

POWER-MATIC 1150

MANUAL



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SAFETY PRECAUTIONS

Steam Way will not be responsible for any injury or loss due to failure to follow safety precautions.

DO NOT OPERATE THIS MACHINE UNTIL ENTIRE TRAINING HAS BEEN COMPLETED AND/OR THE ENTIRE TECH MANUAL HAS BEEN STUDIED.

Do periodic maintenance of components as instructed throughout the manual.

For precautions on individual components, consult the instructions included under Machine Parts: Kohler Engine Instruction Manual; Operators Manual for Electric Generating Systems; Sutorbilt Manual; Hypro Trim Line Piston Pump.

PREVENT INJURIES FROM CARBON MONOXIDE:

- Never operate equipment with doors closed on the van.
- When operating machine, check wind conditions frequently to make sure that fumes are not being blown into the building where cleaning is being done.

PREVENT FIRES:

- Use the proper fuel (see Page 32)
- Keep fuel containers on level surfaces and as far away as possible from exhaust, hot hoses, and other hot objects.
- Check for fuel leaks before operating, and repair if necessary.
- Never smoke while operating machine, repairing machine, or around fuel containers.
- Be extremely careful when removing fuel caps from fuel containers for build-up of fumes released when cap is removed. The fumes are the most explosive part of any fuel.
- Keep fabrics, papers, clothing, and other flammable objects away from fuel containers, hot exhaust, or other hot surfaces.
- When keeping the van warm during cold weather to prevent freezeup, be certain that your auxiliary heating equipment does not come in contact with your fuel line or fuel tank.

PREVENT BURNS OR OTHER INJURIES:

- Whenever possible, repairs should be made on machine when it is not in operation and when it is cool.
- When absolutely necessary to work in and around hot exhaust or other hot surfaces, extreme caution should be used not to touch the exhaust.
- Be extremely careful of moving belts and moving parts.
- Keep loose clothing away from moving parts.
- Before operating, check for leaks in hoses, connections, and high pressure washing tools to prevent scalding.

Section 1

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Section 3

INTRODUCTION

The new Power-Matic truck-mounted unit by STEAM WAY INTERNATIONAL is an economical piece of equipment, introduced for high capacity professional carpet and upholstery cleaning. Although at first glance it appears to be a complex machine, a few moments of study will prove the unit to be designed throughout for minimum maintenance, simple economical operation, and maximum reliability.

In order to understand this equipment more thoroughly, a brief study of the machine operation is necessary. The Power-Matic unit consists of four major systems:

1. Power (Mechanical & Electrical)
2. Water (Supply & Pressure)
3. Water Heating
4. Waste Extraction

To save time and effort, a continuous water supply is necessary. The pump draws from this supply, injects the cleaning agent, and pressurizes the solution. The solution is heated to the desired operating temperature (225° F maximum) and is then transmitted to the head for steam cleaning. Extraction is accomplished in the Power-Matic unit by a powerful positive displacement vacuum blower. The Power-Matic has a large waste recovery tank providing waste collection adequate for cleaning from 1100 to 2200 square feet of carpet, depending on how soiled the carpet is.

A high quality industrial air-cooled gasoline engine supplies power necessary to operate all the other systems. The vacuum blower is driven directly from the engine. The solution pump and the commercial 110 VAC alternator are belt driven. All monitoring gauges are clustered on the control panel.

Each system contains features that make this unit desirably unique. After the water input hose is connected, and through the use of a warm-up valve, the unit can be started and warm-up achieved while the head and hoses are being set up on the job. When final connection is made to the unit, the water is hot and ready to go. Through our process of heating the water, any temperature may be set, up to 225°F maximum. If the need arises, this can be reduced to any lower temperature by a simple adjustment of the temperature control. Since upholstery should be cleaned at a lower pressure, a valve has been mounted conveniently on the pump cluster; turning this valve to low will drop the pressure from the 400 psi (carpet cleaning) to a pre-set 150 psi (or lower). Turning the valve to high will give a pre-set 800 psi for pressure washing.

The waste recovery system is easily drained through the use of a large ball valve for quick operation.

The four systems in your Power-Matic are carefully engineered and matched to complement each other to give the best in carpet cleaning. Now, look at the controls and connections and familiarize yourself with them and their functions. Read this manual; become familiar with your Power-Matic unit before attempting to operate the machine.

Section 4

INSTALLATION OF UNIT

The vehicle must have a clean opening 36" wide by 46" high to the rear or side for installation of the Power-Matic unit. The vehicle should have a rating of 3/4 ton to hold and carry the unit safely.

IMPORTANT! PLEASE NOTE--

In the initial installation of your Power-Matic unit, extreme caution should be used while sliding the unit into your vehicle.

All of the components on the sides and top of the unit must clear the opening and any projections on the vehicle.

Once the unit is in place in the vehicle, it is ESSENTIAL, for the safe transport of the unit and to insure the safety of the driver-operator, that the unit be securely attached through the floor of the vehicle to prevent any type of slide or movement during normal driving or in case of an emergency stop. To accomplish this, we strongly recommend that two or more tie-down points be used. Two options for location of your Power-Matic unit are shown in Figure 4-1. The exact positioning of each tie-down bolt depends on clearing lines (brake, gas, electrical) and fuel tanks under the vehicle floor. Again, for safety's sake, be sure that your unit is securely attached to your vehicle. Always check under the floor before drilling any holes; drill only into clear areas. Avoid gasoline, brake, exhaust, or any other lines, and especially avoid the gasoline tank!

Two options are suggested for the rear tie-downs:

1. Bolts through the side rails of the unit frame.
2. Bolts through the ends of the side rails.

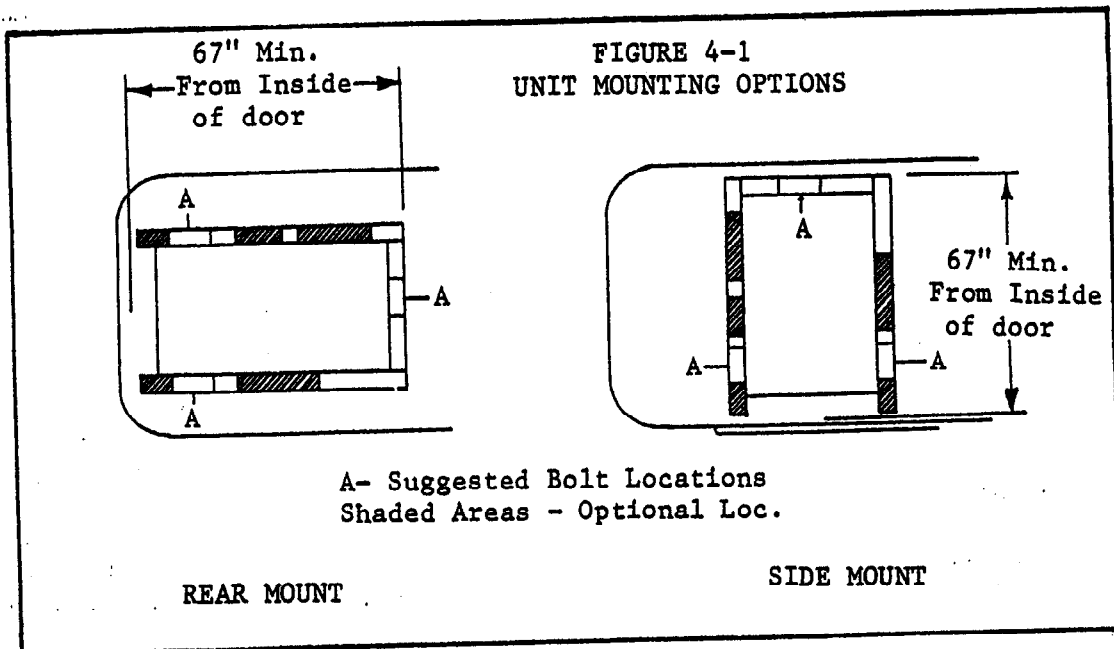
Where swinging rear doors on a van can conceivably swing closed, or swing open wide enough to swing out into traffic while the van is parked at a curb, it is suggested that door stops be installed to hold the doors in a straight-open position during operation. Doors swinging freely during operation could close enough to create a dangerous build-up of toxic fumes within the vehicle. Also, if a door could swing open far enough that it would swing out into traffic or pedestrian lanes, it is a potential traffic hazard.

A camper vent must be installed in the roof of the van directly above the unit to allow heat to escape up through the roof as well as out through the back and side doors.

If the unit is to be operated in an area where freezing weather occurs, it is strongly recommended that some type of heating equipment be installed in the vehicle in order to prevent freezing of the unit during the winter months when it is not operating. In normal shutdown, there are approximately eight gallons of water left in the unit lines, and freezing of the unit could create serious problems. Freezing this unit can cost quite a lot in repair parts and labor, plus the lost business during the down-time of the unit, which could be anywhere from two to five days.

Prevention of freezing can be accomplished very easily by mounting a butane camper furnace in the vehicle. In most areas of the country the minimum repair bill will buy the fanciest automatic camper furnace available. Consider this if you are not protected at this time. A temperature of 45° F is adequate to prevent freezing and make first-job startup more trouble-free. If you are protected with a propane or butane heater, watch your fuel carefully. The best heaters are worthless if they run out of fuel at midnight and the temperature has dropped to freezing or below. In extremely cold areas, insulation can also be installed to assist in the protection against freezing.

It is VERY IMPORTANT to have and ALWAYS USE adequate tie-downs for floor tools, and to store hoses and accessories safely during transport.



Section 5

PRE-OPERATIONAL INSTRUCTIONS

The first step is to fill the various tanks of the unit. Read the operating instructions and become familiar with the connection points.

- 5.1 Obtain gasoline and adequate heating fuel oil. Use unleaded (Preferred) or leaded regular gasoline. Use only kerosene or #1 diesel as a heating fuel. (In some areas, #1 heating fuel or #1 burner oil may be more easily available. Check with your local oil distributor concerning the suitability of the substitution BEFORE using anything but kerosene or #1 diesel in the burner.)

The gasoline tank is red in color and has a female quick disconnect on the end of the tank hose that will attach to the permanently mounted male quick disconnect from the electric fuel pump (H-1, Figure 5-3) on the right hand side of the unit behind the front upright frame post. The diesel fuel tank is painted green and has a sticker on it indicating kerosene or #1 diesel. The male connection on the end of the tank hose attaches to a female connection below the alternator and is marked kerosene or #1 diesel on a green label (H-2, Figure 5-3).

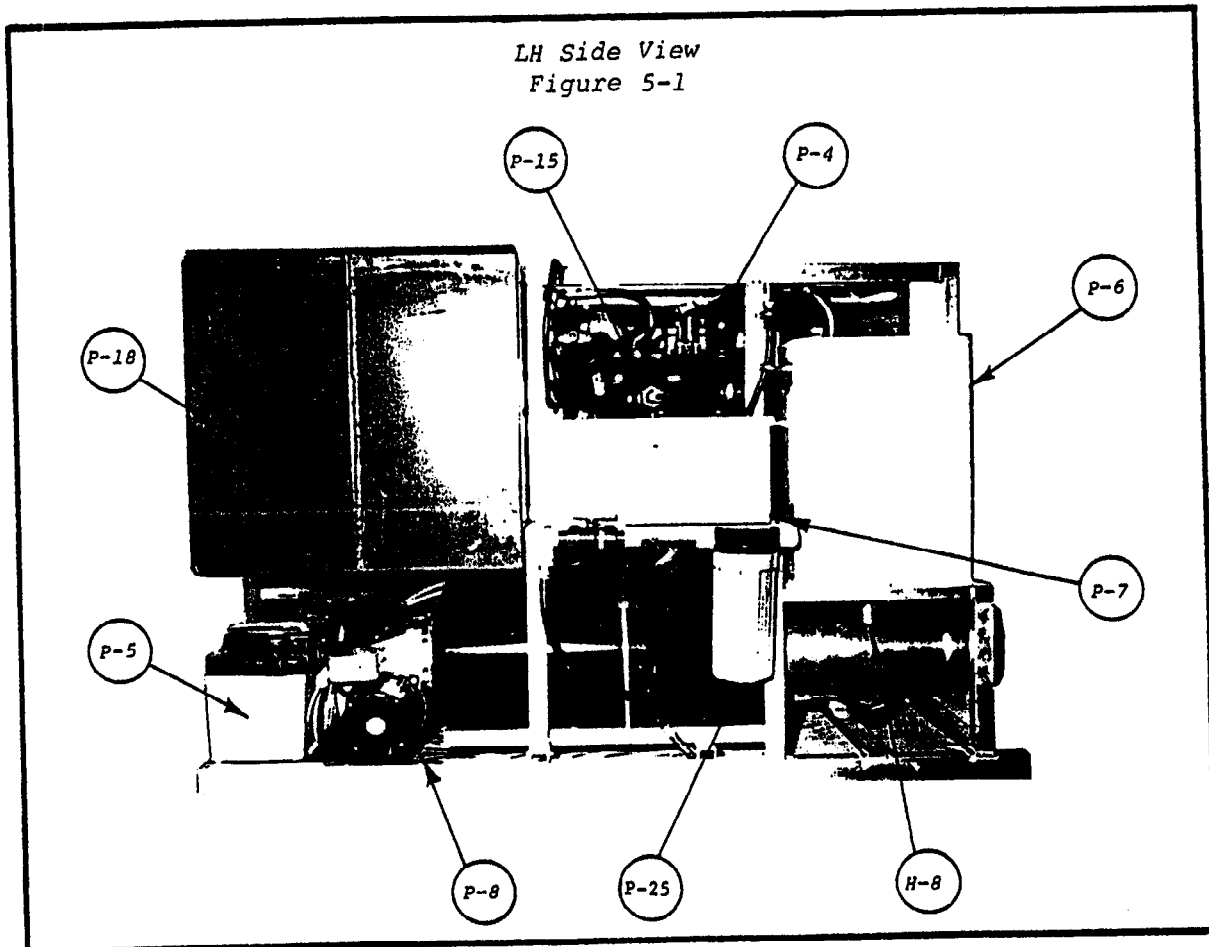
CAUTION: For safety reasons, always leave the supply hoses on the fuel tanks. When it becomes necessary to remove a tank for filling, remove the hose at the quick disconnect on the side of the machine, always keeping the hose attached to the tank. In this way, no incorrect reconnection can be made. (Gasoline and #2 diesel must never be run through the heater unit, and kerosene must NEVER be run through the gasoline engine.

