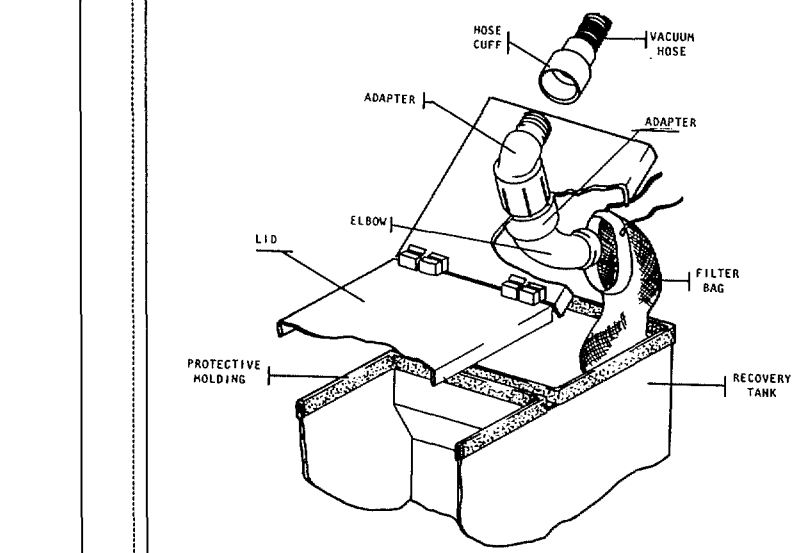


VACUUM TANK FILTER BAGS

HydraMaster filter bags are designed to trap all of the lint, that would normally collect at the bottom of your vacuum tank. The use of these bags, if emptied at the end of each job, will eliminate the build-up of much of the debris in the tank. The drawstring top of these bags is designed to be tied to the incoming dirty water inlet in the vacuum tank.

To reorder bags use part number 049-028.

Vacuum Tank Filter Bags



VACUUM BLOWER TROUBLE SHOOTING GUIDE

PROBLEM: Loss of pressure

Cause	*Solution*
Collapsed vacuum hose between blower and vacuum tank.	Remove and replace hose. **NOTE:** A special reinforced hose is required for replacement.
Clogged stainless steel liner.	Remove and clean or replace stainless steel filter.
Defective vacuum tank seal.	Remove and replace vacuum tank seal.
Defective or "open" vacuum tank dump valve.	Close valve. Replace valve.
Fractured weld on vacuum tank.	Re-weld as required or replace tank.
Collapsed or kinked vacuum hose.	Reshape hose if possible and/or eliminate kinks.
Plugged vacuum hose.	Remove obstructions by reversing the vacuum hose.
Restriction in cleaning tool.	Remove obstruction.
Worn end plates or lobes in vacuum blower.	Replace worn components. **NOTE:** Must be accomplished by a qualified technican.
Defective relief valve.	Inspect and replace if necessary.

PROBLEM: Blower is seized

Cause	*Solution*
Rust.	Spray rust dissolving lubricant onto lobes to emulsify rust and attempt to rotate vacuum lobes.
Foreign matter.	Dismantle and remove foreign matter and repair as required. **NOTE:** Dismantling must be accomplished by qualified technican.
Note: *The above mentioned, rust, foreign matter and seizing are often caused from foam traveling through the blower.*	

PROBLEM: Noise in vacuum blower

Cause	*Solution*
Worn gears.	Remove and replace gears. **NOTE:** Replacement of gears must be accomplished by qualified technican. Timing of vacuum blower has been changed due to worn components. **NOTE:** Replacement of components must be accomplished by qualified technican.
Lack of lubrication. **NOTE:** Permanent damage may have resulted from lack of lubrication.	Lubricate as specified by applicable vacuum blower manual. See Table of Contents.
Worn bearings.	Remove and replace bearings as required. **NOTE:** Must be accomplished by qualified technican.
Debris and/or foreign material build-up. **NOTE:** A stainless steel filter is provided in vacuum inlet located in vacuum blower components.	Dismantle vacuum blower and remove foreign material. **NOTE:** Dismantling should be accomplished by qualified technican only. Replacement of worn parts is necessary.
Loose or missing mounting bolts.	Tighten or reinstall mounting bolts.

VACUUM BLOWER WARRANTY

COOPER warrants products of its manufacture to be free from defects in material and workmanship if properly installed, maintained, and operated under normal conditions with competent supervision.

No person, agent, representative or dealer is authorized to give any warranties on behalf of COOPER nor to assume for COOPER any other liability in connection with any of COOPER'S products.

This warranty shall extend for two (2) years from date of installation provided this equipment has been put into service within six months after shipment from the COOPER factory. If repairs or replacements are made by the Purchaser without COOPER'S prior written consent, COOPER'S warranty shall cease to be in effect. No allowance will be granted for any repairs or alterations made by the Purchaser without COOPER's prior written consent.

Machinery, equipment and accessories furnished by COOPER, but manufactured by others, are warranted only to the extent of the original manufacturer's warranty to COOPER.

COOPER agrees at its option to repair at the point of shipment or to replace without charge f.o.b. point of shipment, any part or parts of products of COOPER'S manufacture, which within the specified warranty period shall be proved to COOPER'S satisfaction to have been defective when shipped, provided the Purchaser promptly notifies COOPER, in writing, of such alleged defect.

COOPER'S liability to Purchaser, whether in contract or in tort arising out of warranties, representations, instructions, or defects from any cause shall be limited to repairing or replacing of the defective part or parts as aforesaid, f.o.b. point of shipment.

No liability whatsoever shall attach to COOPER until said products have been paid for. EXCEPT AS STATED IN THIS SECTION AND IN THE PRECEDING SECTION TITLED 'WARRANTY' AND EXCEPT AS TO TITLE, THERE ARE NO GUARANTEED OR WARRANTIES OF MERCHANTABILITY, FITNESS, PERFORMANCE OR OTHERWISE, EXPRESS, IMPLIED OR STATUTORY, AND COOPER SHALL HAVE NO LIABILITY FOR CONSEQUENTIAL, INCIDENTAL OR OTHER DAMAGES, HOWSOEVER CAUSED.

DATE INSTALLED_____ MODEL_____ SERIAL #_____

COOPER/GARDENER-DENVER 1800 Gardener Expway Quincy, IL 62305-4024

VACUUM BLOWER LUBRICATION

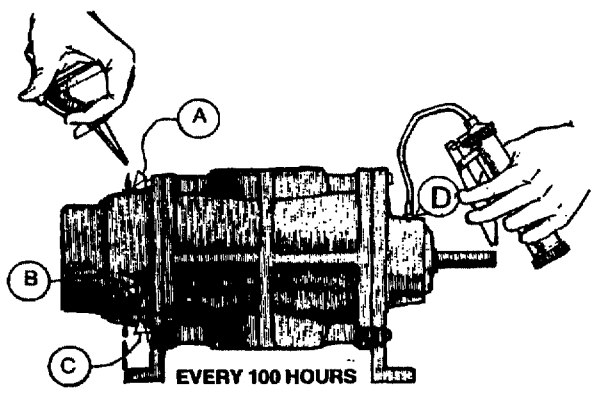
At the gear end the timing gear teeth are lubricated by being partially submerged. The gear teeth serve as oil slingers for gear end bearings. At the drive end of the bearings are grease lubricated.

FILLING PROCEDURE

Remove square head vented oil fill plug (A) on gear end. Remove oil level plug (B) located in the head plate. Fill gear case until oil drips out of the oil level hole (B). Use lubricants as listed. Add fresh oil as required to maintain proper level. The oil should be drained, flushed and replaced every 300 hours or more frequently if inspection so indicates. The oil drain plug is at (C).

NOTE: Older units may have the oil fill level and drain holes located in the cast iron gear case instead of in the head plate. Bearings on drive end of blower require grease lubrication every 100 hours of operation. Bearings which require grease lubrication will have a grease fitting (D) at each bearing. When regreasing, the old grease will be forced out of the vents during operation. To prevent damage to seals, these vents must be kept open at all times.

Vacuum Blower Motor Lubrication



LUBRICATION INSTRUCTIONS FOR OIL LUBRICATED GEARS AND BEARINGS

Add fresh oil as required to maintain proper level. Drain and refill every 1500 hours of operation under normal service, more frequently when required. Use a good quality oil.

BLOWER DISCHARGE TEMPERATURE	OIL GRADE U.S.A.*	OIL VISCOSITY, CENTISTOKES* @ 40° C
–40° to 32° F (–40° to 0° C)	SAE 10W	45
32° to 100° F (0° to 38° C)	SAE 20	100
100° to 275° F (38° to 135° C)	SAE 40	200
over 275° F (135° C)	SAE 50	250

*In applications with extreme variations in ambient temperature a 20W - 50W multiple viscosity oil is recommended.

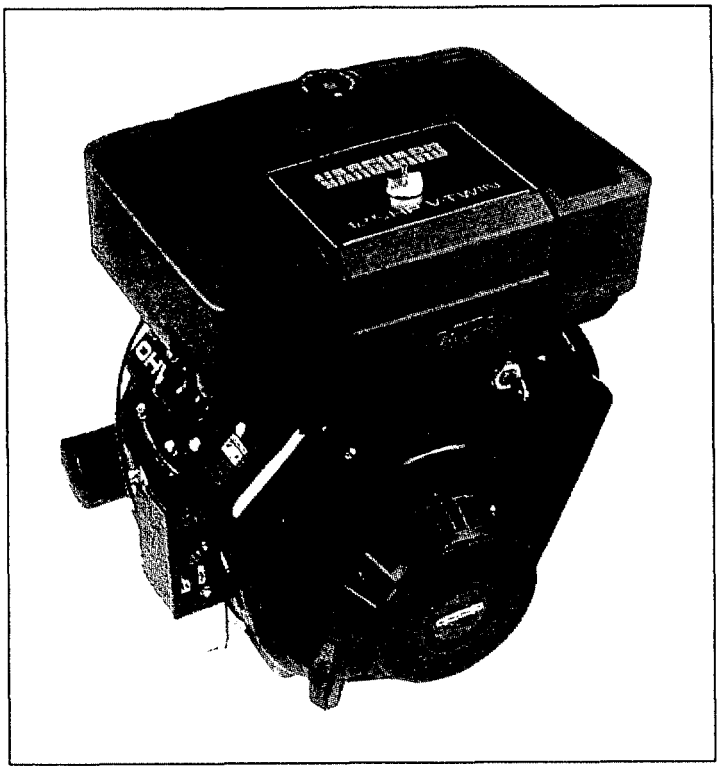
FOR GREASE LUBRICATED BEARINGS

Service every 500 hours of operation

BLOWER DISCHARGE TEMPERATURE	TYPE GREASE
–40° to 275° F (–40° to 120° C)	No. 2 Bearing Grease

VANGUARD OHV

OPERATING AND MAINTENANCE INSTRUCTIONS FOR MODEL SERIES 303400 (16 HP)



INTERNATIONAL SYMBOLS USED IN THIS SECTION OF MANUAL


.....Read Operator's Manual


.....Warning/Caution


.....Oil


.....Fuel


.....Air Cleaner

IN THE INTEREST OF SAFETY

BEFORE STARTING ENGINE, READ AND UNDERSTAND THE "OPERATING AND MAINTENANCE INSTRUCTIONS."

THIS SYMBOL MEANS WARNING OR CAUTION. DEATH, PERSONAL INJURY AND/OR PROPERTY DAMAGE MAY OCCUR UNLESS INSTRUCTIONS ARE FOLLOWED CAREFULLY.

◆ WARNING ◆

WARNING: DO NOT...