Condensation of water in the burner fuel tank causes rapid deterioration of the burner fuel pump. As condensation in the fuel tank cannot be prevented, the addition of a fuel additive to remove moisture is mandatory. A standard gas-line anti-freeze can be used in a ratio of two to four ounces per six gallons of fuel. The material is available under many brands from most service stations. As a protection to the burner system it is wise to establish a fuel additive procedure and have the material on hand at all times. Occasionally dump and filter the fuel and wash out the tank with a small amount of fresh fuel to remove water and debris.

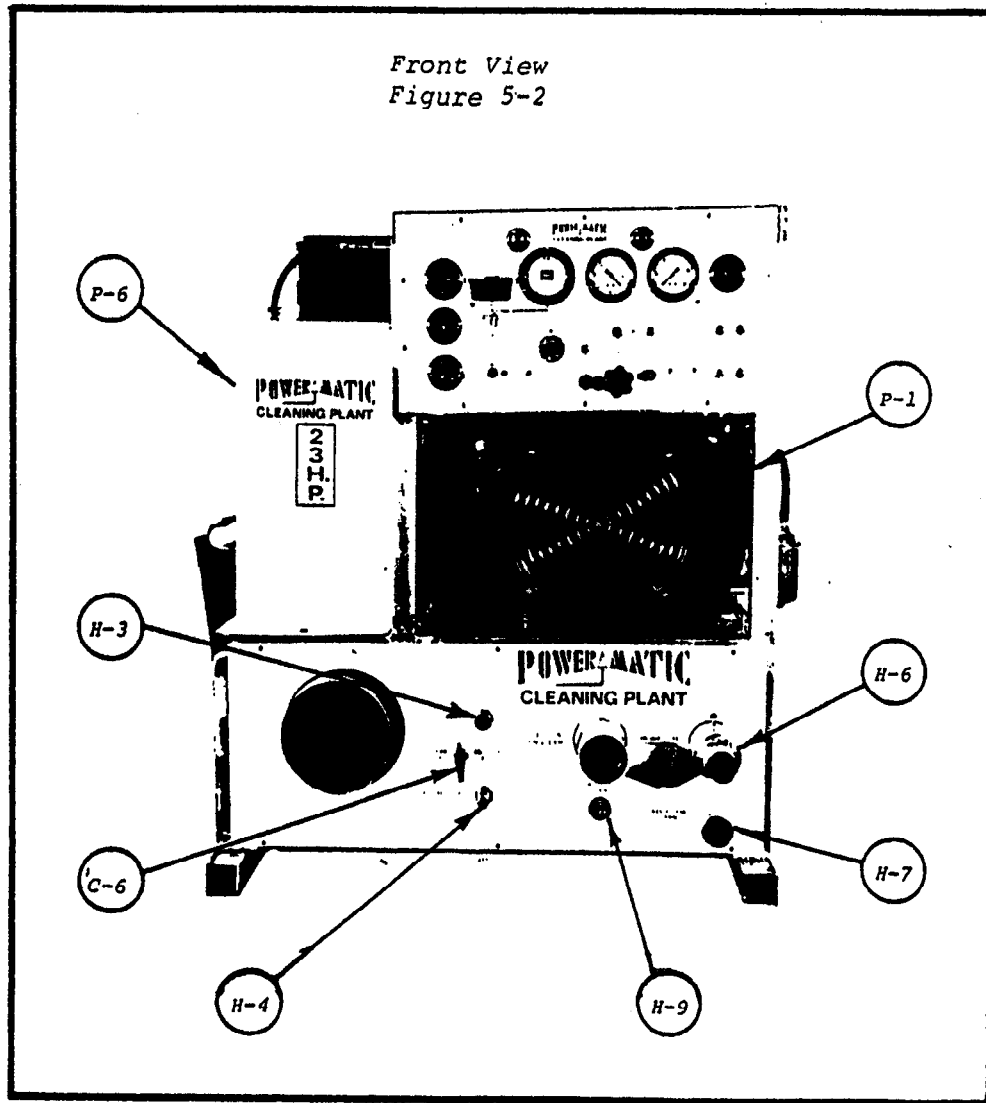
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- 5.2 Fill the holding tank through the water input quick disconnect on lower front panel (H-3). The holding tank, located on the left side (P-7, Figure 5-1), is kept full of water from which the pump

will draw to supply the pressure system. The holding tank is filled from the customer's outside faucet with the water supply hose. This hose has a normal garden hose connection on one end, and a special valve with a quick disconnect on the other end. First, turn on the faucet to be sure you have a water source. Then connect the hose to the faucet, turn the faucet on full, and open the hose valve to check for adequate water flow (approximately 3 gallons per minute); shut off the valve, connect the supply hose to the unit (H-3), and re-open the hose valve. The holding tank will fill until a float mounted inside shuts the system off. When this occurs, the holding tank is full and the water supply system is ready.

- 5.3 Put some type of liquid solution in the solution tank (P-6, Figure 5-2). (Clear water can be put into the solution tank for initial testing, if you wish.) It is very important that the solution level in the solution tank always be kept above 2 inches, as drawing air through the solution system will create zero pressure and damage the pump. (See Section 16.1 for solution information.)

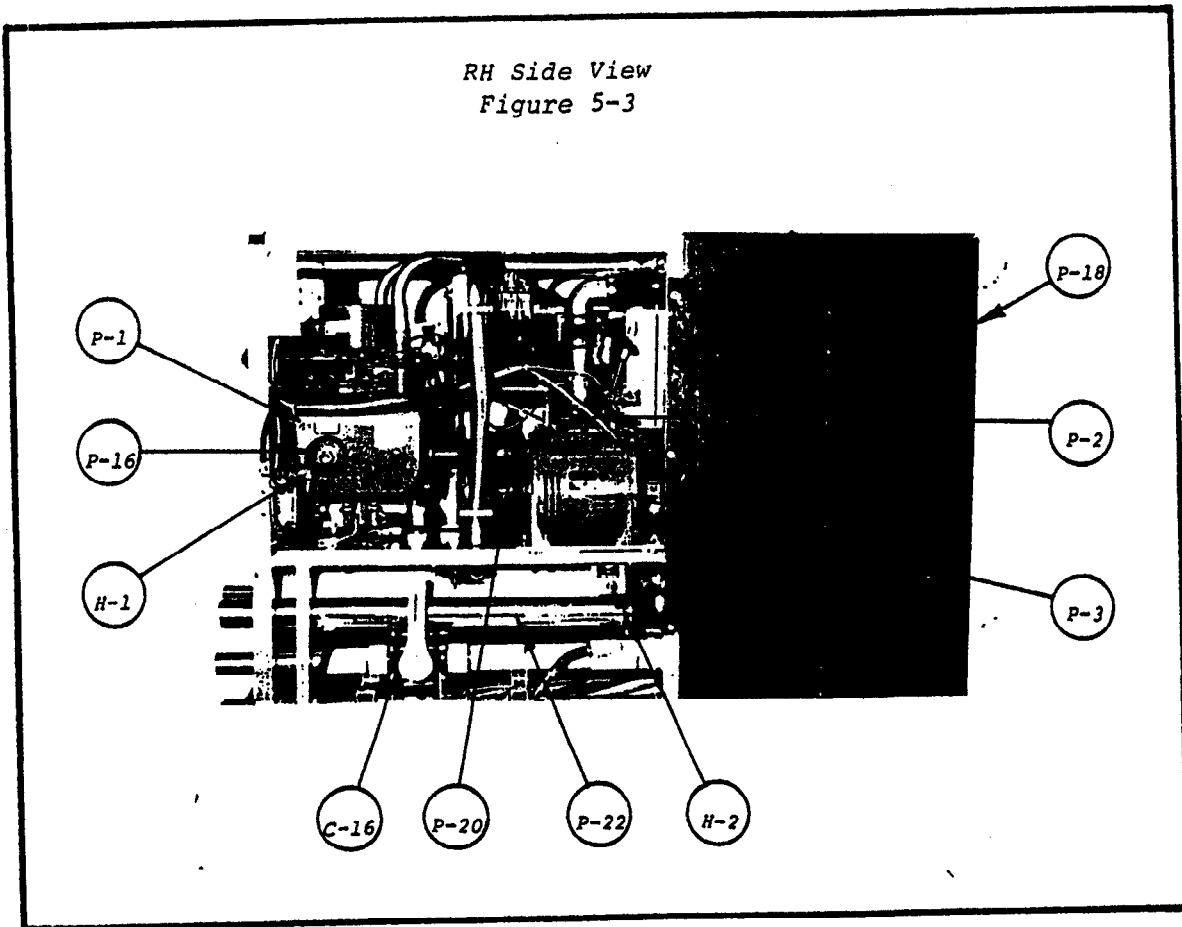


- 5.4 Inspect your waste recovery tank (P-18, Figure 5-4). Remove the cover. Be sure the filter is on the vacuum line, that the vacuum intake and drain lines are free and clear, and that the clutch shut-off is in place and free to move. Replace the cover and be sure it fits all around. Put the dump valve in the closed position.



Before initial test, it is **IMPERATIVE** that the heater fuel lines be bled. Putting fuel into the empty fuel tank traps air in the fuel lines. The bleeding procedure is described in the Heater Section (8.6.2) and should be read carefully.

Now study Section 6 on Operating Procedures; go through all steps of setup and operation. Test your Power-Matic unit on a small section of carpet nearby; then follow procedure for shutdown. When you have finished this test, your Power-Matic unit is ready to help you clean carpets in the fastest, most efficient way yet invented!



Section 6

OPERATING PROCEDURES

6.1 SETUP

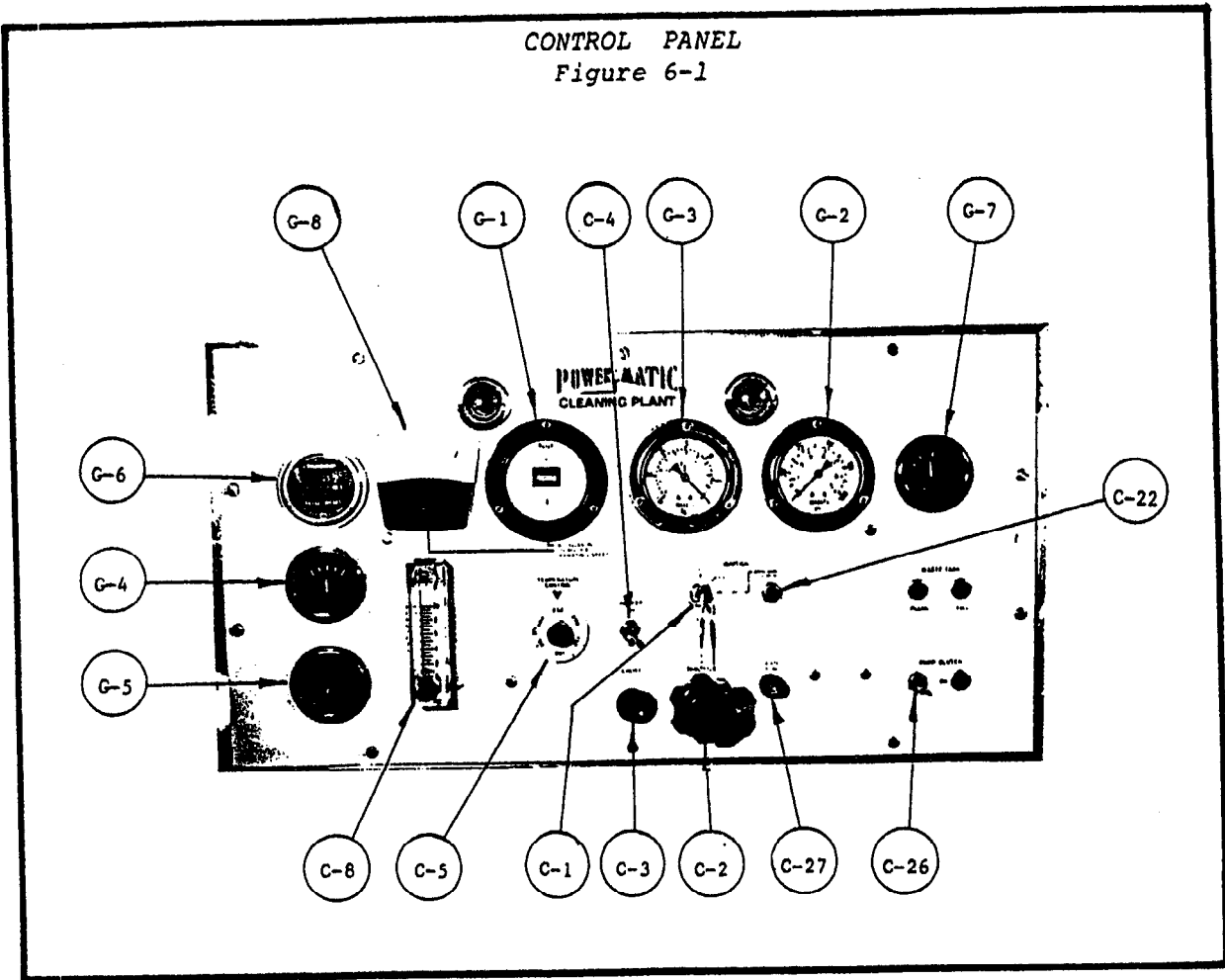
The operational procedures are very important to a long trouble-free operation of your Power-Matic unit. For the setup, these controls should be in the positions indicated.

<u>Control</u>	<u>Number/Figure</u>		<u>Position</u>
Engine Ignition Switch	C-1	6-1	OFF
Engine Throttle	C-2	6-1	CLOSED
Engine Choke	C-3	6-1	IN
Heater Switch	C-4	6-1	OFF
Temperature Control	C-5	6-1	DOWN
Warm-Up/Fill Valve	C-6	6-1	OFF
Three Way Valve Pressure Selection	C-9	7-1	MEDIUM
Heater Motor Reset Button	C-15		RESET
Dump Valve	C-16	5-3	CLOSED
Floor Tool Head Valve (if floor tool connected)			OFF

NOTE: The following controls are not often changed; they are listed here for completeness and as a reminder in case some condition does change that requires adjustment of the control. Each is fully discussed in the appropriate section.