1. DO NOT run engine in an enclosed area. Exhaust gases contain carbon monoxide, an odorless and deadly poison.
2. DO NOT place hands or feet near moving or rotating parts.
3. DO NOT store, spill, or use gasoline near an open flame, or devices such as a stove, furnace, or water heater which use a pilot light or devices which can create a spark.
4. DO NOT refuel indoors where area is not well ventilated. Outdoor refueling is preferred.
5. DO NOT fill fuel tank while engine is running. Allow engine to cool for 2 minutes before refueling. Store fuel in approved safety containers.
6. DO NOT remove fuel tank cap while engine is running.
7. DO NOT operate engine when smell of gasoline is present or other explosive conditions exist.
8. DO NOT operate engine if gasoline is spilled. Move machine away from the spill and avoid creating any ignition until the gasoline has evaporated.
9. DO NOT transport engine with fuel in tank.
10. DO NOT smoke when filling fuel tank.
11. DO NOT choke carburetor to stop engine. Whenever possible, gradually reduce engine speed before stopping.
12. DO NOT run engine at excessive speeds. This may result in injury.
13. DO NOT tamper with governor springs, governor links or other parts which may increase the governed engine speed.
14. DO NOT tamper with the engine speed selected by the original equipment manufacturer.
15. DO NOT check for spark with spark plug or spark plug wire removed. Use an approved tester.
16. DO NOT crank engine with spark plug removed. If engine is flooded, place throttle in "FAST" position and crank until engine starts.
17. DO NOT strike flywheel with a hard object or metal tool as this may cause flywheel to shatter in operation. Use proper tools to service engine.
18. DO NOT operate engine without a muffler. Inspect periodically and replace, if necessary. If engine is equipped with muffler deflector, inspect periodically and replace, if necessary, with correct deflector.
19. DO NOT operate engine with an accumulation of grass, leaves, dirt or other combustible material in the muffler area.
20. DO NOT use this engine on any forest covered, brush covered, or grass covered unimproved land unless a spark arrester is installed on the muffler. The arrester must be maintained in effective working order by the operator. In the State of California the above is required by law (Section 4442 of the California Public Resources Code). Other states may have similar laws. Federal laws apply on Federal lands.
21. DO NOT touch hot muffler, cylinder, or fins because contact may

◆ WARNING ◆

WARNING: DO

1. ALWAYS DO remove the wire from the spark plug when servicing the engine or equipment *TO PREVENT ACCIDENTAL STARTING.* Disconnect the negative wire from the battery terminal if equipped with a 12 volt starting system.
2. DO keep cylinder fins and governor parts free of grass and other debris which can affect engine speed.
3. DO pull starter cord slowly until resistance if felt. Then pull cord rapidly to avoid kickback and prevent hand or arm injury.
4. DO examine muffler periodically to be sure it is functioning effectively. A worn or leaking muffler should be repaired or replaced as necessary.
5. DO use fresh gasoline. Stale fuel can gum carburetor and cause leakage.
6. DO check fuel lines and fittings frequently for cracks or leaks. Replace if necessary.

NOTE: Use Original Briggs & Stratton Service Replacement Parts when servicing your engine. Briggs & Stratton Authorized Service Centers carry a stock of such parts. The use of Briggs & Stratton Parts preserves the original design of your engine. Imitation replacement parts offer potential risk including the risk of personal injury. Contact any Briggs & Stratton Authorized Service Center for Original Briggs & Stratton Replacement Parts.

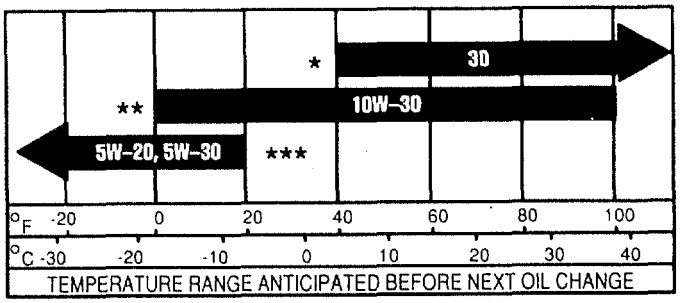
BEFORE STARTING

READ THE OPERATING INSTRUCTIONS OF THE EQUIPMENT THIS ENGINE POWERS.

OIL RECOMMENDATIONS

We recommend use of a high quality detergent oil "For Service SC, SD, SE, SF, or SG," such as Briggs & Stratton high quality detergent 30 weight oil (part no. 100005), or 10W-30 weight oil (part no. 272001). Detergent oils keep the engine cleaner and retard formation of gum and varnish deposits. Use no special additives with recommended oils.

RECOMMENDED SAE VISCOSITY GRADES



* Use SAE 30 oil in high temperature, high load applications.

** 10W-40 oil may be substituted if 10W-30 is not available.

*** Use synthetic oil having 5W-20, 5W-30 or 5W-40 viscosity. If not available, a petroleum-based multi-grade oil may be used having 5W-20 or 5W-30 viscosity.

NOTE: Using multigrade oils (5W-20, 5W-30, 5W-40, and 10W-30) will increase oil consumption. Check oil level more frequently when using them.

TO FILL CRANKCASE WITH OIL

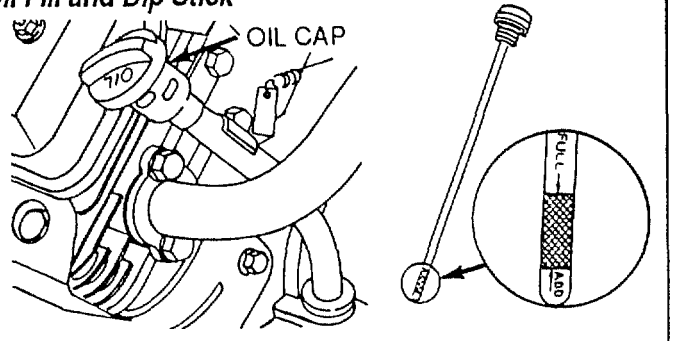
Place engine level. Clean area around oil fill. Remove dipstick. *POUR OIL SLOWLY.* Fill to FULL mark on dipstick. *DO NOT OVERFILL.*

NOTE: After starting engine, stop after 30 seconds. Check oil level and add if necessary. Without filter, oil capacity is approximately 1-1/2 qts. (48 ozs. or 1.42 ltrs). With oil filter, oil capacity is approximately 1-3/4 qts.
(56 ozs. or 1.65 ltrs).

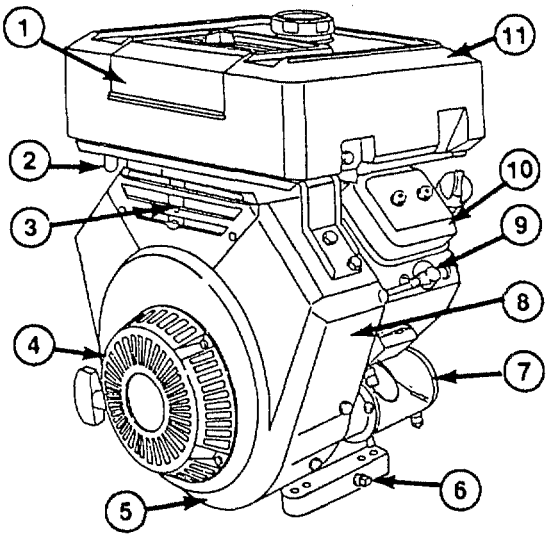
TO CHECK OIL LEVEL

Place engine level. Remove dipstick and wipe oil from it with clean cloth. Screw dipstick into tube until cap bottoms on tube. Remove and check oil level. Dipstick must be firmly screwed into tube when engine is running.

Oil Fill and Dip Stick



Engine Components



1. Air Cleaner
2. Fuel Shut-off Valve
3. Carburetor
4. Rewind Starter
5. Blower Housing
6. Oil Drain Plug
7. 12 Volt Electric Starter
8. Model, Type and Code Numbers
9. Spark Plug
10. Valve Cover
11. Fuel Tank (Optional)

FUEL RECOMMENDATIONS

This engine will operate satisfactorily on any gasoline intended for automotive use. A minimum of 85 octane is recommended. *DO NOT MIX OIL WITH GASOLINE.*

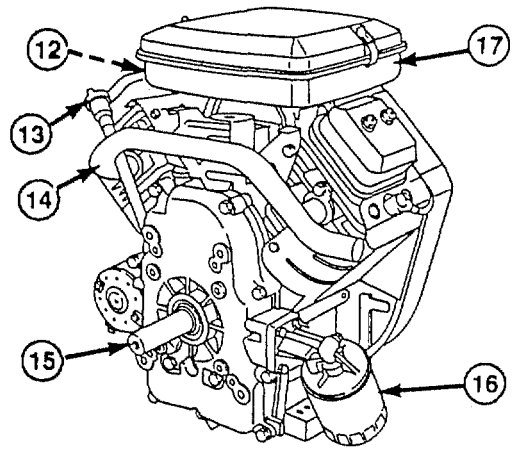
Use clean, fresh, lead-free gasoline. We recommend the use of Briggs & Stratton Gasoline Additive, part no. 5041. Purchase fuel in quantity that can be used within 30 days. This will assure fuel freshness and volatility tailored to the season. Leaded gasoline may be used if lead-free is not available. Use of lead-free gasoline results in fewer combustion deposits and longer valve life.

NOTE: We DO NOT recommend the use of gasoline which contains alcohol, such as gasohol. However, if gasoline with alcohol is used, it MUST NOT contain more than 10 percent Ethanol and MUST be removed from the engine during storage. DO NOT use gasoline containing Methanol. See STORAGE INSTRUCTIONS (page 27).

◆ WARNING ◆

DO NOT REMOVE fuel cap while engine is running. DO NOT FILL fuel tank to point of overflowing. Allow approximately 1/4 in. (5mm) of tank space for fuel expansion.

Engine Components



12. Fuel Pump
13. Dipstick
14. Exhaust Manifold 1
15. Crankshaft
16. Oil Filter
17. Air Cleaner

CARBURETOR ADJUSTMENTS

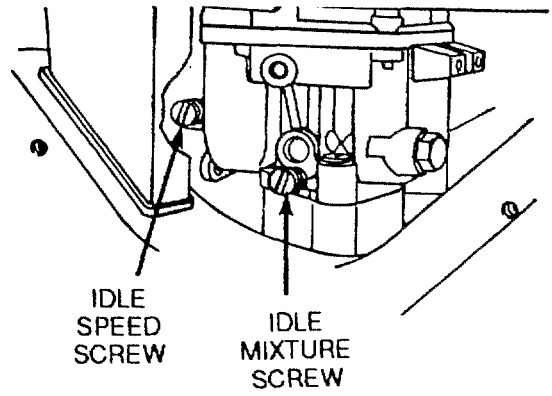
Minor carburetor adjustment may be required to compensate for differences in fuel, temperature, altitude or load. Air cleaner and air cleaner cover must be assembled to carburetor when running engine.

TWIN CYLINDER CARBURETOR ADJUSTMENT IS UNIQUE. ADJUST CARBURETOR FUEL MIXTURE IN THE ORDER STATED AS FOLLOWS:

INITIAL ADJUSTMENT

Gently turn idle mixture screw clockwise until it just closes. Turning screw in too far may damage it. Then turn idle mixture screw 1-1/2 turns counterclockwise. This initial adjustment will permit the engine to be started and warmed up (approximately 5 minutes) prior to final adjustment.

Carburetor Adjustment Screws



FINAL ADJUSTMENT

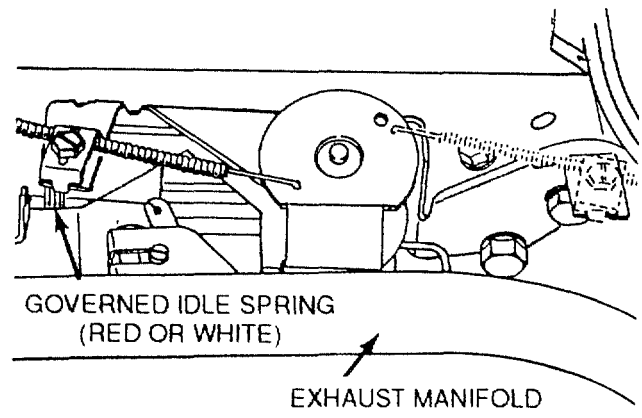
Start engine and place equipment speed control in "IDLE" or "SLOW" position. Hold carburetor throttle lever against idle stop and adjust idle speed screw to obtain 1300 to 1500 RPM. Still holding throttle lever against idle stop, turn idle mixture screw slowly clockwise (lean) until speed just starts to slow and then slowly counterclockwise (rich) until engine just starts to slow. Finally, turn screw to midpoint between rich and lean.

Now adjust idle speed screw to obtain 1200 RPM, if governed idle spring is red, or 900 RPM, if governed idle spring is white. Release throttle lever.

If engine does not accelerate smoothly, readjust idle mixture screw approximately 1/8 turn counterclockwise (rich).

NOTE: Engines operated at altitudes of approximately 3000 to 5000 fee (900 to 1500 meters) or higher may require the installation of a high altitude carburetor main jet to achieve best engine performance. If erratic performance is observed, contact a Briggs & Stratton Authorized Service Center for a high altitude jet.

Governed Idle Spring



◆ CAUTION ◆

TO PREVENT ACCIDENTAL STARTING when servicing the engine or equipment, always remove spark plug wires from spark plugs. Disconnect negative wire from battery terminal, if equipped with 12 volt starting system.

CHECK OIL LEVEL REGULARLY: Check after each 8 hours of operation or daily. BE SURE OIL LEVEL IS MAINTAINED.