Pressure Regulator	C-7	7-1
Soap Flow Meter Valve	C-8	6-1
Upholstery Pressure Adjustment Valve	C-10	7-1
Fuel Oil Bleeder Valve	C-12	8-3
Air Control Lock Bolt	C-14	8-3

CONTROL PANEL
Figure 6-1



6.2 STARTING

6.2.1 FIRST JOB EACH DAY -- SAFETY PRECAUTION

Check engine oil and pump oil levels; fill oil if required, before proceeding. DO NOT OVER FILL.

BEFORE EACH JOB

Check oil filter (P-16) for tightness. Tighten if necessary.

6.2.2 Double Check: All electrical switches must be OFF, all appliances unplugged, and the warm-up valve (C-6) OFF.

6.2.3 Dump any water possible from the waste recovery tank and return the dump valve to the CLOSED position. Make sure the rear doors are supported open, the side door('s) are open, and the roof vent open.

- 6.2.4 A. Attach supply hose to water supply (customer's faucet or outlet).
- B. Open water supply faucet to obtain water flow. If flow is satisfactory, proceed with C; otherwise, find a satisfactory water supply, or clear the line, as required.
- C. Close water supply faucet and attach supply hose to the unit at the quick disconnect (H-3, Figure 5-2). Open water supply, observing that the water holding tank fills and that the water flow stops.

6.2.5 Engine starting procedure.

- A. If the engine is cold, pull out choke (C-3).
- B. Pull out throttle slightly.
- C. Depress oil pressure bypass switch and turn ignition switch (C-1) temporarily to START position, starting the engine. Release push button when oil pressure reaches 15 psi.
- D. As soon as the engine is running, push choke in.
- E. Using the center push button on the throttle for coarse adjustment and with counter-clockwise motion of the throttle knob to speed up the engine, or clockwise motion to slow it down, adjust the engine speed from 60 to 62 hertz on the frequency meter (G-1). The volt meter will read 120 - 130 VAC. (G-8)

6.2.6 Pressure and heater system startup.

- A. Turn pump clutch switch on. (Solution tank must have 2" of solution or flow meter must be off)

Pressure (G-2) about 400 psi
Tachometer 2600 RPM
AC Volts (G-8) 110 - 120 VAC

If all of the above readings are not reached, shut clutch OFF, refer to Section 13 on Trouble Shooting, locate and correct the problem!

- B. Turn the heater switch (C-4) ON. Watch the frequency meter; there is normally a momentary motor-starting load causing a slight slowing of the engine because of the burner motor start up. Ignition will not occur at this time because the warm-up valve is OFF. Recheck the frequency meter now. If it is not at 60 CPS minimum, adjust engine speed.

- C. Open the warm-up valve (C-6) in order to achieve water flow, which is required for the burner to ignite. Observe that the indicated water pressure (G-2) drops, and adjust warm-up valve to attain a 300 psi reading. Check soap flow meter valve (C-8) for chemical flow.
- D. Set the thermal control (C-5) to the temperature desired. If burner ignition has not occurred at this point, refer to Section 13, Trouble Shooting.
- E. Check the solution tank water level. If filling is necessary turn the warm-up valve to solution fill and fill to the desired level, then return the valve to the warm-up mode per above.

6.2.7 Head and hose set-up.

- A. During the warm-up period, vacuum and pressure hoses may be connected and carried on the job along with the floor unit. Head valve must be closed.
- B. Generally, by completion of this operation, the solution has warmed to 190-200° F. Release the machine pressure by fully opening the warm-up valve. Attach the pressure hose (connection H-4) and close the warm-up valve (C-6). Pressure (G-2) will go back up to 400 psi or the preset maximum pressure. Connect the vacuum hose to the vacuum hose connection (H-6). Again observe the cycle meter. Setting must be at 60 to 62 hertz. Adjust engine speed as necessary.

NOTE:

- A. 225° F maximum setting for carpet cleaning using the floor unit or scrub wand. Normal carpet cleaning will not require more than 200° F for proper cleaning. Only heavily soiled, greasy carpets will need higher temperatures.
- B. 150° F maximum setting when using stair or upholstery tool. If more than 50' of pressure hose is used, this may be increased to 175° F, because of excessive temperature loss due to low solution flow.

6.3 CHECK-OUTS DURING OPERATION

Your Power-Matic unit is uniquely designed to require a minimum of attention while in operation. For short jobs, careful attention to the details of setup and shutdown takes care of all normal procedures. For longer jobs, there are some other points to observe:

- 6.3.1 Always keep at least 2 inches of solution in the solution tank (P-6). The metering adjustment (C-8) keeps the solution from being wasted. The solution is drawn only when the jets are on. If the solution gets low, fill the tank again.
- 6.3.2 Always have, in the gasoline supply tank, adequate gasoline for the job. If the engine stops (for lack of fuel) under load, there is danger of severe electrical system problems.
- 6.3.3 Periodically empty the waste recovery tank. If the solution pressure fails after cleaning for a while, a likely cause is that the waste recovery tank is full. For long, dirty jobs, it may be necessary to empty the waste recovery tank and clean the vacuum filters during the job. Refer to 6.5 warning (remove electrical load on 110 VAC circuit); then reduce engine speed to idle to relieve vacuum pressure. After dumping, reset machine per 6.2.6 and 6.2.7.

6.4 RUNNING

<u>Control</u>	<u>Number/Figure</u>		<u>Position</u>
Engine Ignition Switch	C-1	6-1	ON (Green Light)
Engine Throttle	C-2	6-1	Adjusted to 60 hertz on frequency meter
Engine Choke	C-3	6-1	IN
Pump Clutch Switch	C-26	6-1	ON (Orange Light)
Heater Switch	C-4	6-1	ON
Temperature Control	C-5	6-1	Set to temperature desired
Warm-Up Valve	C-6	5-2	OFF
Pressure Regulator Valve	C-7	7-1	Set for pressure desired
Soap Flow Meter Valve	C-8	6-1	Set for appropriate cleaning desired
Three Way Valve Pressure Selection	C-9	7-1	Medium for carpet, Low for upholstery
Upholstery Pressure Adjustment Valve	C-10	7-1	Set to 150 psi maximum
Fuel Oil Bleeder Valve	C-12	8-3	CLOSED

<u>Control</u>	<u>Number/Figure</u>	<u>Position</u>
Heater Motor Reset Button	C-15	RESET
Dump Valve	C-16 5-3	CLOSED
Vacuum Relief Valve	P-15	Set for 13" Hg maximum
Floor Tool Valve		In use

6.5 SHUTDOWN

WARNING: ALWAYS REMOVE ALL ELECTRICAL LOAD FROM THE ALTERNATOR BEFORE REDUCING ENGINE SPEED. EVEN IN AN EMERGENCY SHUTDOWN, UNPLUG ALL APPLIANCES AND TURN HEATER OFF. THEN, AND ONLY THEN, TURN ENGINE OFF.

- 6.5.1 A. Heater switch (C-4) OFF.
 - B. Shut OFF or unplug any and all appliances connected to 110V outlets (back of alternator).
 - C. Turn off pump clutch (C-26).
- 6.5.2 A. Engine throttle (C-2) CLOSED.
 - B. Engine ignition switch (C-1) OFF.
- 6.5.3 Retrieve floor tools and wands used, stow and tie down.
- 6.5.4 Disconnect floor tool hoses, roll up and stow.
- 6.5.5 Check waste recovery tank:
 - A. Empty tank.
 - B. CLEAN LINT FROM VACUUM INTAKE FILTER.
- 6.5.6 A. Turn water supply faucet OFF.
 - B. Disconnect and stow water supply hose.
- 6.5.7 Last job each day:
 After completion of shutdown, connect the water supply hose to #7. Turn on the valve and flush the entire system for 2 to 3 minutes by opening the warm-up valve. This procedure will noticeably reduce the need to descale.

Section 7

WATER SYSTEM

The overall water system is diagramed in Figure 7-3. The water system consists of four parts:

1. Water Supply
2. Solution/Mixing
3. Pressurization
4. Water Heater
(The water heater functional details are given in Section 8.)

7.1 HOLDING TANK

The holding tank (P-7, Figure 5-1) is a 4-gallon zero-pressure tank. It holds water from the outside source at zero head pressure for the high pressure water pump. Water from the customer's water supply is connected to the unit through hookup (H-3, Figure 5-2). The water supply enters the holding tank through the float valve and fills the tank to a depth of about 5 inches. When water is needed at the floor tool or is dumped by the warm-up valve, water flows out of the holding tank through the flow switch (C-11, Figure 7-1) at the cluster block.

The flow switch detects the water flow, allowing operation of the water heater if heating is required. The heat capacity of the water heater is sufficient to heat the water to the desired temperature as it flows through the heater, and the heat capacity is high enough that the water heater must not be on if there is no water flow. The flow switch is connected in series with the other water heater electrical controls.

7.2 SOLUTION TANK

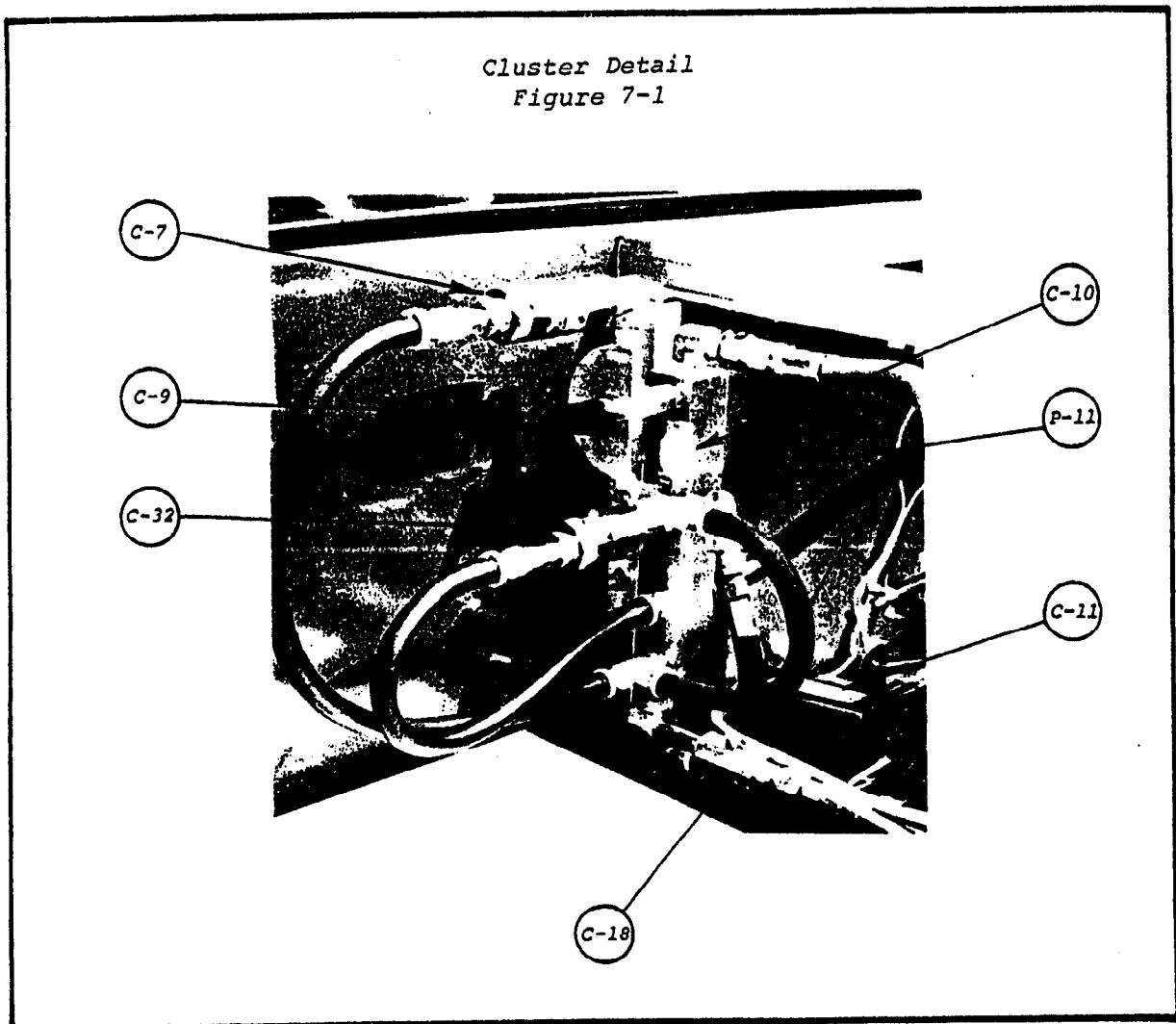
The solution tank (P-6), an 8-gallon tank located on the front of the unit (Figure 5-1), is filled with the liquid cleaning concentrate to be metered into the water for cleaning carpet or upholstery. See Appendix Section 16.1 for information on cleaning agent usage.

It is **ESSENTIAL** to keep a minimum of at least 2 inches of cleaning solution in the tank. If the level drops below 2 inches, air can be drawn into the pump, greatly reducing pump cup and plunger life. The concentrated solution flow is controlled by the adjustable valve on the front panel (C-8). Typical usage will allow about 8 hours of running on a full tank of concentrated solution. The valve may be adjusted from 0 (closed), for clear water rinse, to 5 or 6 for very viscous cleaning agents or very dirty carpets.

Fully open, 10, the solution tank may empty in 10 minutes! There is a check valve (C-18) in the solution line to prevent water from backing up into the solution tank. The solution tank can be emptied by use of the vacuum hose.