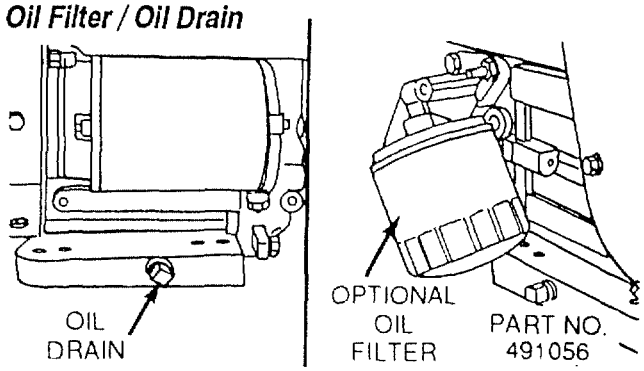
CHANGE OIL AS RECOMMENDED

Change oil after first 8 hours of operation. Thereafter, under normal operating conditions change oil after every 50 hours of operation or every season, whichever occurs first. Change oil every 25 hours if engine is operated under heavy load or at high ambient air temperatures. Remove oil drain plug and drain oil while engine is warm. Replace drain plug. Remove dipstick and refill with new oil of correct grade and weight. Replace dipstick.

CHANGE OIL FILTER

Replace oil filter after every 100 hours of operation or every season, which ever occurs first. Before installing new filter, lightly oil filter gasket with fresh clean engine oil. Screw filter on by hand until gasket contacts oil filter adapter. Tighten 1/2 to 3/4 turn more. Start and run engine at idle to check for oil leaks. Recheck oil level and add oil if required.

Oil Filter / Oil Drain



AIR CLEANER MAINTENANCE

SERVICE AIR CLEANER

Remove and service foam pre-cleaner every 25 hours or every season, whichever occurs first. Service paper cartridge every 100 hours or every season, whichever occurs first.

NOTE: Service air cleaner more often under dusty conditions.

ROUND DUAL ELEMENT

1. Unhook clips on both sides of air cleaner and remove cover.

To service pre-cleaner:

a. Slide foam pre-cleaner off cartridge.
b. Wash it in liquid detergent and water.
c. Squeeze it dry in a clean cloth.
d. Saturate it in engine oil. Wrap it in clean, absorbent cloth and squeeze to remove EXCESS oil.
e. Reinstall pre-cleaner over cartridge.
f. Reinstall air cleaner cover and reattach clips to sides of air cleaner body.

To service cartridge:

a. Remove knob and cover plate.
b. Remove cartridge and clean by tapping gently on flat surface.
c. If very dirty, replace or wash in a non-sudsing detergent and warm water solution. Rinse thoroughly with water from inside out until water runs clear. Let cartridge dry thoroughly before using.

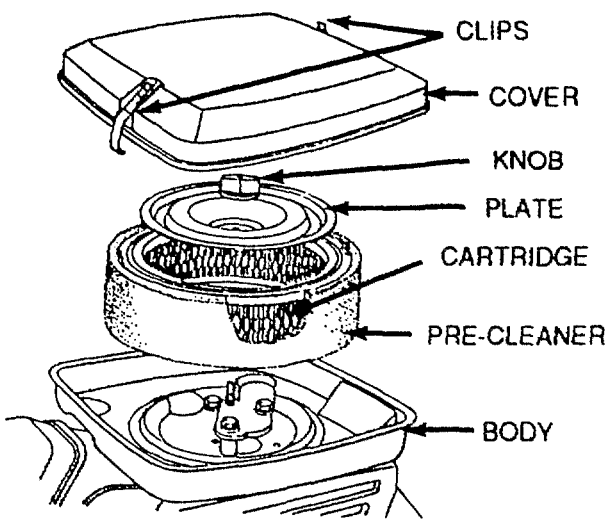
◆ CAUTION ◆

Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.

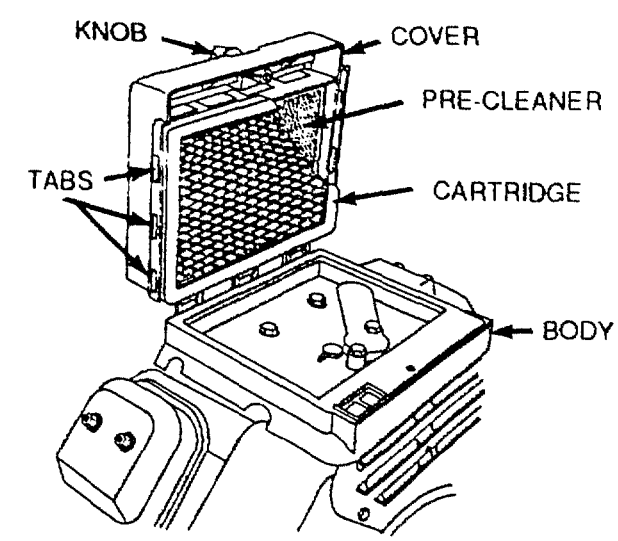
d. Reinstall cartridge, cover plate, knob and pre-cleaner.

2. Reinstall air cleaner cover and reattach clips to sides of air cleaner body.

Round Dual Air Cleaner Element



Square Dual Air Cleaner Element



SQUARE DUAL ELEMENT

1. Loosen knob and remove cover assembly.
2. Remove cartridge and pre-cleaner from cover.

To service pre-cleaner:

a. Wash pre-cleaner in liquid detergent and water.
b. Squeeze it dry in a clean cloth.
c. Saturate it in engine oil. Wrap it in clean, absorbent cloth and squeeze to remove all EXCESS oil.

To service cartridge:

a. Clean by tapping gently on flat surface.
b. If very dirty, replace or wash in a nonsudsing detergent and warm water solution. Rinse thoroughly with water from inside out until water runs clear. Let cartridge dry thoroughly before using.

◆ CAUTION ◆

Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.

3. Reinstall pre-cleaner in cover with foam toward cover.
4. Reinstall cartridge in cover with tabs on cartridge in slots in cover.
5. Reinstall cover assembly on air cleaner body.

CLEAN ENGINE

Remove dirt and debris with a cloth or brush. Cleaning with a forceful spray of water is not recommended as water could contaminate the fuel system.

CLEAN ROTATING SCREEN (ELECTRIC START ENGINES) OR REWIND STARTER GARD

Brush grass, chaff and dirt from rotating screen or rewind starter gard daily (more often if needed) to prevent engine damage caused by overheating and/or overspeeding.

◆ CAUTION ◆

To assure smooth operation, keep governor controls and linkage clean and free of debris.

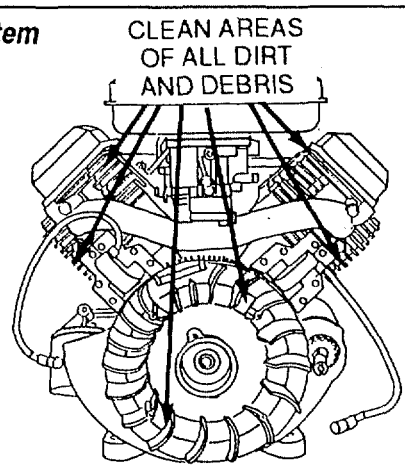
◆ CAUTION ◆

Periodically clean muffler area to remove all grass, dirt and combustible debris.

CLEAN COOLING SYSTEM

Grass, chaff or dirt may clog the rotating screen and the air cooling system. Every 100 hours or every season, whichever occurs first, remove the blower housing and clean the area shown to prevent overspeeding, overheating and engine damage. Clean more often if necessary.

Cooling System

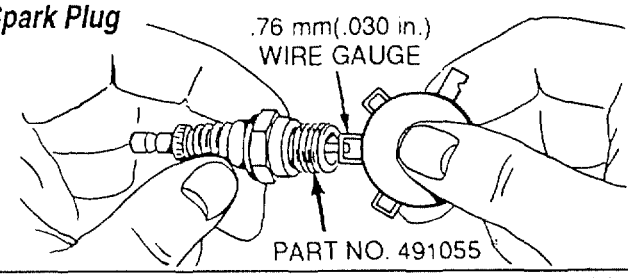


CLEAN SPARK ARRESTER SCREEN

If engine muffler is equipped with spark arrester screen assembly, remove every 50 hours or every season for cleaning and inspection. Replace if damaged. Contact any Briggs & Stratton Authorized Service Center.

REPLACE SPARK PLUGS

Spark Plug



Replace every 100 hours of operation or every season, whichever occurs first.

NOTE: Do not blast clean spark plugs. Spark plugs should be cleaned by scraping or wire brushing and washing with a commercial solvent.

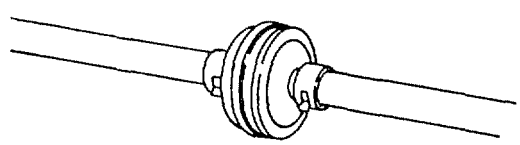
◆ CAUTION ◆

Sparking cannot occur if wire terminal does not fit firmly on spark plug. Reform terminal if necessary.

REPLACE FUEL FILTER

Replace In-Line filter every season or more often if required. Contact any Briggs & Stratton Authorized Service Center for correct replacement.

Fuel Filter



ENGINE MAINTENANCE SCHEDULE

Follow the hourly or calendar intervals, whichever occur first. More frequent service may be required.

MAINTENANCE OPERATION	Every 8 Hours or Daily	25 Hours or Weekly	50 Hours or Monthly	100 Hours or Every Season	Yearly
Check Oil Level	●				
Change Oil ♦			● Note 2		
Change Oil Filter				●	
Service Air Cleaner Pre-Cleaner		● Note 1			
Service Air Cleaner Cartridge				● Note 2	
Inspect Spark Arrester (Optional Accessory)			●		
Clean Cooling System				● Note 2	
Replace In-Line Fuel Filter					●
Replace Spark Plug				●	
Check Valve Clearance					●

Change oil after first 8 hours, then after every 50 hours or every season.

Note 1: Change oil every 25 hours when operating under heavy load or in high ambient temperatures.

Note 2: Clean more often under dusty conditions or when airborne debris is present.

BRIGGS & STRATTON AUTHORIZED SERVICE CENTERS ARE READY TO SERVE YOU AND COMMITTED TO QUALITY SERVICE.

GENERAL INFORMATION ABOUT ENGINE

This is a twin cylinder, overhead valve, air cooled engine. All drilled/tapped holes and fasteners on this engine are ISO metric. However, where equipment attaches to engine, SAE standards apply.

On mobile equipment, this engine will operate satisfactorily at any angle at which operator and equipment can function safely.

MODEL SERIES 290400, 294400 & 303400

Bore ..... 2.68 in. (68 mm)
Stroke ..... 2.60 in. (66 mm)
Displacement ..... 29.3 cu. in. (480 cc)
Horsepower ..... 290400 12 HP @ 3600 RPM
Horsepower ..... 294400 14 HP @ 3600 RPM
Horsepower ..... 303400 16 HP @ 3600 RPM

MODEL SERIES 350400

Bore ..... 2.83 in. (72 mm)
Stroke ..... 2.76 in. (70 mm)
Displacement ..... 34.7 cu. in. (570 cc)
Horsepower ..... 18 HP @ 3600 RPM

NOTE: For practical operation, the horsepower loading should not exceed 85% of this rating. Engine power will decrease 3-1/2% for each 1,000 feet (305 m) above sea level and 1% for each 10° F (5.6°C) above 77° F (25°C).

TUNE-UP SPECIFICATIONS

DESCRIPTION	B & S PART NO.
Air Cleaner Pre-cleaner (round)	271271
Air Cleaner Cartridge (round)	394018
Air Cleaner Pre-Cleaner (square)	805113
Air Cleaner Cartridge (square)	805267
Air Cleaner Pre-cleaner (with fuel tank)	271794
Air Cleaner Cartridge (with fuel tank)	393957
Fuel Filter (without fuel pump)	298090
Fuel Filter (with fuel pump)	394358
Oil Filter	491056
Resistor Spark plug (Champion RC 12YC)	491055

NOTE: Walking fingers logo and "Yellow pages" are registered trademarks in various jurisdictions.

CLEARANCES	DIMENSION
Spark Plug Gap	.030 in. (.76 mm)
Intake Valve*	.004-.006 in. (.10-.15mm)
Exhaust Valve*	.004-.006 in. (.10-.15mm)

* Check when engine is cold.

In some areas, local law requires the use of a resistor spark plug to suppress ignition signals. If an engine was originally equipped with a resistor spark plug, be sure to use the same type of spark plug for replacement.

STORAGE INSTRUCTIONS

Engines to be stored over 30 days need to be protected or drained of fuel to prevent gum from forming in the fuel system or on essential carburetor parts.

1. For engine protection, we recommend the use of Briggs & Stratton Gasoline Additive, Part No. 5041, available from any Briggs & Stratton Authorized Service Center. Mix Additive with fuel in fuel tank or storage container. Run engine for a short time to circulate Additive through carburetor. Engine and fuel can be stored up to 24 months.

◆ CAUTION ◆

If Additive is not used or if engine is operating on gasoline containing alcohol, remove all fuel from tank and run engine until it stops from lack of fuel.

2. While engine is still warm, drain oil from crankcase. Refill with fresh oil.
3. Remove spark plugs and pour approximately 1 ounce (30 ml) of engine oil into each cylinder. Replace spark plugs and crank slowly to distribute oil.
4. Clean dirt and chaff from cylinders, cylinder head fins, blower housing, rotating screen and muffler areas.

SERVICE & REPAIR INFORMATION

If service or repair is needed, contact a Briggs & Stratton Authorized Service Center. To serve you promptly and efficiently, a Service Center will need model, type and code numbers from your engine.

Your nearest Service Center may be located in the "YellowPages" directory under "Engines, Gasoline," "Gasoline Engines," or similar category. You may also locate the Service Center in your mailing zip code area by calling: **1-800-233-3723.** There are over 30,000 Authorized Service Centers worldwide available to serve you.

Authorized Service Centers carry a stock of Original Briggs & Stratton Service Replacement Parts and are equipped with special service tools. Ask for and use ONLY original Briggs & Stratton Service Replacement Parts which preserve the original design of your engine. Imitation replacement parts offer potential risks in internal construction as well as fit, finish and warranty back-up. Trained mechanics offer expert service. Major engine repairs require proper tools and a thorough knowledge of internal combustion engine repair procedure.

Part No. 272144

Briggs & Stratton publishes illustrated shop manuals, parts lists and owner's manuals for every engine it manufactures. To receive a list of available publications, write to Briggs & Stratton Corporation, P.O. Box 1144, Milwaukee, WI 53201, Attention: Service Division. The shop manual shown here includes "Theories of Operation," common specifications and detailed information covering the adjustment, tuneup and repair of Briggs & Stratton OHV, twin cylinder, 4 cycle engines and is available from any Briggs & Stratton Authorized Service Center. You can also order directly from the factory at the above address. Request manual, Part No. 272144.

ABOUT THE WARRANTY ON THE VANGUARD ENGINE

If warranty service is needed, contact your nearest Authorized Briggs & Stratton Service Center. For prompt attention, your Center will need to know the engine model, type and code numbers, the trouble experienced and the total number of hours the engine was run.

BRIGGS & STRATTON WARRANTY COVERS ONLY DEFECTIVE MATERIAL AND/OR WORKMANSHIP.

Briggs & Stratton Corporation welcomes the opportunity to make justified warranty repairs by any of its Authorized Service Centers. In most instances, the requests for warranty repair are handled in a quick and routine manner. However, some requests for warranty are received which appear not justified. In these cases, though engine owners may not be aware of it, the premature failure of their engine was caused by abuse or neglect, or the equipment on which it was mounted, rather than the engine.

If you differ with the decision of your Service Center, investigation will be made to determine the applicability of warranty. Ask the Service Center to submit all supporting facts to the Factory for review. If the Factory decides that your claim is justified, you will be fully reimbursed for those items accepted as defective. To avoid misunderstanding which might occur between engine owners and Authorized Briggs & Stratton Service Centers, we list below some of the causes of engine failure that Briggs & Stratton warranty does not cover for repair or replacement.

LIMITED WARRANTY FOR VANGUARD ENGINES

"For two years from date of purchase, Briggs & Stratton Corporation will replace for the original purchasers, free of charge, any part, or parts of the engine, found upon examination by any Factory Authorized Service Center, or by the Factory at Milwaukee, Wisconsin, to be defective in material or workmanship or both. This is the exclusive remedy.

"For five years from date of purchase, Briggs & Stratton Corporation will replace for the original purchasers, free of charge, any part, or parts of the MAGNETRON® Ignition System (excluding the spark plug), found upon examination by any Factory Authorized Service Center, or by the Factory at Milwaukee, Wisconsin, to be defective in material or workmanship, or both, so as to result in the loss of ignition. This is the exclusive remedy.

"All transportation charges on parts submitted for replacement under this Warranty must be borne by purchaser. For warranty service contact your nearest Authorized Service Center as listed in the 'Yellow Pages' under 'Engines, Gasoline' or 'Gasoline Engines.'

THERE IS NOT OTHER EXPRESS WARRANTY. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO ONE YEAR FROM PURCHASE AND TO THE EXTENT PERMITTED BY LAW ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. LIABILITY FOR CONSEQUENTIAL DAMAGES UNDER ANY AND ALL WARRANTIES ARE EXCLUDED TO THE EXTENT EXCLUSION IS PERMITTED BY LAW.

Some jurisdictions do not allow limitations on how long an implied warranty lasts, and some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction."

Briggs & Stratton Corporation

F.P. Stratton, Jr.
Chairman and Chief Executive Officer

WARRANTY PERIOD

ENGINES ..... All Vanguard and I/C engines.
CONSUMER USE* ..... 2 year-engine Lifetime**-Magnetron® ignition
COMMERCIAL USE*..... 2 year-engine Lifetime**-Magnetron® ignition

*For purposes of this warranty policy, "consumer use" shall mean personal residential household use by the original retail consumer. "Commercial use" shall mean all other uses, including use for commercial, income producing or rental purposes. Once an engine has experienced commercial use, it shall thereafter be considered as a commercial use engine for purposes of this warranty policy.

**Lifetime limited warranty of the Magnetron ignition shall cover parts and labor for the first five (5) years from the date of purchase; thereafter only parts, "Lifetime" shall mean lifetime of the engine in the hands of the original purchaser.

*** Applies to equipment retailed in the U.S.A. and Canada. In all other countries, the warranty for CONSUMER USE is the same as COMMERCIAL USE.

NO REGISTRATION (WARRANTY) CARD IS NECESSARY TO OBTAIN WARRANTY ON BRIGGS & STRATTON ENGINES. SAVE YOUR PURCHASE RECEIPT. PROOF OF PURCHASE DATE WILL BE REQUIRED TO OBTAIN WARRANTY.

To avoid misunderstandings which might occur between engine owners and authorized Briggs & Stratton service accounts, we are listing some of the causes of engine failure, where repair or replacement is **NOT covered by Briggs & Stratton warranty.**

NORMAL WEAR:

Warranty will not cover repair where normal use has exhausted the life of a part or engine. Engines, like all mechanical devices, need periodic parts replacement and service to perform well. It should be remembered that the service life of any engine is dependent on the care it receives and the conditions under which it has to operate. Some applications, such as tillers, trash pumps, rotary mowers, are very often used in dusty or dirty conditions, which can cause what appears to be premature wear. Such wear, when caused by dirt, dust, spark plug cleaning grit or other abrasive material, which has entered the engine because of improper maintenance, is not covered by Warranty.

ABUSE OR NEGLECT:

1. Bent or broken crankshafts: Such damage is normally the result of abuse, such as striking a solid object with the cutter blade on a rotary lawn mower, and is not covered by Warranty.
2. Engine repairs required from the use of contaminated or stale fuel are not covered by Warranty. Such failures would include sticking valves, and carburetors and fuel pipes which are clogged by gum deposits which form through the use of stale fuel. Always use clean fresh regular gasoline.
3. Parts which are scored or broken because an engine was operated without sufficient lubricating oil, the proper grade of lubricating oil or contaminated lubricating oil are not covered by Warranty. Check oil level at least every five hours and refill when necessary. Change oil at recommended intervals.
4. Damage caused by overheating or overspeeding is not covered by Warranty. Overspeeding or overheating occurs if the cooling fins become plugged with dirt, grass or debris, or if an engine is operated in a confined area without sufficient ventilation. Clean fins on thecylinder, cylinder head and flywheel regularly.
5. Damage or wear caused by dirt which enters the engine because of improper air cleaner maintenance is not covered by Warranty. Clean and re-oil the air cleaner regularly.
6. Damage or wear caused by grit from blast cleaning spark plugs is not covered by Warranty. We do not approve of cleaning spark plugs on an abrasive blast cleaning machine, since grit can remain in the plug, and later enter the engine.
7. Warranty does not cover the tune-up or adjustment of an engine unless the need for such repair is the result of defects in material or workmanship or both. If equipment is assembled and adjusted by the owner, the engine operating and maintenance instructions are sufficiently clear to permit the average owner to make minor adjustments. Such minor adjustments are NOT covered by Warranty.
8. Broken parts, which result from excessive vibration caused by loose engine mounting, loose cutter blades, blade unbalance, improperly attaching equipment to engine crankshaft, overspeeding or abuse in operation, are not covered by warranty.
9. Repair or adjustment of associated parts or assemblies such as clutches, transmissions, remote controls, etc., which are not of Briggs & Stratton manufacture will not be covered by Briggs & Stratton Warranty.
10. Only ORIGINAL Briggs & Stratton parts, or parts approved by Briggs & Stratton may be covered by Warranty.

WARRANTY IS AVAILABLE ONLY THROUGH SERVICE CENTERS WHICH HAVE BEEN AUTHORIZED BY THE BRIGGS & STRATTON CORPORATION. YOUR NEAREST SERVICE CENTER IS LISTED IN THE YELLOW PAGES OF YOUR TELEPHONE DIRECTORY, UNDER "ENGINES, GASOLINE" OR "GASOLINE ENGINES."

ENGINE TROUBLESHOOTING

See engine section of this manual beginning on page 21 to assist you in resolving engine related problems.

PROBLEMS:

ENGINE FAILS TO START
ENGINE RUNS ROUGH
ENGINE BACKFIRES
ENGINE FAILS TO ACCELERATE
ENGINE REDUCES SPEED TO LOW RPM UNDER LOAD

CAUSES AND/OR SOLUTION:

1. Loss of fuel.
   - A. Empty gas tank.
   - B. Plugged fuel line or filter.
   - C. Defective fuel pump (Replace with mfg. suggested replacement parts only).
   - D. Gas line kinked, crushed or quick disconnect inside the truck not connected.

2. Blown master fuse.
   - A. Electrical short.
   - B. Defective fuse.

3. Defective spark plugs.
   - A. Remove and replace.
   - B. Clean and regap.

4. Defective spark plug wires.
   - A. Spark plug wires along with many others may, at certain points come in contact with heated parts (exhaust manifold) or abrasive parts (sharp metal, teflon hose). This may be taken into consideration for electrical shorts.
   - B. Remove and replace ignition module.

5. Low compression.
   - A. Defective valve.
   - B. Stuck valve.
   - C. Worn compression rings.
   - D. Defective piston.

6. Float switch in recovery tank inoperative.
   - **NOTE:** Temporary repair permits disconnection of float switch wire between tank and machine. Continued operation with this condition will compromise vac blower.
   - A. Switch stuck on upright position by foreign material.
   - B. Defective float switch.

7. Engine will not turn over.
   - A. Dead battery.
   - B. Loose terminal connection on battery or ignition switch.
   - C. Defective starter.
   - D. Seized engine or blower.

8. Defective Carburetor or gas leakage.
   - A. Clean carb.
   - B. Replace carb.
   - C. Choke locked in closed position.

◆ CAUTION ◆

D. When replacing fuel pump insure that it is the same pressure rating recommended by manufacturer.

9. Improperly adjusted carb.
   - **NOTE:** A comprehensive manual is available and defines necessary adjustments.
   - A. Incorrect air mixture ratio adjustment.
   - B. Incorrect float level adjustment.

10. Carbon build-up in cylinders.
   - **NOTE:** Carbon build-up can be minimized by using unleaded regular gas. Should carbon removal be necessary, reinstall heads with new gaskets.
   - A. Carbon build-up may be excessive if carb, or valves are improperly adjusted, engine RPM too low, improper spark plug gap.
   - B. Remove cylinder heads and eliminate carbon build-up with wire brush.

11. Incorrect ignition module air gap.
   - A. Regap ignition module to specifications.

12. Dirty air cleaner.
   - A. If exhaust gaskets do not seat properly or heat exchanger gasket is bad, exhaust may heat and melt the air cleaner requiring much clean-up repair.

13. Clogged fuel filter.
   - A. Remove and replace.

14. Low oil level or malfunctioning oil pump.
   - A. Oil pressure sensors can be installed on the engine. This will eliminate many problems which may occur.

15. Vacuum tank full.
   - A. Empty vacuum tank.

ELECTRICAL SYSTEM

The entire electrical system operates on 12 volts DC which is provided by a battery. Battery levels are sustained by a 16 amp alternator designed with the engine.