7.3 CLUSTER BLOCK

The cluster block is the heart of the water supply system. It provides two plenums and space for 10 connections to those two plenums (Figures 7-1 and 7-3). The lower plenum of the cluster block is the low pressure side; the upper plenum is the high pressure side. Incoming water from the holding tank enters at the bottom, #7 (Figure 7-1). As it flows past the cleaning solution connection, #6, cleaning solution concentrate is added. The clean-



ing solution leaves the bottom plenum through connection #8 and goes to the pressure pump. The pump pressurizes the solution, which returns to the top, #1. If any tool is in operation, most of the high pressure solution leaves through connection #9, going to the heater and on to the tool.

When the operating tool does not use all of the pressurized solution it must be by-passed. (The pump is capable of producing higher flow than you need.) The by-pass is from the upper plenum, through the regulator system, connections #2 and 3, to the lower plenum, connection #4 and/or 5. The maximum solution pressure is controlled by the pressure selection valve (C-9) in the system between the upper and lower plenums. If the operating tool is using no solution, the solution flows in a loop, out of the lower plenum from connection #8, through the pump, back into the upper plenum at connection #1, out the upper plenum, through the pressure regulator system and back into the lower plenum. The lower plenum remains at a low pressure, the upper at the regulator pressure selected. No water flows from the holding tank, the heater is OFF, and no chemical is drawn.

Three pressure selections can be preset and achieved by the turn of a valve. The Hi-pressure regulator (C-32) can be set for 800 to 900 psi for pressure washing. The medium pressure regulator (C-7) should be set at 400 psi for carpet cleaning. The low pressure adjustment should be set at 150 psi maximum for upholstery cleaning. Due to the ease of pressure changes make certain the proper tool is attached before changing the pressure as excess pressure will damage low pressure valves.

Connection #10 is for blowing solution out of the system. It is a tank-type pressure valve and cap. The valve and cap must be kept tight during normal operation. If you desire to clear solution from the system, do it while shut down; set warm-up valve OPEN, remove cap, and blow the solution out with compressed air. Replace cap, CLOSE warm-up valve.

7.4. CAT PUMP

The Cat pump (p-4) is belt driven from the engine and pressurizes the solution used for cleaning. The pump intake is from connection #8 of the cluster block; solution from the cluster block passes through the pump inline filter (P-10, Fig. 7-2) before being pressurized. The pressurized solution goes to the #1 connection of the cluster block. The pump also has a tap (#11) for pressure measurement; a line runs from the pump to the pressure gauge (G-2) on the front panel.

This 3-plunger Cat water pump will supply about 3.0 gallons per minute at the normal operating pressure of 400 psi. There is a rubber wear-cup on each pump plunger. The pump is designed to run wet and will wear the cups slowly in normal wet use. If it runs dry, three to five minutes running will destroy the cups, necessitating replacement. Read the Cat Pump Manual in Appendix Section 16.5.

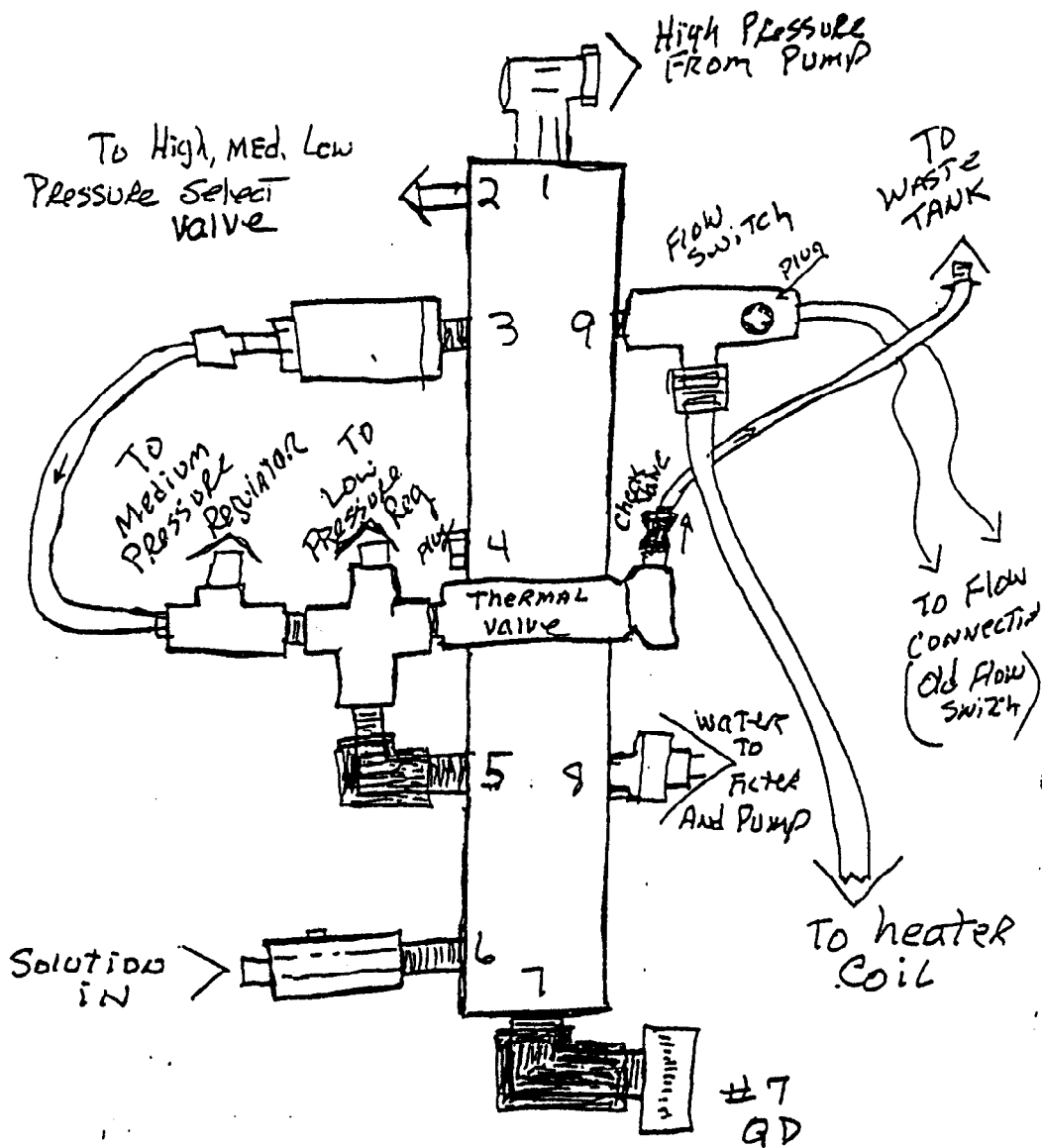
7.5 LOW PRESSURE PROBLEMS

Low pressure problems are considered in various places in sect. 13. Troubleshooting, but are listed here collectively for ready reference.

7.5.1 Poor flow from water supply hose to low supply pressure, faucet not fully on, air in hose, collapsed or kinked hose, hose screen clogged or leaks at the connections or in the hose.

7.5.2 Inadequate supply to the Cat Pump, with low pressure indicated on the pressure meter, can be poor flow from the water supply.

Overheat protection for water pump on Power Matic, Model 1150



When RETURNED water from either the high pressure regulator, medium pressure regulator, or low pressure regulator reach a temperature of 145° F (still safe for the Cat pump), the pop-off valve will open, sending water to the waste tank, thus drawing cool water from the water holding tank. This will cool the pump and make it safe to operate.

It was necessary to change the location of the water flow switch for this modification and put it into the high pressure output #9 port of the cluster block. A high pressure flow switch had to be used for this update.

The data flow on Page 25 of your Technical Manual is still valid, but these changes must accompany that schematic for complete detail.

(as in 7.5.1), problems in any of the feed lines through to the pump, inadequate level control by the float valve in the holding tank, crossed connections on the cluster block, air trapped in the lines, clogged Hypro pump intake filter, or leaks in the unit. If the water supply is inadequate and cannot be easily improved, the supply hose can be connected directly to the bottom (#7) connection of the cluster block (See Section 16.2). If the holding tank is so by-passed, the solution pressure must be watched (city water pressure will increase the output pressure of the pump), for if the water supply pressure comes back up, the Hypro pump pressure may rise to unsafe levels. The pressure is the sum of the setting plus the supply pressure. This by-passing of the holding tank also reduces the effectiveness of the pressure regulator.

- 7.5.3 Low pressure indicated on the pressure meter (with an adequate water supply) may be caused by incorrect setting or failure of the pressure regulator, a slipping belt or pulley to the Hypro pump, three way pressure selection valve not set correctly, failure of the Hypro pump cups (which do wear out), engine speed too low, warm-up valve ON, pump clutch failure, leaks in the high pressure cluster block or connection, leaks in the high pressure output line or hose, or the waste tank being full.
- 7.5.4 High pressure indicated on the pressure meter (but poor flow from jets) can be caused by any of the above failures and an incorrectly reading pressure meter, by obstructions anywhere in the high pressure lines or hoses (including scale in the heater or flaked-off scale in the quick disconnects, screens, or jets), by kinked hoses, or dirt or lint in the jets or screens.
- 7.5.5 With 400 psi pump pressure, you should be able to clean as high as ten floors above the unit. The pressure at the floor tool will be noticeably reduced at higher than ten floors above the unit, both because of the head pressure to be overcome and because of the length of hose required. If you have to clean at considerable height in a tall building, use of a portable cleaning unit might be advisable.

7.6 HEATER

Operating details of the heater system are given in Section 8. As a part of the water system, the heater is the last machine function for solution on its way to the floor and upholstery cleaning tools. The solution passes from #9 on the cluster block to the input fitting of the heater coil. After being heated, the solution flows through the heater output cluster (P-12), which has four connections:

1. The temperature sensor for the temperature control (C-5).

2. The temperature sensor for the temperature gauge (G-7).
3. The warm-up valve (C-6) connecting hose.
4. The main supply connection (H-4) to floor and upholstery tools on the back of the machine.

Solution passing through the warm-up valve goes to the warm-up valve output hose at the back of the machine. Solution going to the tools is sprayed into carpet or upholstery and extracted.

7.7 OVERALL REVIEW

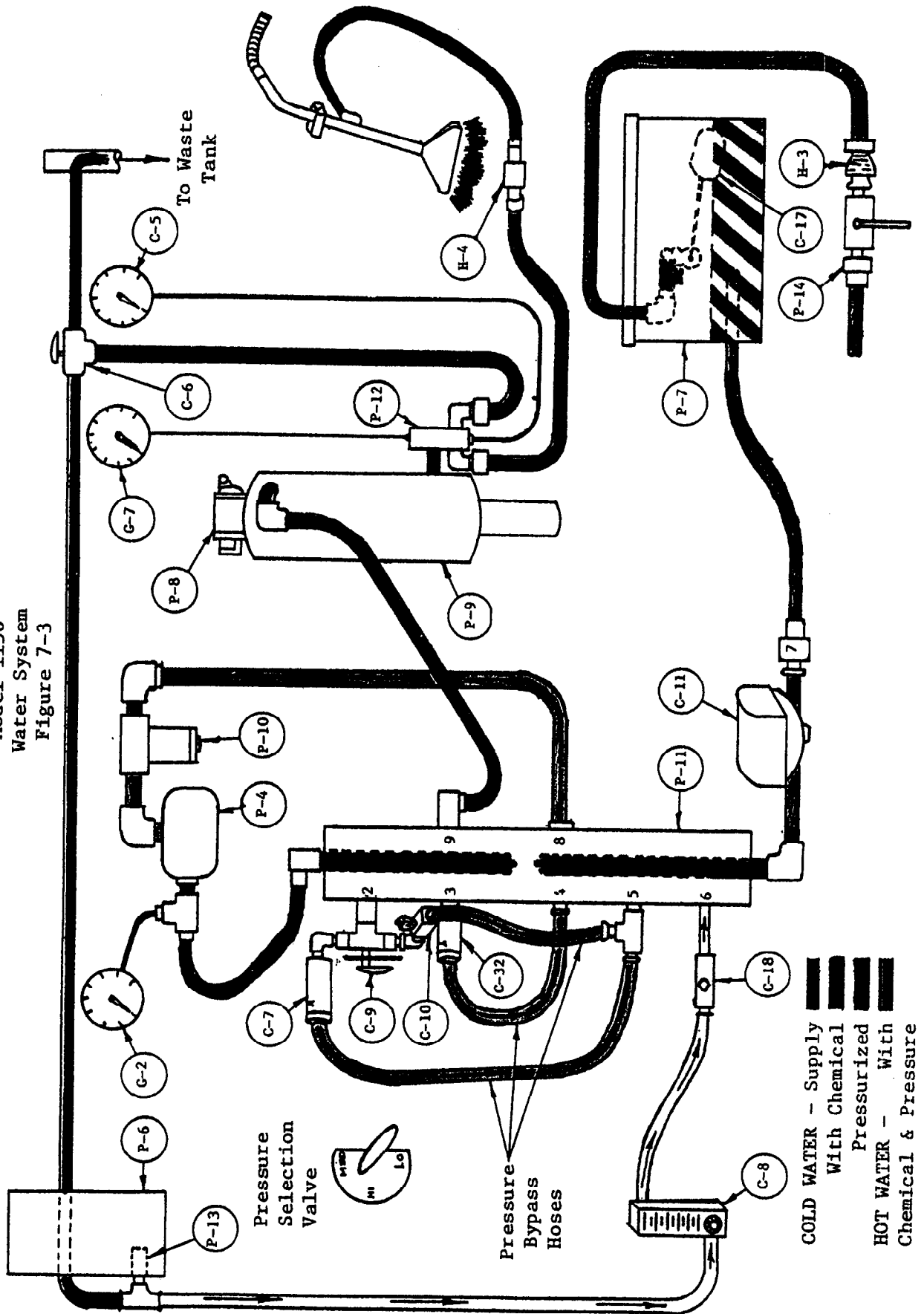
The water system is a linear (in line) system, with three possible loops and four branches. Refer to Figure 7-3. The color coding for the water flow is as follows: green until cleaning solution is added, light blue until pressurized, dark blue until heated, then red. In line are the cold water supply (green), holding tank (green), lower cluster block (light blue), pump (dark blue), upper cluster block (dark blue), line to the heater (dark blue), and finally the solution supplied to the tools (red). There are three possible loops from the upper cluster block to the lower cluster block (light blue) for pressure control. The four branches of the water system are:

1. Cleaning solution line from the solution tank into the lower cluster block (no color).
2. Fill line for the solution tank from the warm-up/fill valve (no color).
3. Pressure gauge line from the pump (no color).
4. Warm-up line from the heater to the vacuum input line (red).