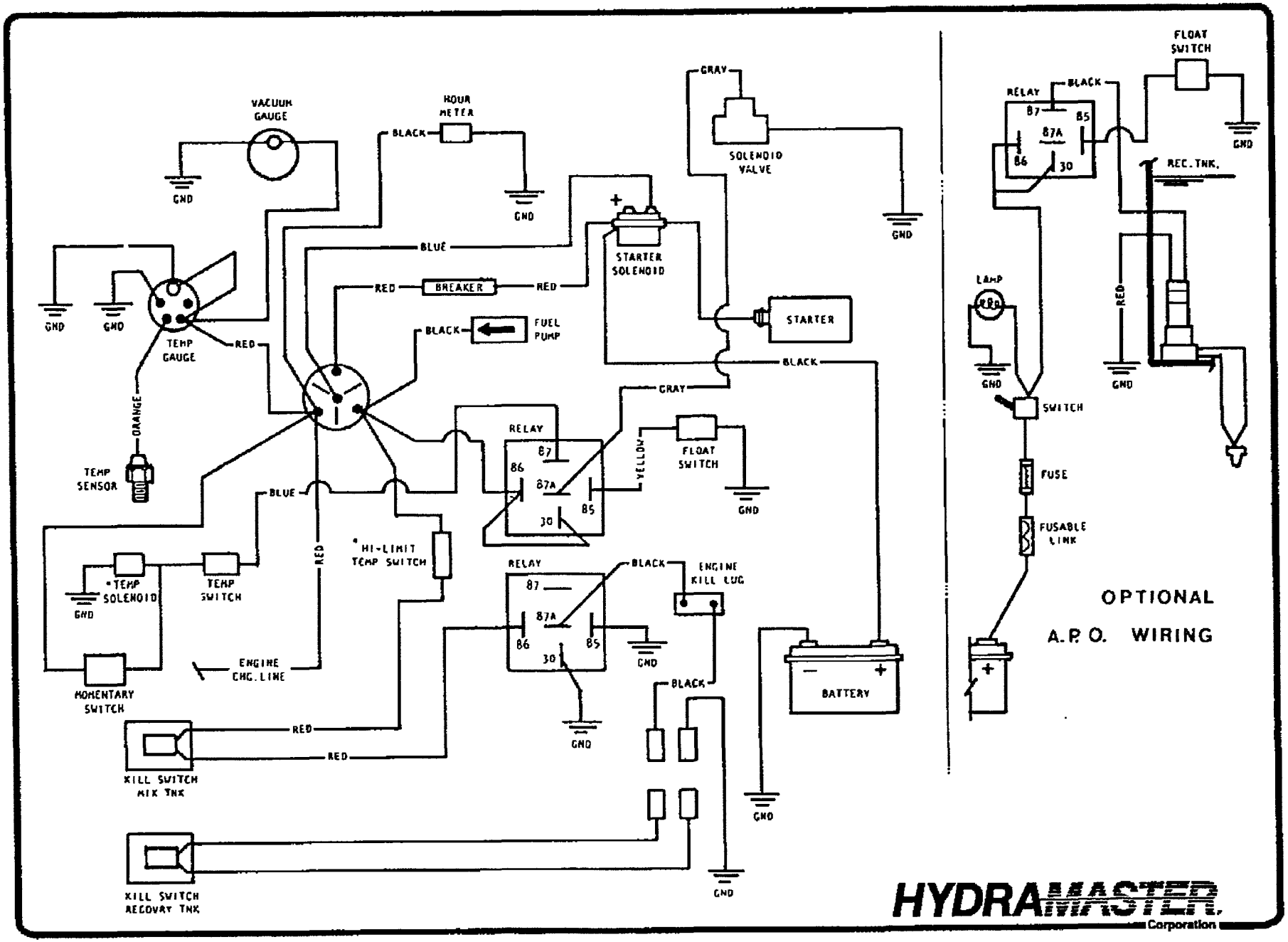
NOTE: When new battery is installed insure it is properly charged before installation or damage to the charging regulator may occur.

PROBLEM: Low battery voltage

Cause	*Solution*
Defective battery.	Remove and replace.
Corroded battery terminals.	Clean terminals and battery posts.
Low battery fluid.	Add water to appropriate level.
Loose wiring within electrical system.	Examine all terminal connections and verify that they are secure.
Electrical short in wiring system.	Examine electrical systems for bare wires.
Poor ground connection.	Examine terminal and remove corrosion if necessary.

PROBLEM: Inoperative hour meter

Cause	*Solution*
Time is not advancing correctly.	Verify 12 volt DC is available at the hour meter with the ignition switch turned on. This can be accomplished with a volt meter or a test lamp. Remove and replace hour meter if 12 volt is available. A nylon gear within the clock may have been jammed due to sudden jolt of the machine or truck. You may try simply tapping on the meter to try to free the nylon gear.


VACUUM GAUGE
HOUR METER
BLACK
GND
GND
GRAY
SOLENOID VALVE
GND
BLUE
STARTER SOLENOID
RED
BREAKER
RED
STARTER
GND
GND
TEMP GAUGE
RED
BLACK
FUEL PUMP
BLACK
GRAY
ORANGE
RELAY
87
86
87A
85
30
YELLOW
FLOAT SWITCH
GND
TEMP SENSOR
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TEMP SWITCH
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87A
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BLACK
ENGINE KILL LUG
GND
ENGINE CHG. LINE
MOMENTARY SWITCH
BLACK
BATTERY
RED
RED
KILL SWITCH MIX TNK
GND
KILL SWITCH RECOVRY TNK
GND
FLOAT SWITCH
RELAY
BLACK
87
87A
86
85
30
GND
REC. TNK.
LAMP
GND
GND
RED
SWITCH
FUSE
FUSABLE LINK
OPTIONAL
A.P.O. WIRING
HYDRAMASTER
Corporation

FREEZE PROTECTION

AQUACAT

Any freezing of this machine is not covered by warranty and during the colder months of operation, careful protection should be of utmost concern.

THE FOLLOWING PRECAUTIONS ARE RECOMMENDED:

1. Run machine before leaving for the first job to insure nothing has frozen the night before, including hoses and wand.
2. Insulate the garden hose from the cold ground by running it through and extra 1-1/2 inch vacuum hose.
3. Leave truck doors closed until time cleaning begins, then open slightly for ventilation of air cooled engine.
4. In colder climates, insulating the tuck walls and floor boards will help protect the unit.
5. Don't procrastinate during the cleaning operation or the hot water solution line will also freeze on the ground. The solution line should be insulated in extremely cold climates.
6. Whenever possible, the truck and machine should be stored in a heated garage at night or over the weekend. If not possible, place a 1500 watt electric heater inside the truck, aimed directly at the machine. Never use a propane heater - it causes excessive moisture on the truck ceiling and the possibility of it going out is higher. If the machine and truck are left outside with a heater, you should first drain all possible water from the machine cleaning tools and hoses. (They freeze also.)

TO DRAIN THE MACHINE, FOLLOW THESE STEPS:

1. Before shutting off the machine, remove the chemical line from the chemical jug and place in a mixture of 50/50 anti-freeze and water. With the cleaning tool on, allow mixture to fill chemical system back to the chemical mix tank.
2. Loosen the petcock valve on your bypass drain hose and allow the water to drain thoroughly from the mix tank.
3. Using the freeze guard hose provided with the machine, freeze guard the unit. First plug the rubber stopper into the outlet of the recovery tank. Then with the pressure regulating valve unscrewed, plug the other end of the freeze guard hose into the high pressure cleaning solution fitting on the front of the machine. Run the unit until the engine stops.
4. Open the mix tank drain valve and drain out the remainder of the water. The unit is now freeze guarded.

CLEANING AND CHEMICALS

PRECAUTIONS

Your mobile carpet cleaning plant has been engineered using the latest and most sophisticated technology available, to produce the finest carpet cleaning results possible. Despite this, however, it remains only a tool of the carpet cleaning trade, and it can produce only as good a job as the person operating it.

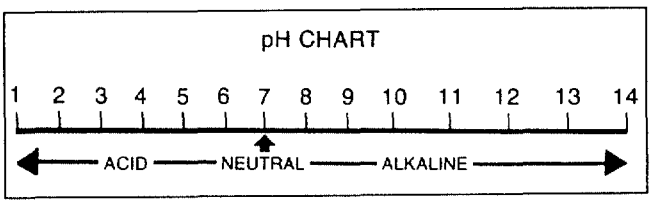
There are not short cuts to good carpet cleaning. It requires time, cleaning knowledge and the use of good chemicals.

The manufacturer recommends the use of spotting agents, and traffic lane cleaners prior to the actual cleaning of carpeting, as required.

The use of some chemicals through your mobile carpet cleaning plant can seriously damage the internal plumbing, high pressure pump and heater (Chemical such as concentrated acids, solvents, and some paint oil and grease removers w/high concentration of solvents).

The manufacturer recommends only the use of chemicals containing rust and corrosion inhibitors and water softening agents to prevent chemical build-up which may lead to component failure and warranty invalidation.

NOTE: At no time should a chemical solution with a pH of less than 7 or higher than 10 be used in the unit.

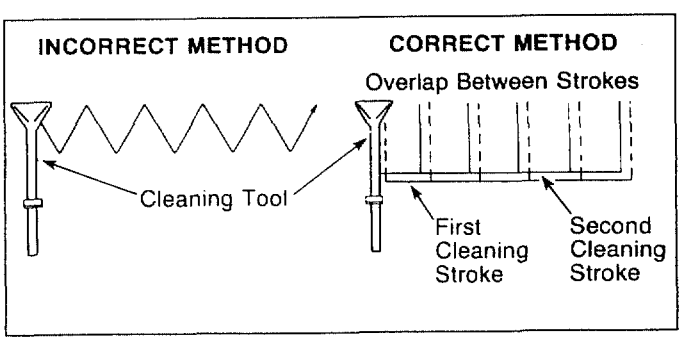


CLEANING STROKE PROCEDURE/OVER-WETTING

PURPOSE: To eliminate excess moisture remaining in the carpet fiber and the sawtooth appearance which results from diagonal movement of the cleaning tool on all types of carpet.

PROCEDURE: Always move the cleaning tool in smooth forward and backward strokes. Apply slight pressure to the forward stroke while the solution is injected into the carpet. When extracting (drying), apply firm pressure on the forward stroke to ensure a positive "lock" for the vacuum and minimize the "hopping" effect resulting on unsmooth carpet. During the forward and reverse strokes, movement to the right or left should only be accomplished at the extreme rear of the stroke. Overlapping is also important to ensure even application of solution to prevent saturation when cleaning wand is stopped twice at the same point at the rear of the cleaning stroke.

Failure to adopt this procedure can result in increased chance of 'clean streaks', fiber shrinkage, brown-out and longer drying periods.



OVER-WETTING

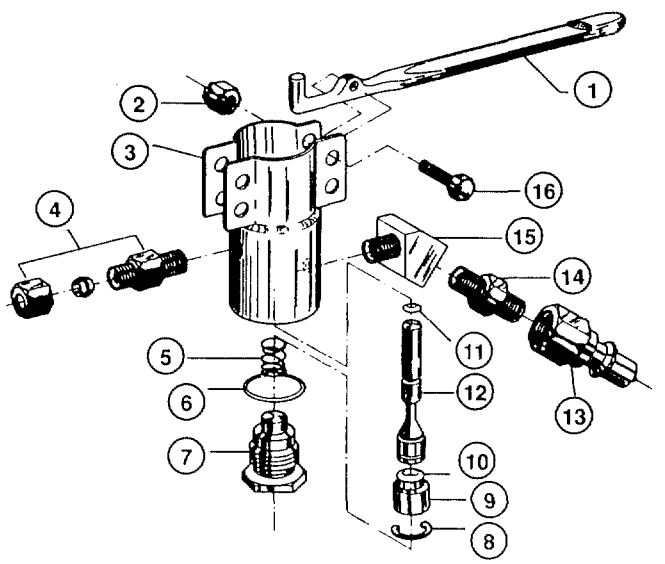
Over-wetting is annoying to all concerned and sometimes, leaves a bad impression of the cleaning process used.

THESE ARE SEVERAL AREAS THAT WILL CAUSE OVER-WETTING:

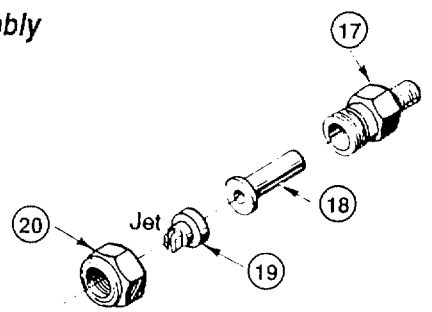
1. Too few vacuum strokes or improper saw-tooth vacuum strokes as shown in the previous illustration.
2. Obstructed, cut or kinked hoses.
3. Vacuum tank drain valve left partially open.
4. Clogged vacuum blower filter or vacuum tank lid not sealing properly.
5. Cleaning a heavily foam-saturated carpet without defoamer. (We recommend crystal type.)