The holding tank is filled with water from an outside source by means of the water supply pressure. From the holding tank to the pump, intake pressure is zero. From the pump on, the solution pressure is controlled by the setting of the pressure regulators. This pressurized solution is brought to the pre-set temperature as it passes through the heater, with no change in pressure.

POWERMATIC CLEANING PLANT

Model 1150
Water System
Figure 7-3



Section 8

SOLUTION HEATER SYSTEM

8.1 OPERATING CONDITIONS

The solution heater system is diagramed in Figure 8-1. The heater is one compact assembly, interconnected with several other elements of the unit. The heater burns only when:

- 8.1.1 There is 110 VAC power supplied.
- 8.1.2 Pump clutch switch must be ON.
- 8.1.3 The heater switch (C-4) is ON.
- 8.1.4 There is water flow through the flow switch (C-11) to open solenoid valve.
- 8.1.5 It receives fuel through an open solenoid valve (air must be bled from lines for fuel to reach heater).
- 8.1.6 The output solution temperature is lower than that desired.

If any one of these six conditions is not met, the burner is NOT ON. When conditions 1 and 3 are met, the blower motor, heater fuel pump, and igniter are ON.

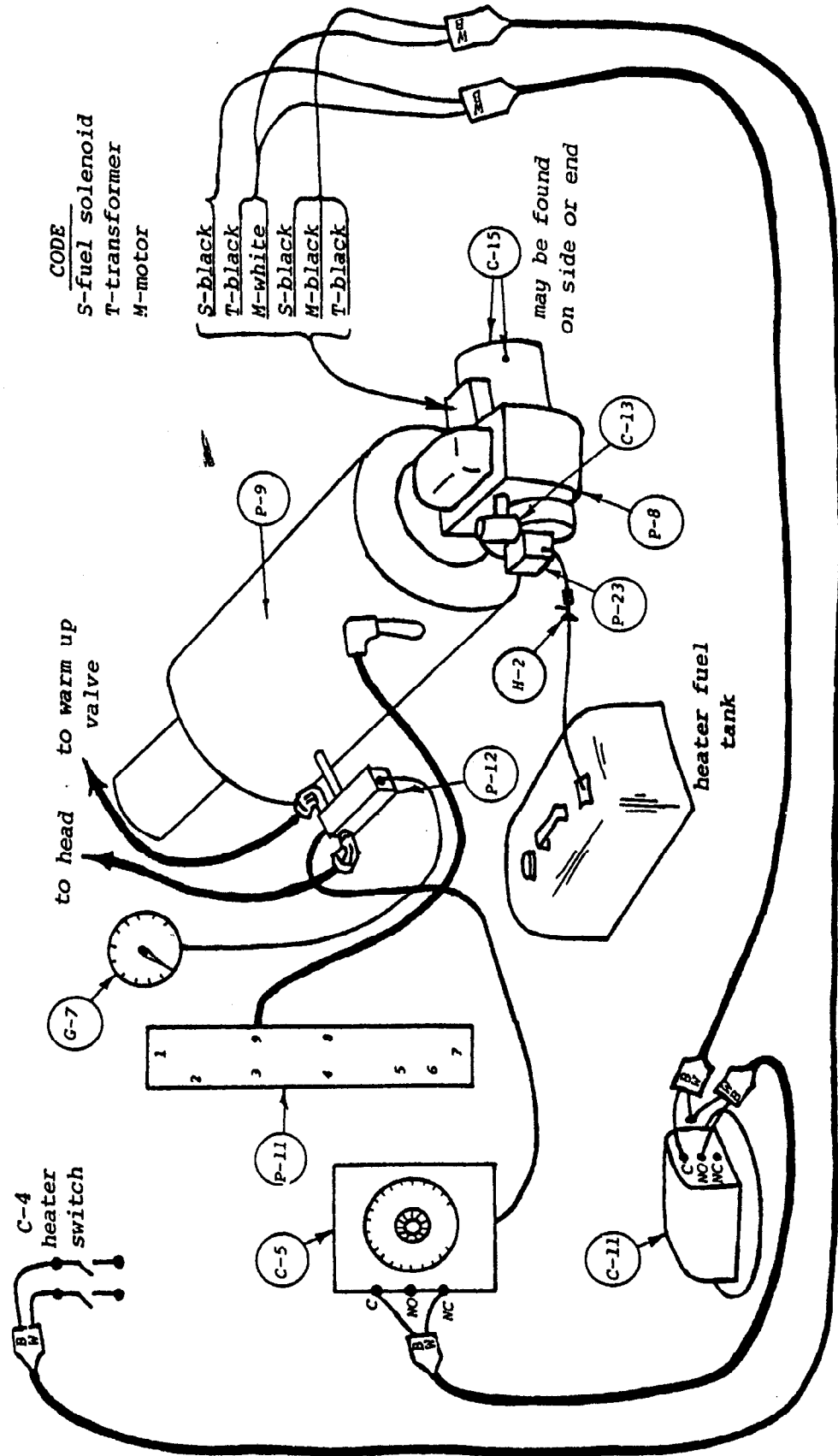
8.2 TEMPERATURE CONTROL

The temperature control (C-5) is a thermostatic control for the water heater. The water temperature indicator reads the temperature at the heater output brass cluster (P-12, Figure 8-1). The temperature setting at 12 o'clock on the dial indicates the temperature desired by the operator. If the temperature setting at 12 o'clock is below the temperature indicated on the temperature gauge, the heater is OFF. If the temperature setting at 12 o'clock is above the temperature indicated on the temperature gauge, the heater can be ON. Notice that unless all of the other five conditions are satisfied, the heater is still OFF.

The maximum temperature setting should not exceed 225° F. At 225° F, the unit is cleaning with wet steam; higher temperatures are unsafe. Due to high heating capacity of the heater and because the temperature is read at the brass cluster, outside of the heat exchanger, the temperature indication may overrun the setting. You may set the temperature down to, say, 150° F, for cleaning upholstery. Always set the temperature all the way DOWN when the unit is OFF.

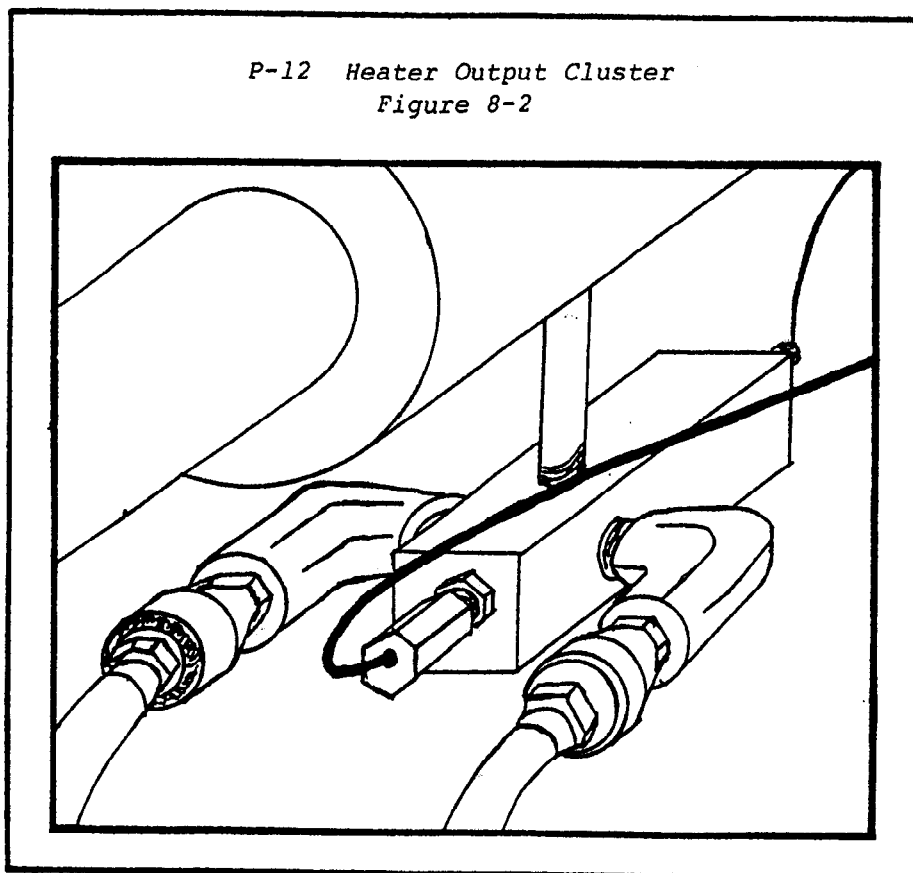
POWEROMATIC CLEANING PLANT

Model 1150
Heater System
Figure 8-1



8.3 HEAT EXCHANGER

Solution flows from the cluster block connection #9 to the heat exchanger (P-9, Figures 7-3 and 8-1) in the heater. In normal operation the solution is under pressure (400 psi), on its way to the cleaning tools. The heat exchanger is where it is heated. When the blower/heater is ON, the mixture flowing through the heat exchanger is heated; its temperature is sensed at the heater output brass cluster. The heater heat capacity is quite high; so the solution is soon hotter than required. The heater turns OFF. There is considerable residual heat in the heat exchanger; so the hot flow continues for a while before the temperature falls below the requested value and causes the heater to turn back ON. The normal operation is for the heater to cycle ON and OFF two or three times a minute, keeping the solution at the proper operating temperature. Hot solution flows from the exchanger to the heater output brass cluster (P-12), where its temperature is read, and to the tools through hookup (H-4), or to the warm-up valve drain through the warm-up valve.



8.4 HEATER BURNER

The heater is a gun-type oil burner. The blower is a centrifugal fan which is connected directly (on the same motor shaft) to the heater fuel pump. When there is 110 VAC power, TURN ON the heater switch, and the burner motor, the fuel pump, and the igniter are energized. When the blower is ON, you should be able to detect the airflow at the intake and exhaust. When the igniter is ON, the blue spark is visible through a crack, or you can loosen the screw and slightly lift the transformer on top on the hinges. These three items: the blower, igniter, and fuel pump, run all the time. Thus, when heat is required, nothing has to start or come up to speed.

When heat is required, more things happen. If solution is flowing, the flow switch (C-11) detects it and is ON. If the indicated temperature is below the set temperature, the temperature control electrically opens the fuel oil solenoid (C-13) and fuel flow starts. Since the blower and igniter are already running, the fuel ignites and heat is carried through the heat exchanger. As the solution heats up, its temperature is detected by the temperature control. Soon the set temperature is reached, the temperature control electrically closes the fuel oil solenoid, and the fuel flow stops.

Also observe that even if the heater is on and you turn the cleaning head OFF, the flow switch turns off and the fuel oil solenoid CLOSES, stopping the fuel flow. With the high heating capacity of the system, a noticeable variance above and below the set temperature will be observed during cycling of water flow.

In normal shutdown, the heater goes OFF as soon as the solution flow stops. When you turn the heater switch OFF, the blower, igniter, and fuel pump go OFF. Always have these OFF before throttling down the engine.

8.5 FUEL SOLENOID

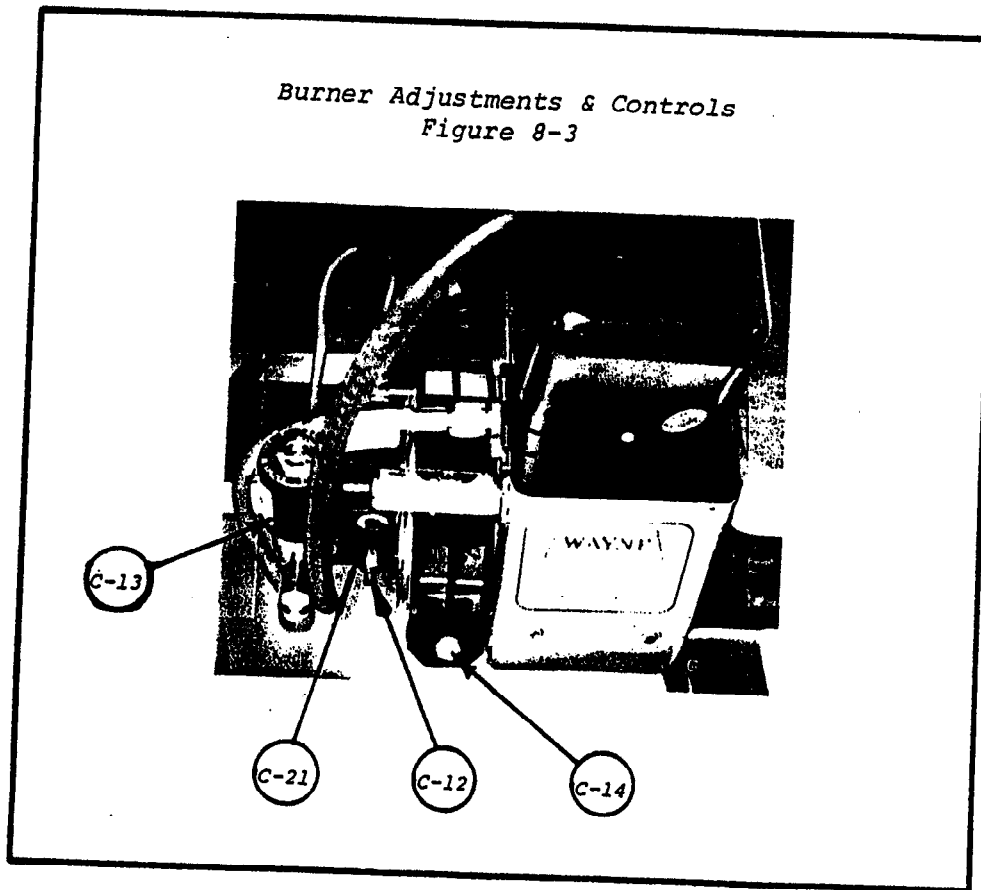
The fuel solenoid (C-13, Figure 8-3) is a key element in the operation of the heater. In normal operation, it cycles several times a minute. It is important to be able to check it for proper operation.

If heater action is not attained during normal operation and the click of the fuel solenoid is not obvious, a second check may be made:

- 8.5.1 Shut water flow OFF, cleaning head OFF, and warm-up valve OFF.
- 8.5.2 Disconnect the yellow jacket hose on the output side of the solenoid at the gun assembly fitting.
- 8.5.3 Put the hose end in a bottle (for fuel, if it runs).
- 8.5.4 Start water flow with the warm-up valve.
- 8.5.5 Turn the temperature control temperature setting up past the indicated temperature. As the setting passes indicated temperature

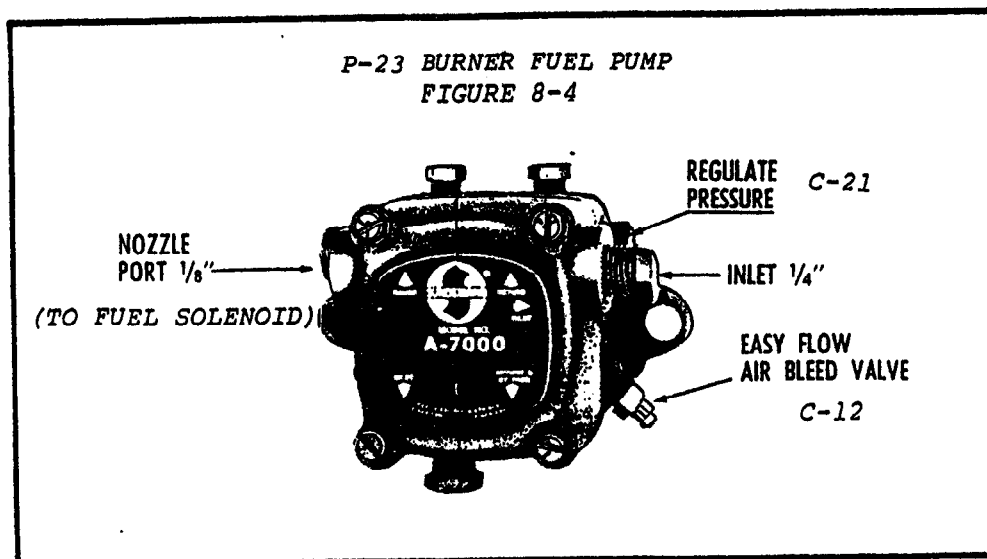
(if the other five conditions for burn are satisfied), the fuel solenoid should click and fuel should run. Turning the setting down below the indicated temperature should cause another click, and the flow should stop. If this does happen, the problem is in the heater assembly or in the fuel. If this action does not occur, trouble can be in the electrical circuit to the solenoid, malfunction of the solenoid itself, or a clogged fuel line. Make the electrical circuit tests first. See Section 13, Electrical System Checks.

- 8.5.6 Reconnect the yellow jacket hose to the gun assembly fitting after the problem is corrected.
- 8.5.7 The above procedure may be checked with the engine off. Using a 110 VAC extension cord, supply the machine circuit with external power by attaching the extension cord to the machine power core (from back of alternator). Turn on the heater switch. Supply the water system with water by connecting the water supply hose to connection #7. Turn on supply hose and open warm-up valve to achieve necessary water flow. Then proceed with 8.5.1.



8.6 FUEL AND ADJUSTMENT

- 8.6.1 The proper heating fuel for this heater is kerosene, #1 diesel, #1 home heating oil, or another equivalent. Check with your local suppliers if you have problems finding the correct fuel. Use of too volatile a fuel causes a real hazard of explosion, and use of too gummy or oiled fuels will cause the heater to gum up, reducing efficiency and finally preventing operation. Be sure to use the proper fuel! See Section 5.1 for an important note on conditioning of burner fuel in cooling, damp weather.
- 8.6.2 It is necessary to bleed the heater fuel line for original start-up and also if the fuel supply is used up. Fill the heater fuel tank with suitable fuel. Locate the bleeder valve (C-12, Figure 8-3). Loosen the valve with a 3/8" box end wrench, re-tighten to finger tightness. Put a catch pan or jar in place to catch the bled fuel. Start the unit, using normal procedures (Section 6.1) or refer to 8.5.7, except that vacuum hoses and floor tools do not have to be out. Have an adequate water supply. When everything but the heater is running, set the temperature control for a higher temperature than being sensed. This should cause an audible click in the heater solenoid. Open the bleeder valve and allow the stream of fuel to continue until it is steady and clear and there are no more bubbles. Close the bleeder valve, tighten it snugly with the wrench. Heater fire should occur within seconds after you close the bleeder valve. Remove the bled fuel. Shut the unit down. (Additional trapped air may necessitate repeating the above procedure.)



- 8.6.3 The fuel oil pressure to the heater is controlled by the fuel oil pressure control (C-21, Figure 8-3) on the fuel pump. This is set at the factory at 115 to 120 psi static and 100 psi operating pressure. One-quarter turn changes the pressure 3 to 4 psi. If proper psi cannot be maintained, water condensation may be present in the pump.
- 8.6.4 The heater air control is set at the factory in Denver (at 5000 feet above sea level). For proper combustion and maximum efficiency, this should be changed for significantly different operational altitudes (500 feet vertical change). The heater air adjustment band locking screw (C-14, Figure 8-3) should be loosened for adjustment. With the screw loose, the two flat bands may be moved around on the air intake chamber. Proper operation is obtained when the heater emits a low-toned roar. Too lean, too little air causes smoky exhaust; too much, too rich air causes a sputtery-sounding burn. Operation at or near sea level will require considerable closing, compared to the factory setting. Tighten the air-adjustment band locking screw when the adjustment is complete.

Figure 8-5
BURNER ADJUSTMENT

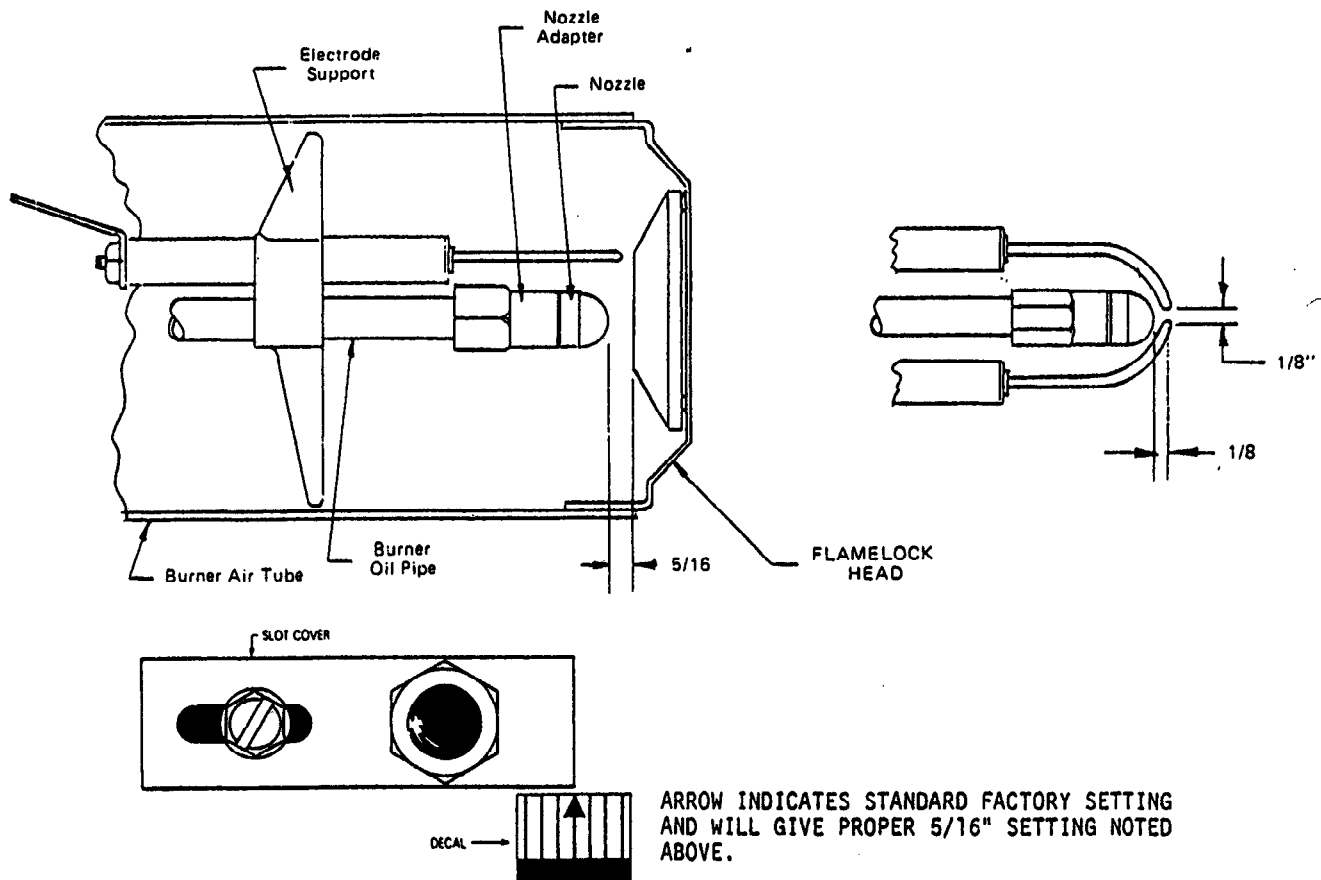
Removing Gun Assembly: Disconnect the oil line at the fan housing and remove lock nut on copper tube fitting. Remove transformer hold-down screws and swing transformer on hinge. Gun Assembly can now be removed through this opening.

BURNER NOZZLE

Check nozzle size as to conformance to installation requirements. Install nozzle by screwing into hexagon adapter.

Nozzle Adapter: This burner is equipped with a dribble-proof nozzle adapter which will accomplish intended results only when installed with the stamped word "TOP" in the correct position.

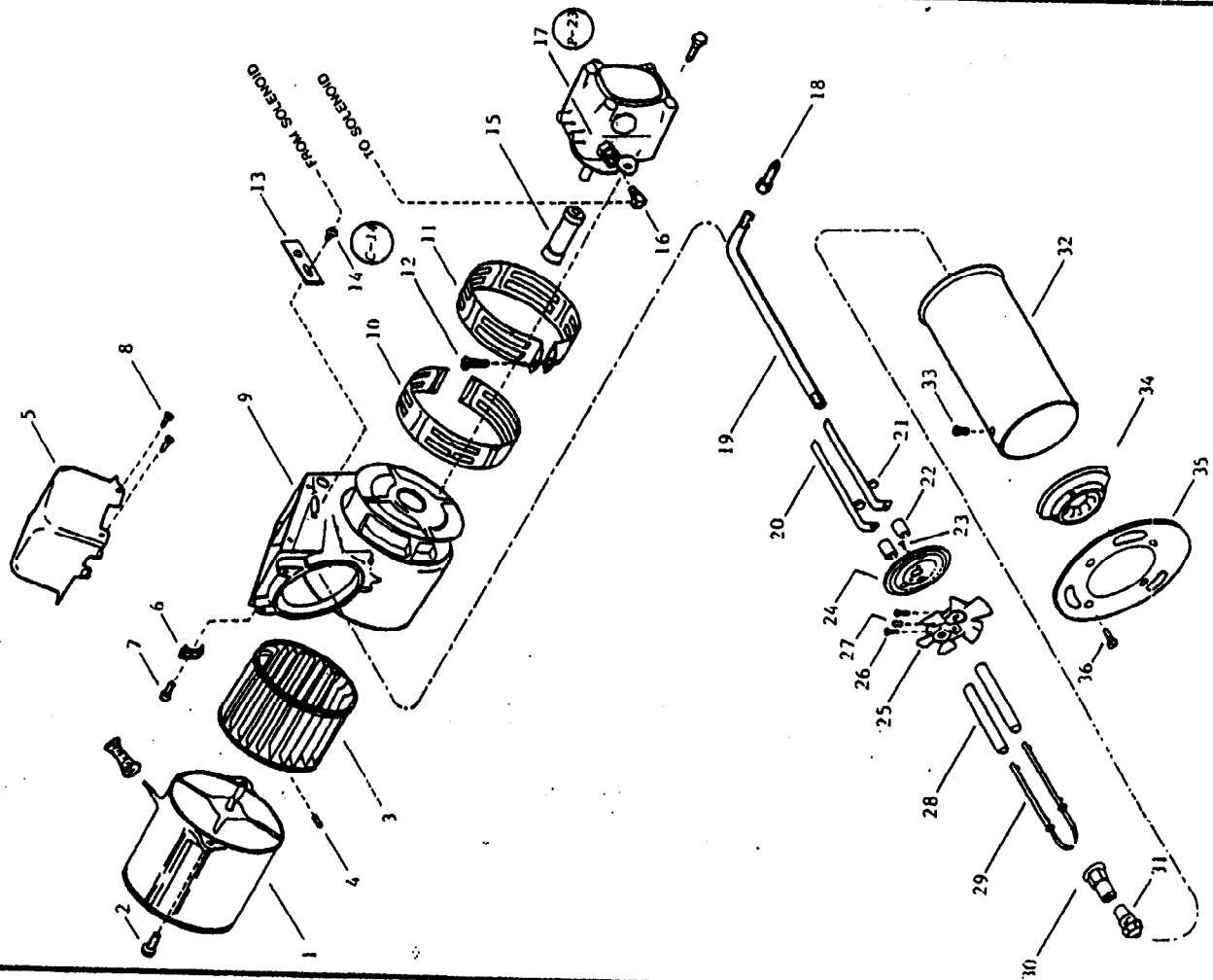
Spacing of Electrodes: The electrodes should be spaced 1/8 inch apart. They should extend 1/8 inch beyond the end and 1/2 inch above the center of the nozzle tip as shown in drawing below



Air Adjustment: The air intake is located on the left side of the blower housing and consists of two interlocking bands. To adjust, loosen screw in outer band and position band by rotating to the desired opening. Retighten screw after adjustment to assure permanent adjustment.