CLEANING WAND

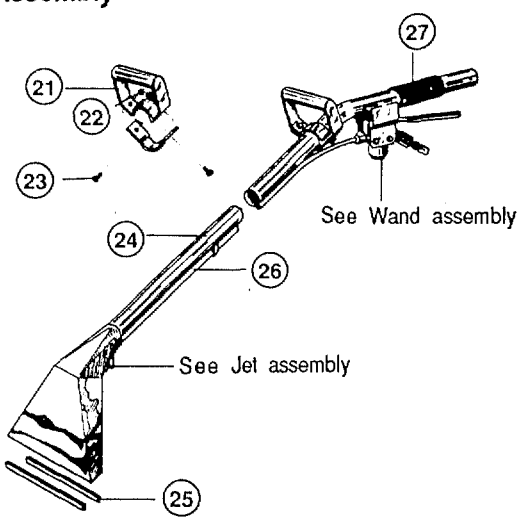
Wand Valve Assembly 169-005



Jet Assembly



Wand Assembly



WAND VALVE, JET & WAND PARTS LIST

ITEM	PART NO.	DESCRIPTION	QTY.
1	167-013	Trigger, cast Hydra hoe valve	1
2	094-009	Nut, 1/4 - 20 s/s nylock	2
3	107-130	Valve body - HydraMaster valve	1
4	052-152	1/4 Male comp. fitting - Hydra hoe	1
5	155-003	Spring, HydraMaster solution valve	1
6	097-011	O-Ring, HMaster solution valve cap	1
7	027-001	Cap, s/s HMaster solution valve	1
8	139-004	Ring, solution valve retaining	1
9	139-003	Ring keeper, HMaster solution valve	1
10	097-010	O-Ring, HM valve plunger - large	1
11	097-022	O-Ring, solution valve / flw mtr - small	1
12	107-129	Plunger, HydraMaster solution valve	1
13	052-050	440 Male quick connect w/viton	1
14	052-071	Nipple, 1/4 brass hex	1
15	052-082	Elbow, 1/4 brass 45 street	1
16	143-002	Screw, 1/4 - 20 x 1" HHC s/s	1
17	052-153	Brass stabilizer housing	1
18	186-001	Stabilizer	1
19	076-005	Jet, #6 s/s Hydra hoe, BobCat	1
	076-003	Jet, #4 s/s Hydra hoe, AquaCat	1
20	094-028	Nut, brass - jet assembly group	1
21	061-006	Handle, pressure guide wand	1
22	094-035	Nut, 5/16 - 18 s/s nylock half nut	2
23	143-012	Screw, 5/16 - 18 x 3/4" s/s HHC	2
24	173-006	Wand, s/s Hydra hoe - stock	1
25	082-001	Lips s/s Hydra hoe (2 piece set)	1
26	168-001	Tube, s/s Hydra hoe solution	1
27	061-007	Handle grip - Hydra hoe	1
Not shown in illustrations			
	154-001	Spacer, 1/4 x 5/16 - s/s sol. valve	5
	169-055	Valve assembly, s/s Hydra hoe	1
	143-004	Screw, 1/4 - 20 x 1.5" HHC s/s	2
	094-009	Nut, 1/4 - 20 s/s nylock	1

PROCEDURES

To avoid costly repairs and down-time, it is imperative to develop and practice good maintenance procedures from the beginning. These procedures fall into daily, weekly, monthly and quarterly increments, and are outlined below. We have provided a maintenance log for your convenience on next page; it is recommended that you affix a copy of the log on the vehicle door near your unit for convenience and to serve as a maintenance reminder.

DAILY

Check engine oil level.
Inspect garden hose screen - clean as needed.
Visually inspect machine for loose wires, oil leaks, water leaks, etc.
Inspect recovery tank s/s filter and filter bag for tears, holes, etc. - clean, repair or replace as needed.
Lubricate blower with LPS-1 through blower inlet.

WEEKLY

Change engine oil. (50 hours of operation.)
Check engine air cleaner filter - clean as necessary.
Check high pressure pump oil - add as necessary.
Check drive coupler set screws - tighten as needed.
Check pump drive belt for wear - tighten as needed.
Check pump pulleys - tighten as needed.
Check fuel lines for wear/chafing.
Check all nuts and bolts - tighten as needed.
Check heater burner assy. union for tightness/leaks.
Clean vacuum tank thoroughly with high pressure washer.
Flush water and chemical system with 50/50 white vinegar solution.

MONTHLY

Grease blower bearing fittings.
Remove pressure Bypass Valve stem, grease cup and stem, reinstall.
Check water level in battery. Clean connections as needed.

QUARTERLY

Change oil in blower.
Check engine compression.
Check for combustion chamber carbon deposit.
Change spark plugs.

IMPORTANT:
Record date and machine hours in maintenance log.

AS REQUIRED: DESCALING

Scale deposits on the interior of heater tubes can cause a noticeable loss in heating performance. Deposits of this kind result from hard water deposits, excessive chemical use, improper chemicals, etc. The frequency with which descaling procedures are required will vary.

If your area has particularly hard water or you see evidence of deposits in the water system, you may have to descale monthly. To descale your system, add an appropriate descaler chemical to your mix tank, circulate in the heater, let stand, flush and repeat as necessary. Clean all screens and strainers, and check them frequently following descaling.

OVERALL CARE OF UNIT

MAINTAINING THE ORIGINAL APPEARANCE OF YOUR UNIT IS IMPORTANT FOR TWO REASONS:

1. It represents a big dollar investment for your cleaning business and its appearance should reflect that fact. A dirty machine is not professional!

2. Maintenance, trouble shooting, and repair is much easier to accomplish on a clean well maintained unit. Regular cleaning of the machine offers you an opportunity to visually inspect all facets of the machine and spot potential problems before they occur.

FOLLOWING MAINTENANCE IS RECOMMENDED BY THE MANUFACTURER AT THE FREQUENCY INDICATED.

AFTER EACH JOB:
Check recovery tank, s/s filter and filter bag as required.

DAILY:
Wipe machine down thoroughly with a damp cloth; flush recovery tank out thoroughly. Empty filter bag and inspect for rips, tears, etc. - replace as needed; remove, thoroughly clean and reinstall stainless steel filter screen in recovery tank; inspect and clean vacuum slot on cleaning wand; check wand head for sharp edges that could tear carpet - file down as needed; clean wand to maintain original appearance; wipe down vacuum and high pressure hoses as needed - visually inspect for cuts, etc.

WEEKLY:
Wipe down entire unit as needed - apply good coat of auto wax to all painted surfaces inside and out, and to control panel; thoroughly clean recovery tank using high pressure hot water (unit with optional high pressure cleaning gun may be used for this); remove stainless steel filter in recovery tank, thoroughly clean removing all lint build-up, inspect for damage and reinstall. Remove filter bag, thoroughly clean and reinstall - if torn, replace; empty chemical from chemical container, wash out thoroughly to remove any chemical build-up; inspect chemical feed line strainer and use 50% white vinegar/water solution to remove any chemical build-up; thoroughly clean wand and inspect for clogged jet, debris in vacuum slot and leaking fittings at valve. Apply light coat of auto wax to wand. Thoroughly clean vacuum and high pressure hoses including hose cuffs - inspect for wear or damage to hoses and quick connect fittings. Inspect garden hose connect/adapter screen for debris, remove and clean thoroughly. Inspect all lines for wear or abrasions that may cause possible leaks.

MAINTENANCE LOG

DAILY CLEANING & INSPECTION

Engine oil - check
Garden hose screen - clean
Machine - general inspection
Clean vac tank filter bag after every job
Blower inlet - spray with LPS 1 after last job

WEEKLY SERVICE

MAX HRS	SERVICE	DATE/HRS	DATE/HRS	DATE/HRS	DATE/HRS	DATE/HRS	DATE/HRS	DATE/HRS
25	BLOWER check oil level							
25	PUMP OIL check (top of sight gauge)							
25	BELTS & PULLEYS check tightness							
25	HIGH PRESSURE LINES check for chafing							
25	NUTS & BOLTS check tightness							
25	BATTERY LEVELS check							
25	VACUUM TANK clean							
25	WIRING check for chafting							
25	CHEMICAL SYSTEM flush w/vinegar							
50	ENGINE OIL CHANGE							

MONTHLY SERVICE

100	BLOWER grease bearing							
100	ENGINE AIR CLEANER clean							
100	BY PASS VALVE grease cup & stem							
100	OIL FILTER CHANGE							

QUARTERLY SERVICE (3 MONTHS)

300	BLOWER OIL change							
300	ENGINE compression							
300	SPARK PLUGS change							

MAINTENANCE LOG

DAILY CLEANING & INSPECTION

Engine oil - check
Garden hose screen - clean
Machine - general inspection
Clean vac tank filter bag after every job
Blower inlet - spray with LPS 1 after last job

WEEKLY SERVICE

MAX HRS	SERVICE	DATE/HRS	DATE/HRS	DATE/HRS	DATE/HRS	DATE/HRS	DATE/HRS	DATE/HRS
25	BLOWER check oil level							
25	PUMP OIL check (top of sight gauge)							
25	BELTS & PULLEYS check tightness							
25	HIGH PRESSURE LINES check for chafing							
25	NUTS & BOLTS check tightness							
25	BATTERY LEVELS check							
25	VACUUM TANK clean							
25	WIRING check for chafting							
25	CHEMICAL SYSTEM flush w/vinegar							
50	ENGINE OIL CHANGE							

MONTHLY SERVICE

100	BLOWER grease bearing							
100	ENGINE AIR CLEANER clean							
100	BY PASS VALVE grease cup & stem							
100	OIL FILTER CHANGE							

QUARTERLY SERVICE (3 MONTHS)

300	BLOWER OIL change							
300	ENGINE compression							
300	SPARK PLUGS change							

HYDRAMASTER WARRANTY

WARRANTY INFORMATION

To avoid misunderstandings which might occur between machine owners and manufacturer, we are listing causes of component failure that specifically voids warranty coverage. Such causes as listed below shall constitute **abuse or neglect.**

BLOWER: Failure to lubricate impellers daily with LPS-1 lubricant. Failure to lubricate bearings as recommended in blower manual. Failure to maintain proper oil levels in the blower. Failure to use the correct oil grade and viscosity as recommended in blower manual. Failure to properly maintain blower safeguard systems such as waste tank filter screen, vacuum safety relief valve and waste tank automatic shut-off system. Allowing foam to pass through blower.

HIGH PRESSURE WATER PUMP: Failure to maintain proper oil level as recommended in pump manual. Failure to change oil in pump at recommended intervals. Failure to protect pump against freezing. Failure to maintain pump protection shut-off system. Failure to use water softener in hard water areas. Use of improper chemicals.

VAC TANK: Failure to properly maintain filtering devices in tank. Failure to clean tank as recommended by manufacturer. Failure to maintain vacuum safety release in tank lid. Use of improper chemicals.

CHEMICAL PROPORTIONER: Use of improper chemical. Failure to use water softener in hard water area. Operating machine without proper chemical filter screen. Failure to protect against freezing.

CONTROL PANEL: Failure to protect flow meter and water pressure gauge against freezing.

VACUUM AND SOLUTION HOSES: Failure to protect hoses against freezing. Failure to protect hoses against burns from engine/blower exhaust. Damage to hoses from being run over by vehicles. Kinking or cracking from failure to store or unroll hoses correctly. Normal wear and tear from everyday use.

CLEANING WAND: Failure to protect against freezing. Obvious physical abuse of wand.

WATER HEATER: Over pressurization of the system (recommended maximum working pressure - 800 PSI). Failure to protect against freezing. Modification of the gas delivery system.