Sufficient air should be introduced into the fire until a Number 1 or trace of smoke is obtained. (Check with smoke tester). The screws should then be locked in position.

P-8 OIL BURNER
Exploded View
Figure 8-6



Item no.	Description
1.	Motor 1/8 HP - 3450Rpm
2.	Motor Mounting Screw
3.	Fan
4.	Fan Set Screw (Included w/fan)
5.	Transformer
6.	Transformer Hold Down Clip
7.	Transformer Hold Down Clip Screw
8.	Transformer Hinge Screw
9.	Fan Housing Assembly
10.	Air Adj. Band - Inner
11.	Air Adj. Band - Outer
12.	Air Band Screw
13.	Oil Line Adj. Slot Cover
14.	Oil Line Slot Cover Screw
15.	Pump Coupling
16.	Oil Line Elbow
17.	Fuel Unit
18.	Oil Line Fitting
19.	Oil Pipe
20.	Buss Bar
21.	Pinnut
22.	Insulator Bushing
23.	Baffle Plate Screw
24.	Baffle Plate
25.	Stabilizer - Reversed
26.	Rd. Head Machine Screw - Electrode
27.	Set Screw
28.	Insulator
29.	Electrode Stem & Washer
30.	Nozzle Adapter
31.	Nozzle
32.	Air Tube
33.	Air Cone Mounting Screw
34.	Air Cone
35.	Flange
36.	Flange Mounting Screw

Section 9

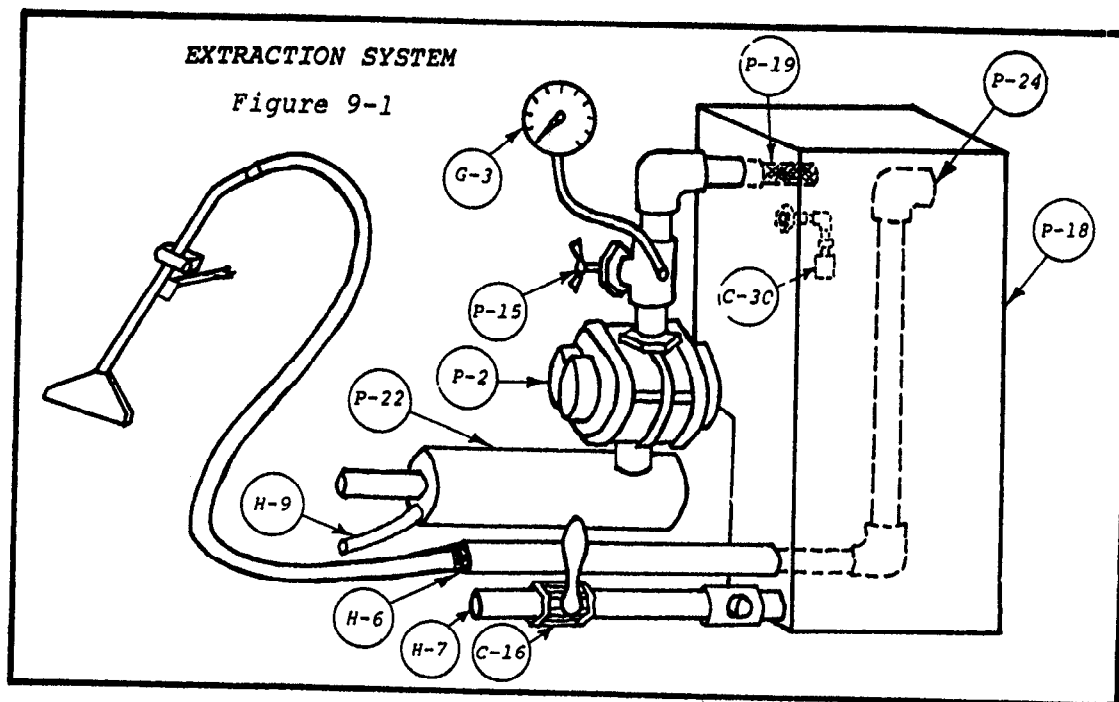
EXTRACTION SYSTEM

The extraction system in your unit is a high capacity (97 gallons) waste recovery tank. You may clean from 1100 to 2200 square feet of carpet between waste dumps, depending on how soiled the carpet is.

The extraction system consists of three major parts:

1. The blower (P-2, Figure 9-1) with vacuum relief valve (P-15) and silencer (P-22).
2. The waste recovery tank (P-18, Figure 9-1).
3. Floor tools and hoses.
(See Section 14, Floor Heads and Accessories)

The vacuum lines must be tight for efficient extraction. The floor tool picks up solution, which is carried to the waste recovery tank (P-18). The waste water is left in the tank, the air going into the top line to the vacuum blower and out the silencer (P-22), while the waste water settles in



the tank. The waste water is dumped periodically. If the waste water reaches the level of the float switch (C-30), the water pump clutch is disengaged; no more solution is pumped until the waste water is dumped.

When flood water extraction is being done, no blower protection exists. If the carpet is wet, less than one tank will generally be pulled. If standing water is visible, the tank should be checked frequently.

9.1 VACUUM BLOWER

The vacuum blower (P-2, Figure 5-3) is the heart of the extraction system. It is a Sutorbilt positive-displacement blower, powered by direct, in-line drive from the engine. The Blower Manual is in Appendix Section 16.5. Scheduled maintenance of the blower includes lubrication and periodic checks of the blower oil level. To enjoy long, trouble-free life for your blower, read the Blower Manual and pay strict attention to the lubrication requirements.

The blower is equipped with a vacuum relief valve (P-15, Figure 5-1). If the vacuum line were to become blocked, the blower is capable of drawing down a very high vacuum, causing internal damage to the blower. To prevent this and the resulting collapse of the vacuum lines and tank, the blower is equipped with a vacuum relief valve, set by the manufacturer to operate at about 13 inches of mercury vacuum. Do not readjust!! The normal operating vacuum is in the range of 10 to 11 inches of mercury.

You may check the vacuum by covering the vacuum hose connection (H-6, Figures 9-1 and 5-2) with something that seals well. If the vacuum relief valve is working properly, the total pressure over the vacuum connection can be 30 to 35 pounds; be careful of hands! With the vacuum hose connection covered, check the vacuum gauge (G-3). It should read about 13 inches of mercury vacuum, with the engine running about 2600 rpm (60 to 62 hertz on frequency meter). Never try to cover the vacuum relief valve openings. Closing the valve and the inlet can result in almost 70 pounds force on each inlet (very bad for hands).

The input to the blower from the tank is the central pipe in the tank. It is supplied with a filter (P-19, Figure 9-1). This filter keeps harmful material out of the blower. **KEEP THE FILTER CLEAN AND IN PLACE WHEN OPERATING.** Remember, the blower operates all the time the engine is running.

The output of the blower goes through the silencer before being exhausted to the environment. The silencer quiets the exhaust and dampens the pulsations caused by a positive-displacement blower. As the exhaust is quite humid and water can collect in the silencer, a drain hose (H-9, Figures 9-1 and 5-2) is provided for draining the water. Place this hose at the door of the truck before starting the unit. Keep all the vacuum connections tight and snug.

Daily Maintenance to the blower is a must for long life. During normal operation of the unit the blower is drawing damp air continuously. When the

unit is shut down this damp air will condense in the blower and if left for any period of time will rust the vacuum chamber causing excessive wear.

If the unit is to be shut down for more than two (2) hours it is suggested before complete shut down, the lid be removed from the waste recovery tank and the blower be allowed to draw air for two to three minutes to allow drying. This alone will reduce greatly the chance of rust and, towards the end of this operation, pour 1/8 of a cup of light machine oil or rust inhibitor into the vacuum relief valve while pushing in, to give even a more positive insurance policy against wear due to corrosion.

Once a week, at least, a flushing agent should be run through the blower to remove all foreign material from the impellers and impeller chamber followed by the oil or rust inhibitor treatment.

In the case of a known blow-over of foam the flushing procedure should be followed at the end of the job or serious damage can occur due to soap build up.

Please note: Problems to the blower can occur and if the blower is damaged because of blow-over the Fuller Company does not consider it covered by their warranty.

Before a long period of down-time (vacation, etc.), it is wise to flush and lubricate the impellers of the blower as described above to insure a properly working unit when it is again put into service.

9.2 WASTE RECOVERY TANK

The waste recovery tank (P-18, Figures 5-1 and 5-3) is a 97-gallon capacity tank of marine aluminum. The large capacity will allow the cleaning of a sizeable amount of carpet before having to dump the waste.

The incoming air and waste enter the bottom of the tank and are carried near the top in an interior tube. On the inside of the tank, the waste and air separate. The air finds its way into the air filter near the top of the tank. The air goes through the filter and on to the blower. The waste water settles to the bottom of the tank. Once the solution depth reaches the float switch, the solution pump shuts off. It is then necessary to dump the waste water out the drain. To dump the waste water.

- 9.2.1 Turn the engine off, following the shut-down procedure of Section 6.5, and remove the tank top. The lint screen on the blower inlet must be kept clean. A clean lint screen also means more efficient air flow.
- 9.2.2 Have the dump hose connected (H-7, Figure 5-2) and run to a convenient drain. Turn the dump valve (C-16, Figure 5-3) to OPEN.
- 9.2.3 Flush the tank with clear water from the water supply hose. Be sure the pump float switch is free on its spindle. If foam or

water goes through the blower, it promotes rapid rusting in the blower. Keep the float switch clean!

- 9.2.4 When the tank is clean, the water OFF, and the dump valve CLOSED, replace the top and start up again.

9.3 PRESSURE WASH HOLDING TANK

The waste recovery tank can be converted to a water holding tank for remote pressure washing through a filter system mounted on the left side of the frame. To make this conversion several steps are necessary the first of which is the most important.

- 9.2.1 Flush the tank thoroughly washing out all the lint, sand, and dirt. This can be done with the water fill hose. Be very thorough with this procedure.
- 9.3.2 Remove the pvc plug from the Tee on the dump valve line and connect the hose from the copper pipe.
- 9.3.3 On the left side of the machine the filter system supply hose is hanging in a clip. Remove this hose from the clip. Remove the holding tank hose from #7 connection and place it in the clip. Connect the filter system hose to the #7 connection.
- 9.3.4 Using the water supply hose fill the waste recovery tank with clear cold water. The water level should be left four (4) inches below the blower filter screen inside the tank. When full, transport to the job site.

Before starting the unit for pressure washing open the ball valve
- 9.3.5 on the filter system so the pump will not be started dry. Set the pressure selection valve to high (800#), then start the unit in the normal manner.
- 9.3.6 Upon completion of pressure washing with the waste tank used as a holding tank drain the tank, reconnect the normal holding tank to #7 on the cluster, turn of the ball valve on the filter system then clean the filters. The screen in the "Y" strainer must be removed and cleaned and the strainer unit washed out. The cartridge in the large filter should be removed and disposed of and the holder then washed out and a new cartridge installed. Disconnect the hose from the Tee (9.3.2) and replace the plug.

Section 10

POWER SYSTEM

The power system in your Power-Matic unit makes you independently able to clean any place you can get into that has a water supply. There is no need to hook up to electrical sources or look for hot water.

There are two major components in the power system:

1. The engine.
2. The alternator.

10.1 ENGINE

The engine on your Power-Matic is a gasoline-powered, air cooled engine. In Appendix Section 16.5 is the Engine Owner's Manual, describing maintenance and trouble-shooting procedures for the engine. There are several things that will be pointed out in this section that can be of importance.

10.1.1 The engine is to be operated on regular leaded or unleaded gasoline.

10.1.2 A single weight high detergent motor oil of good quality is to be used, the weight varying with the seasons as normal operations of any gasoline engine would dictate. The factory supplies Pennzoil in the engine. The engine is shipped with 30-weight oil. If the daytime temperature is 80°F or higher, 40-weight oil should be used.

General Service Schedules are established in the owners manual. This covers all major items that would need attention from the operator of this engine. In addition it is suggested that the oil and filter be changed at the end of the first five operating hours, the normal break-in period of the engine.

The engine gauges are on the control panel and consist of an automotive ammeter and an oil pressure gauge. Under normal operating conditions, the ammeter will indicate a very small charging rate. Normal oil pressure should be about 35 pounds per square inch. For your protection, if the oil pressure drops below 15 psi for any reason, an oil pressure kill-switch (C-23) will kill the engine to prevent internal damage.

Remember, proper preventive maintenance at pre-determined and prescribed intervals can prevent serious corrective maintenance that is costly, not

only in replacement parts but also in down-time. Read thoroughly all instructions in this manual and in the appendix manuals to make certain proper maintenance procedures are established and followed. Change your oil regularly. Turning engine oil to pudding is not proper maintenance. CHECK THE OIL LEVEL DAILY.

10.2 ALTERNATOR 110 VAC

The 110-volt, 60-hertz power required for operation of the heater system is supplied by a two-bearing alternator. The alternator used has a rated capacity of 2000 watts (18 amperes) at 110 volts, single phase, 60 hertz. With the engine operating about 2600 rpm, the alternator will be turning at the proper 3600 rpm. This is a heavy-duty alternator and is built with life-time-lubricated, sealed bearings; therefore, service to the alternator should be absolutely minimal. One important point: during cleaning of the unit in any manner, keep water out of the alternator. Water could cause shorting and burning out of the alternator. Schematics for the 110-volt electrical system supplied by this alternator are in Section 11. The alternator is supplying power to operate:

1. The heater, which includes the fan, the igniter transformer, and the fuel solenoid valve.
2. A double 110-volt electrical outlet on the end of the alternator.