WARRANTY PROCEDURE

Warranty coverage is available to you ONLY through HydraMaster Corporation, 20309 64th Ave. West, Lynnwood, Washington 98036. When warranty parts are needed, write **HydraMaster Warranty Dept.** at the above address, or call the Warranty/Service Dept. at (206) 775-7275. **No collect calls will be accepted. Hours of Warranty/Service Dept. are 8:00 am to 5:00 pm Pacific Time.**

IMPORTANT: HydraMaster's warranty policy provides replacement parts without charge for thirty (30) days to customers maintaining current account status. An invoice dated thirty (30) days from date of replacement parts shipment will be sent to the customer for the amount of the parts sent. The customer's faulty parts **must be** returned for evaluation prior to the expiration of the thirty (30) day period. Upon warranty approval, a credit will be issued the customer for the replacement parts invoice. **Warranty disapproval or failure to return the faulty parts within the thirty (30) day period allowed will result in the customer being charged for the replacement parts sent.**

HOW TO ORDER PARTS

To obtain a proper diagnosis of your malfunction, and to order warranty replacement parts, it is important that you proceed in the following manner:

1. Call HydraMaster Warranty/Service Department at (206) 775-7275.
2. Give the Warranty/Service representative the following information:
   - A. Name of your company and your address.
   - B. Equipment model (i.e. HydraCat, BobCat 2, etc.).
   - C. Date of purchase.
   - D. Hours on the unit.
   - E. Serial number of unit.
   - F. Name of person authorized to order parts.
   - G. Salesman unit purchased from.
   - H. Description of malfunction.
   - I. Pressure readings on high pressure gauge with wand turned on and off.
3. If warranty replacement parts are needed, please specify method of shipment desired. **NOTE:** All replacement parts are sent freight collect, via:
   - A. U.P.S.
   - B. Air Freight
   - C. Air Mail
   - D. Air Express
   - E. Auto Freight
4. Do not give malfunctioning parts to a HydraMaster sales or service representative. **All parts must be returned directly to HydraMaster, Freight prepaid.**

PARTS ORDERS

To expedite your parts needs, please call your sales representative. In most instance, he either stocks or has access to parts through a regional service center. In the event parts are unavailable locally, contact the factory and coordinate your needs. If this becomes necessary, always indicate the method of shipment you desire, i.e. UPS. Blue Label, Air Freight, Air Express, etc.

HydraMaster Parts Department. Phone (206) 775-7276.

ONE FINAL NOTE

Any questions you have regarding the warranty program should be directed to the Warranty/Service Department personnel at HydraMaster Corporation.

We shall always endeavor to be fair in our evaluation of your warranty claim, and shall provide you with a complete analysis of our findings.

HydraMaster Warranty Policy
Effective February 1, 1989

HydraMaster warranty covers only defective materials and/or workmanship for the periods listed. Labor, and/or diagnostic reimbursement is specifically excluded.

AquaCat

2 YEAR
LIMITED WARRANTY PLAN

HydraMaster warrants products of its manufacture to be free from defects in material and workmanship if properly installed, maintained, and operated under normal conditions with competent supervision. No person, agent, representative or dealer is authorized to give any warranties on behalf of HydraMaster nor to assume for HydraMaster any other liability in connection with any of HydraMaster's products. This warranty shall extend to the original purchaser of said equipment for the periods listed by component below from date of installation. If repairs or replacements are made by the Purchaser without HydraMaster's written consent, HydraMaster's warranty shall cease to be in effect. No allowance will be granted for any repairs or alterations made by the Purchaser without HydraMaster's prior written consent.

Machinery, equipment and accessories furnished by HydraMaster, but manufactured by others, are warranted only to the extent of the original manufacturer's warranty to HydraMaster.

HydraMaster agrees at its option to repair at the point of shipment, or to replace without charge any parts or parts of products of HydraMaster's manufacture, which within the specified warranty period shall be proved to HydraMaster's satisfaction to have been defective when shipped, provided the Purchaser promptly notifies HydraMaster, in writing, of such alleged defect. HydraMaster will pay all freight and transportation charges, via normal ground shipping means, for replacement of parts covered under this warranty.

HydraMaster's liability to Purchaser, whether in contract or in tort arising out of warranties, representation, instructions, or defects from any cause shall be limited to repairing or replacing the defective part or parts. To qualify for warranty coverage, defective parts must be returned to HydraMaster within 30 days.

No liability whatsoever shall attach to HydraMaster until said products have been paid for.

Except as stated in this section and in the preceding section titled "Warranty" and except as to title, there are no guarantees or warranties of merchantability, fitness, performance or otherwise, express, implied or statutory, and HydraMaster shall have no liability for consequential, incidental or other damages, howsoever caused.

FRAME/COVER ASSEMBLIES: ..... 3 years

VACUUM RECOVERY TANK/CHEMICAL MIX TANKS: ..... 3 years

CHEMICAL PROPORTIONING SYSTEM: ..... 2 years

CLEANING WAND: ..... 2 years

ENGINE: (Thru original Manufacturer. On Direct Drive units see original Manufacturer's warrranty.) ..... 2 years

INTERNAL MACHINE HOSES ..... 2 years

VACUUM BLOWER: (Thru original Manufacturer. See Cooper Industries warranty.) ..... 2 years

HIGH PRESSURE BY PASS VALVE ..... 2 years

EXTERNAL MACHINE HOSES ..... 1 year

BELTS, FITTINGS, FILTER SCREENS, GAUGES: ..... 1 year

WATER HEATER OR HEAT EXCHANGER ..... 1 year

HIGH PRESSURE PUMP: (Thru original Manufacturer.) ..... 1 year

All components not specifically referenced in the above schedule are covered under this warranty for a period of one (1) year, except those parts which are considered expendible in normal use.

Freezing of any water or chemical related component will VOID all warranties on water or chemical related components, internal or external, of this equipment.

Deposits and build-up in the water, chemical or heater systems, due to hardness in the water used or poor quality chemicals which result in deposits, will void all warranties on affected components.

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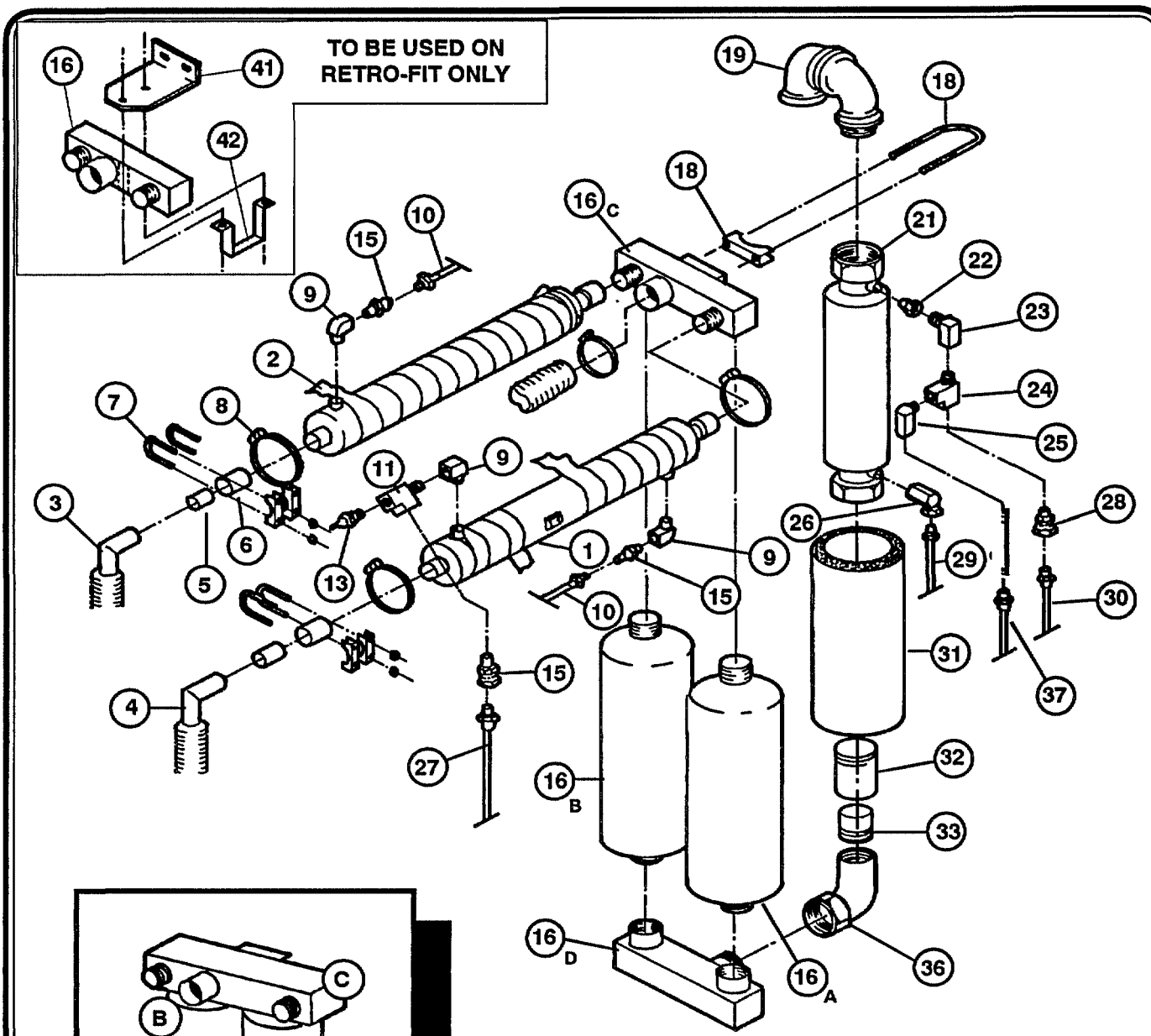
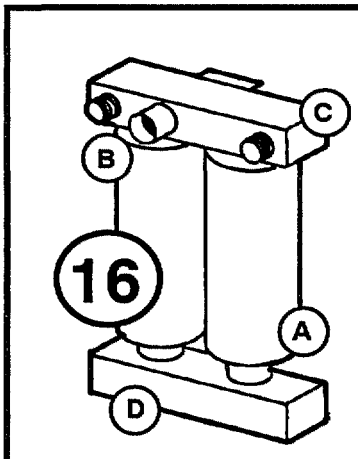




ITEM SHOWN IS SOLD
AS ONE COMPLETE UNIT.

HYDRAMASTER
corporation

AQUA CAT 3.9

HEAT EXCHANGER SYSTEM

EXPLODED VIEW
and
PARTS LIST

PARTS LIST

1	000-038-019	CORE, FINNED - S/S
2	000-131-037	INSULATION WRAP
3	000-090-036	MANIFOLD ASSY. - LONG
4	000-090-035	MANIFOLD ASSY - SHORT
5	000-033-070	CLAMP, 1" EXHAUST - INNER
6	000-033-071	CLAMP, 1" EXHAUST - OUTER
7	000-033-042	CLAMP, 1-1/8" MUFFLER
8	000-033-012	CLAMP, #44
9	000-052-085	ELBOW, 1/4" BRASS
10	000-068-210	HOSE, 3/8" x 24" LONG
11	000-052-090	TEE, 1/4" MALE BRASS
12	000-068-215	HOSE, 3/8 x 13" TEFLON
13	000-149-002	SENDER, S/W TEMP.
* 14	000-068-098	HOSE, 1/2 x 16" RUBBER
15	000-052-013	FITTING, 4M-6UFS
16	000-093-013	SILENCER ASSEMBLY
* 17	000-068-099	HOSE, 3/8 x 43" TEFLON
18	000-033-034	CLAMP, 3" MUFFLER
19	000-052-268	ELBOW ASSY., 2" - 180°
* 20	000-068-039	HOSE, 3/8 x 55" THROB
21	000-038-018	CORE, A/C HEAT EXCHANGER
22	000-052-086	BUSHING, 1/2 MALE x 3/8 FEMALE
23	000-052-086	ELBOW, 3/8 BRASS
24	000-052-023	FITTING, 6MT-6F-6F
25	000-052-020	6MA-6UFS
26	000-052-033	8MA-6UFS
27	000-068-211	HOSE, 3/8 x 34" TEFLON
28	000-052-019	6M-6UFS
29	000-068-211	HOSE, 3/8 x 34" TEFLON
30	000-068-214	HOSE, 3/8 x 68" TEFLON
31	000-131-035	INSULATION, 3-1/8" I.D. - FOAM
32	000-052-267	ADAPTER, A/C REAR HT.EXCHGER - UPPER
33	000-052-266	ADAPTER, A/C REAR HT.EXCHGER - LOWER
** 34	000-033-052	CLAMP, 2-3/4"
** 35	000-049-033	FILTER, 3/8 INLINE
36	000-052-210	ELBOW, 2" BLACK STEEL
37	000-068-213	HOSE, 3/8 x 58"
38	000-015-037	BRACKET, MTG. - HT.EXCHGER/SILENCER
39	000-015-038	BRACKET, MTG. - HT.EXCHGER/SILENCER
** 40	000-068-079	HOSE, 3/8 x 30" TEFLON
41	000-015-038	BRACKET, RETRO-FIT - SILENCER
42	000-015-037	BRACKET, RETRO-FIT - SILENCER

* NOT INCLUDED IN KIT # 000-078-033
** NOT SHOWN

HYDRAMASTER

CORPORATION

20309 64th Avenue, West
Lynnwood, WA 98036

PRODUCT SUPPORT BULLETIN

TO: ALL HYDRAMASTER DISTRIBUTORS **DATE: 17 FEB '92**

RE: USE OF WATER SOFTENERS **PSB #: 9221**

For quite some time, HYDRAMASTER has encouraged the use of water softeners in concert with its equipment. With the introduction of the 3.5 AQUA CAT last year, the issue of water softeners has once again come up.

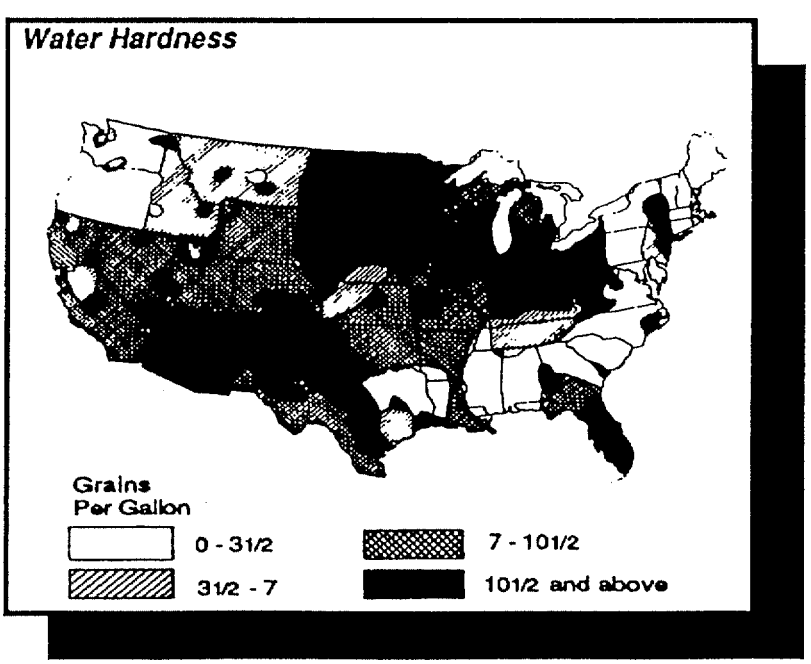
Our increased use of exhaust gas heat exchangers requires us to reiterate our position concerning water softeners and the subsequent invalidation of machine warranty claims due to hard water and/or chemical deposits.

Included in each HYDRAMASTER manual is a "hard water area map". The map graphically portrays the average hardness of water in each region of the United States. This map does not excuse anyone living in a "soft water area" from using water softeners if circumstances require it.

Under the heading of "water softeners", the manual states: *"Many areas of the country have an excess of minerals in the water which result in what is commonly refered to as 'hard water'. These minerals tend to adhere to the insides of heater coils and other parts of the machine causing damage as well as loss of cleaning effectiveness... the relatively low cost of a water softener service is more than made up for in the increased life of machine parts and continued cleaning efficiency."* The manuals also have advice on de-scaling procedures.

As stated in the manual, any deposits that form on the inside of the machine may cause damage. Any damages resulting from hard water or chemical deposits are considered abuse and/or neglect and will not be covered by the HYDRAMASTER WARRANTY.

Avoid costly repairs and downtime by using whatever water softening method that is readily available. Also remember to follow-up the de-scaling recommendations that are shown in your manual.



for more information
please contact your local
HYDRAMASTER
representative.

HYDRAMASTER
CORPORATION
20309 64th Avenue, West
Lynnwood, WA 98036

PRODUCT SUPPORT BULLETIN

TO: ALL *HYDRAMASTER*® DISTRIBUTORS
SERVICE CENTERS
AQUA CAT OWNERS

DATE: 29 APRIL 1992

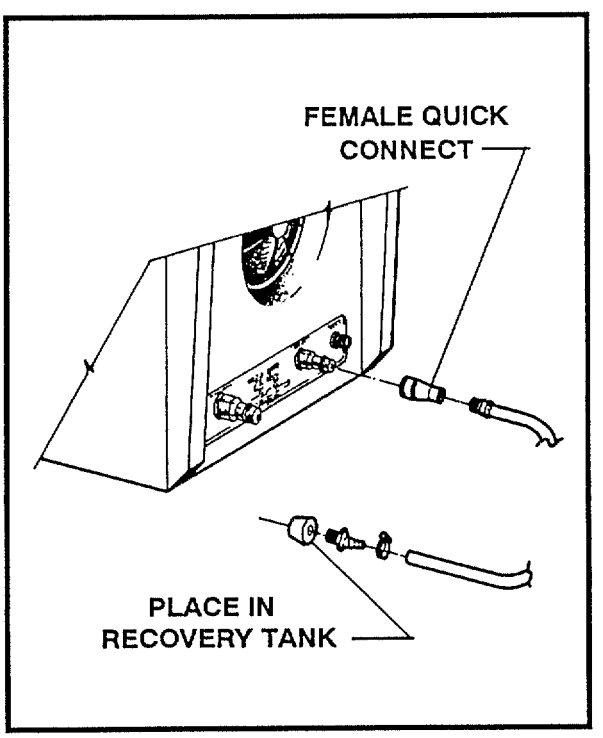
RE: IMPROPER AQUA CAT OPERATION
(i.e.: no pressure indicated on pressure gauge)

PSB #: 9243

The ***HYDRAMASTER*®3.5 AQUA CAT** machine *must* have pressure indicated on the pressure gauge before the unit will operate.

When starting your ***HYDRAMASTER*®3.5 AQUA CAT,** it is of utmost importance that care be taken to verify a working pressure reading on the pressure gauge within the **first 30 seconds** of operation. If this does not occur, shut the machine down ***IMMEDIATELY*** and follow the procedure outlined below:

1). Remove mix tank lid and verify the presence of water in the mix tank.
2). If water is present in the mix tank, use the freeze guard hose provided with the ma chine to purge air from the system.
3). Attach the female quick connect to the front of the machine and place the rubber stopper in the recovery tank.
4). Start the machine.
5). As soon as water becomes visible in the clear freeze guard hose, stop machine, disconnect freeze guard hose and proceed with cleaning operations.



The problem of low or no pressure may be symptomatic of either a clogged pump inlet filter or worn pump seals. Cleaning of the pump inlet filter and/or replacement of the pump seals may be necessary to correct the problem.

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PRODUCT SUPPORT BULLETIN

TO: ALL *HYDRAMASTER®* DISTRIBUTORS DATE: 29 OCT 1992

RE: 3.9 AQUACAT FREEZE GUARD PSB #: 92104

1. Begin by attaching your garden hose, or pump-in hose, to the machine. Now, remove the chemical line from the chemical jug and place it in a 50/50 mixture of anti-freeze and water; turn the ignition switch on. Open the mix tank drain valve and allow the mix tank to drain to the point that it starts to demand water. Allow the mix tank to draw the anti-freeze solution through the chemical flow meter and the hoses back to the mix tank.

2. Remove the garden hose, or pump-in hose. Now, open the mix tank drain valve and drain all the water from the machine.

3. With the machine drained of water, close the mix tank drain and pour one (1) gallon of 50/50 anti-freeze and water mix into the chemical mix tank.

4. Start the machine and allow it to run for two (2) minutes.

5. For machines equipped with a manual override switch: with the machine running, depress the dump solenoid manual override switch and hold for thirty (30) seconds.

6. Remove the garden hose inlet fitting from the end of your garden hose and plug it into the front of the machine. Leave it plugged in until the next time the machine is used.

With the hoses and wand connected, run machine and spray the water/anti-freeze solution out of the wand until the 'low water' switch in the mix tank shuts the machine off. Your machine is now freeze-protected.

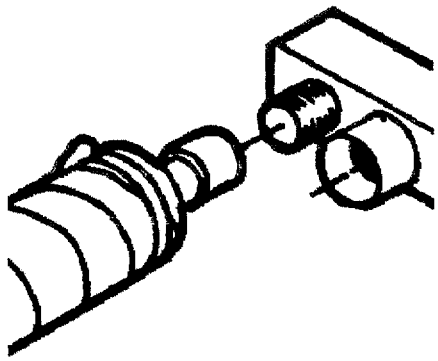
7. Solution hose and wand freeze guard procedure: (optional): Attach the solution hoses and wand to the machine. (Dependent upon the amount of hose attached, more anti-freeze solution may be needed in the chemical mix tank). With the machine running, spray the wand into a container to recapture the anti-freeze solution. Continue to spray the wand until the machine shuts down by itself.

Recovering anti-freeze for re-use:

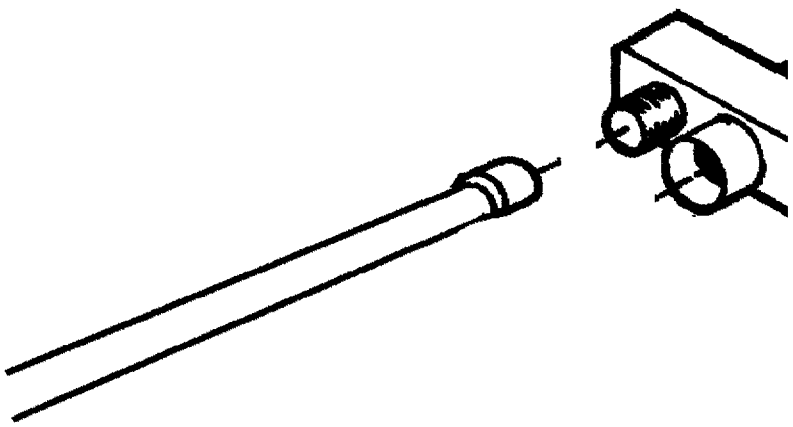
Open the mix tank drain valve and allow the anti-freeze solution to drain into a sealable container so that it may be used again.

Before cleaning with the machine again, flush the remaining anti-freeze solution from the system by spraying water through the hoses and wand until all signs of anti-freeze are gone.

Unscrew damaged heat exchanger as per instructions and remove. If smaller heat exchangers are used, removal of the silencer may not be necessary.



Length of pipe with 1-1/2" coupler attached, used as 'alignment tool'. Screw onto male thread of manifold allowing sufficient thread engagement, preventing damage to the threads.



After alignment, the replacement heat exchanger should install without **ANY** load factor whatsoever. If this is not the case, remove the heat exchanger and re-align. The exchanger must not be under load at any connection.

HYDRAMASTER
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20309 64th Avenue, West
Lynnwood, WA 98036

PRODUCT SUPPORT BULLETIN

TO: ALL ***HYDRAMASTER®*** DISTRIBUTORS **DATE: 5 FEB 1993**

RE: REMOVAL AND REPLACEMENT OF AQUA CAT HEAT EXCHANGERS **PSB #: 93024**

In an effort to maintain our high standard of performance in both our equipment and our service, ***HYDRAMASTER®*** is issuing this update covering the removal and replacement of heat exchangers on the AQUA CAT cleaning unit.

It has come to our attention that in the past, this removal has been achieved by the bending of the mounting brackets to allow the removal of the heat exchanger past the frame. As a direct result, the 'bending process' weakens the heat exchanger and promotes failure. This is not a practice adopted by ***HYDRAMASTER®***, and we would like to take this opportunity to illustrate the proper method of removal and replacement.

In ALL cases, the best way is to remove the silencer unit first. This allows the heat exchanger to then be unscrewed and removed without further modifications to it's surroundings. (note: if small diameter heat exchangers are being used, removal may not be necessary)

Before installing the replacement heat exchanger, use a 'aligning jig' (shown in illustration A) to insure correct placement of the unit. **DO NOT** use the heat exchanger as an alignment tool. To do so would place unnatural stress on the end plate, thereby weakening the weld integrity. To fabricate an 'alignment tool', you need only a length of pipe -- about 18" -- and a 1-1/2" coupler welded to one end (see illus.).

HYDRAMASTER
CORPORATION

6323 204th Street, S. W.
Lynnwood, WA 98036

PRODUCT SUPPORT BULLETIN

TO: ALL *HYDRAMASTER®* DISTRIBUTORS DATE: 28 MAY 1993

RE: 3.5 to 3.9 AQUA CAT Conversions PSB #: 93051

Poor performance has been noted in several instances regarding the conversions from 3.5 AQUA CATs to 3.9 AQUA CATs. Such indications may appear as low RPM or discharging fuel from the carburetor.

The most probable cause would be back pressure.

To correct the situation, we recommend that you remove the third heat exchanger from the rear of the machine and remove any rust or foreign material that may be blocking the copper tubes.

If at all possible, prior to installing the third heat exchanger, run the machine with the silencer unrestricted. This will allow larger particulates to flow through the system and avoid any build-up.