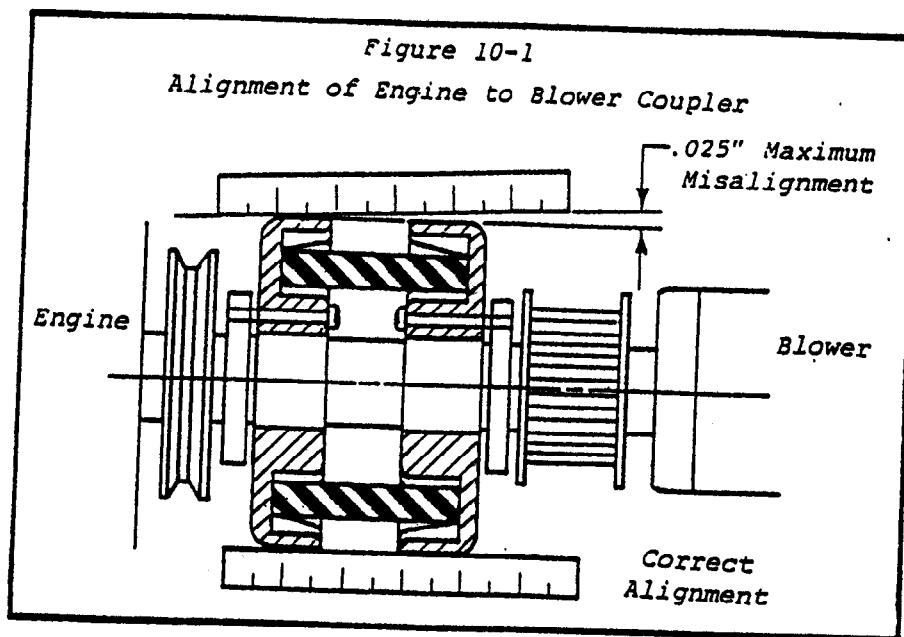
Limit the power drawn through these outlets to 10 amperes maximum! However, two 100-watt bulbs can be lit after the engine has begun operation. Always disconnect or turn OFF all electrical items during startup of the engine under any conditions. For startup and shutdown, turn all electrical switches OFF and disconnect all devices plugged into outlets.

WARNING: LOW VOLTAGE CAN CAUSE THE RESET ON THE FAN MOTOR TO KICK OUT. BEFORE STARTING ANY ELECTRICAL DEVICES, 60 TO 62 HERTZ MUST BE MAINTAINED.

10.3 BELT AND DRIVE MAINTENANCE

The Hypro pump and blower details are given in Sections 7.4 and 9.1. The blower is driven directly from the engine with a flexible coupling. The pump is driven with a V-belt and the alternator with a timing belt, and they require some maintenance. The Hypro pump, alternator, and blower mounts must be kept secure and tight. Learn to check your drive belts. If the drive belt is too tight, the wear rate of the bearings on both shafts is high. If the drive belt is too loose, the belt vibrates excessively and will soon fail. Firm pressure in the center should deflect the Hypro pump and alternator belt about 1/2 inch. To adjust a belt, loosen the mounting bolts and move the assembly appropriately; tighten the bolts and check the belt. Keep the shafts parallel to the engine shaft. Keep the belts properly adjusted at all times. Whenever you observe serious cracks or belt

wear, replace the belt. Tighten the replaced belt the same as a used belt. Assume that the belt will not stretch; if it does, then readjust the tension. To attain long life of the sleeve in the engine to blower coupler, the flanges of the coupler should be kept aligned, with a minimum allowance of .025" misalignment. This must be checked at four (4) points around the outside edge of the flanges.



10.4 GASOLINE

The engine requires regular gasoline engine fuel. Unleaded fuel is recommended, however, leaded fuel may be used. Keep the gas tank clean. At regular intervals clean the fuel filter located at the bottom of the fuel pump. You may use the vehicle tank as your fuel source for the unit engine. If you do this, watch the fuel gauge carefully; running out of gas to start your van would be an unpleasant complication.

10.5 BATTERY

The 12 VDC lead/acid battery is used for starting; it is your lifeline to your operation. Take good care of it. Keep it filled with distilled water. Watch the charging rate: normal is a very small positive charge after a surge to recharge the starting current. If there is a continuing discharge with no apparent cause, trouble shoot the 12 VDC system at once (see Section 13). The battery residual charging rate will slowly increase as the battery gets older. Keep all terminals, connections, and cables clean. In colder weather, keep the battery charged to prevent freezing.

10.6 AUXILIARY ELECTRICAL POWER

In event of alternator failure, operation may continue on a temporary basis by connecting to an extension cord run from the job location. Unplug the main power connection from the back of the alternator. Run a grounded 12/3 extension cord from this plug to the closest 110 VAC outlet on the job. For this type of operation it is absolutely necessary to use a three-wire cord. Use this only as a temporary measure.

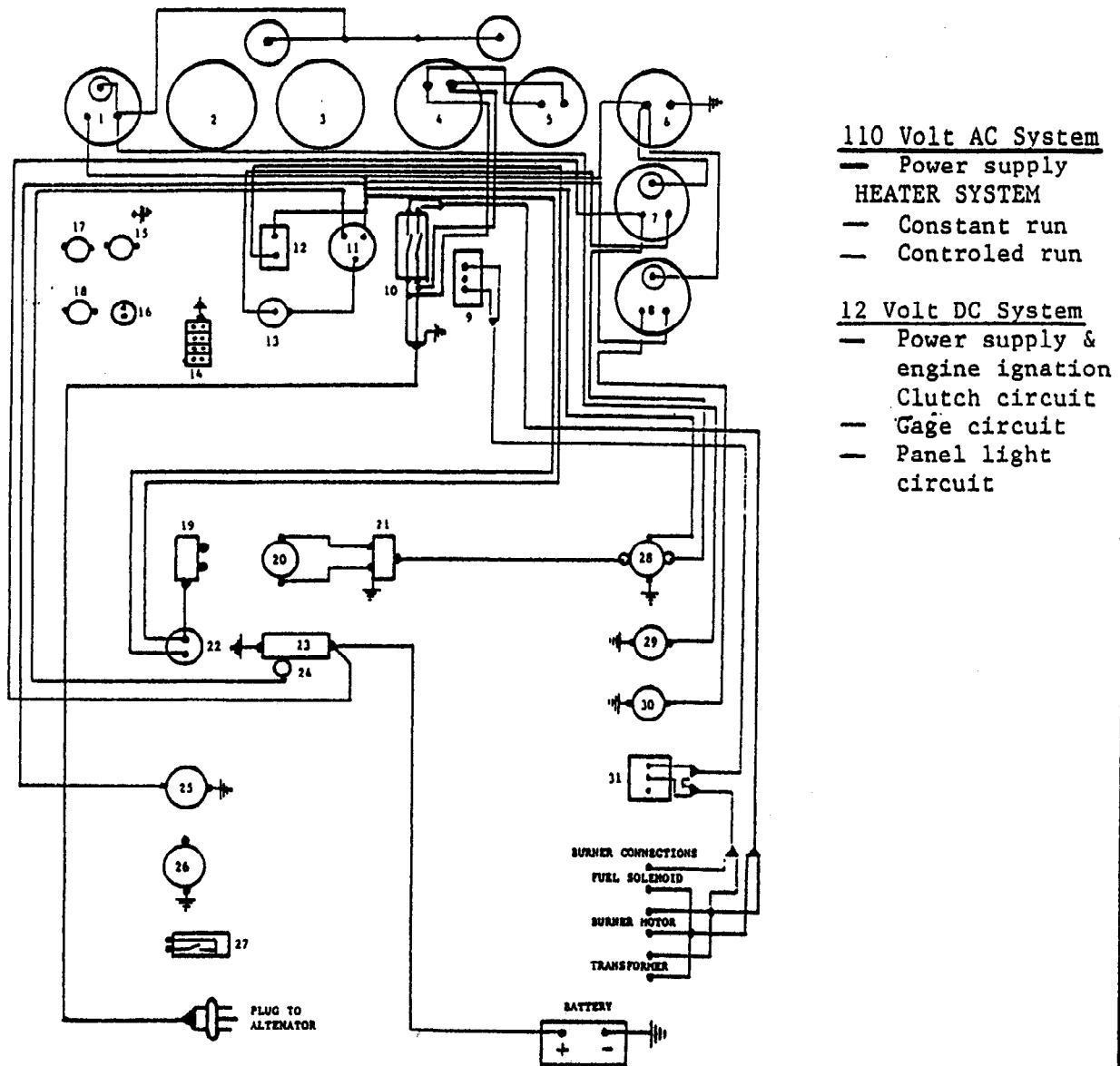
Section 11

ELECTRICAL SYSTEM

The unit has two independent electrical circuits. The 12 VDC circuit is powered by a 12-volt automotive battery (P-5, Figure 5-1), augmented by an engine flywheel alternator with diode rectifiers. A regulator keeps the battery charged when the engine is running. The 12V system powers the engine starter, fuel pump, engine ignition, pump clutch, and the gauges. The 110 VAC 60-hertz circuit is powered by the alternator driven by the engine. When running, the alternator supplies power to the heater burner unit and to any 110 VAC items plugged into the outlets provided. These two circuits, 12 VDC and 110 VAC, are electrically independent, although the wiring brings them into close association in some places in the unit.

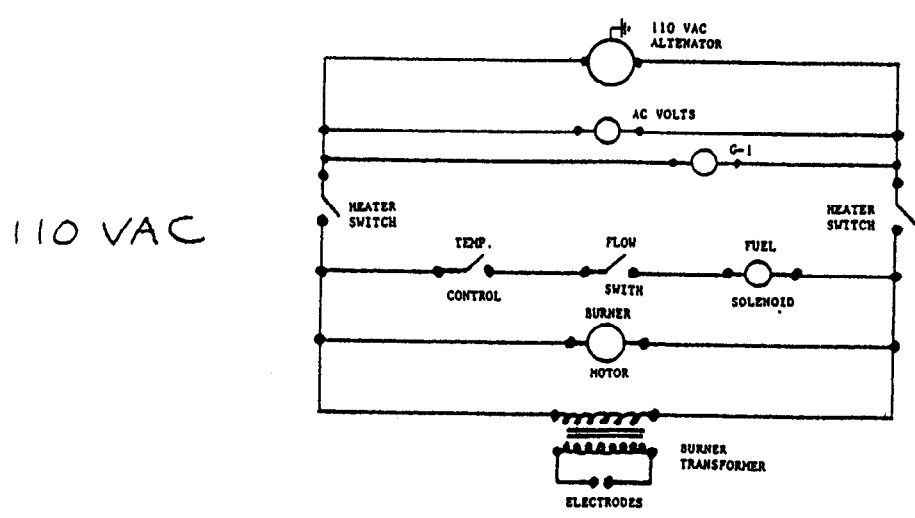
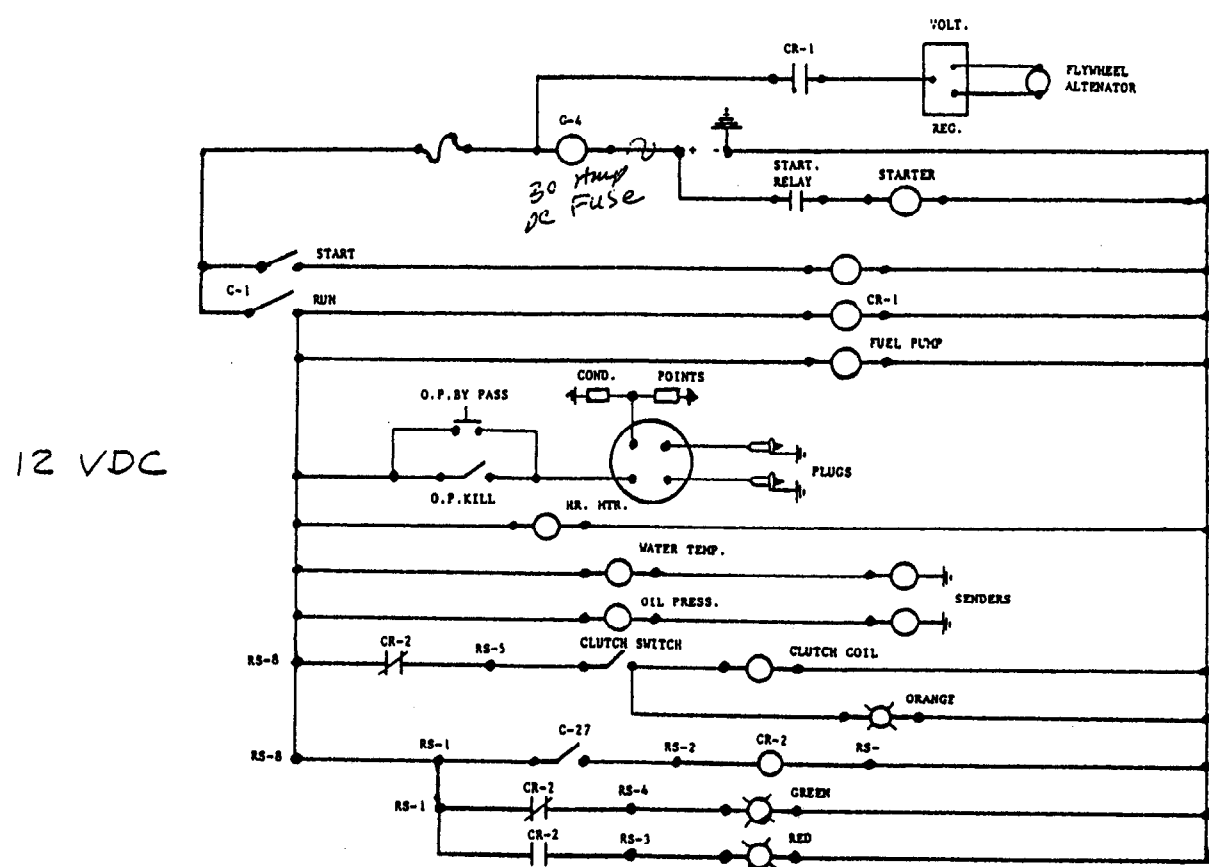
The overall wiring schematic is given in Figure 11-2. The overall wiring diagram is given in Figure 11-1. Keep all electrical connections tight, contacts bright and clean. All wires should be kept clean and dry. You are working with water, heat, soaps, and cleaners, gathering in dirt. All of these can harm electrical circuits. Keep the electrical circuits clean and dry.

MODEL 1150 POWER-MATIC WIRING DIAGRAM
Figure 11-1



- | | | | | | |
|----|------|--|----|------|--------------------------|
| 1 | G-7 | Water Temp. Gauge | 16 | C-26 | Pump Clutch Switch |
| 2 | G-2 | Pressure Gauge | 17 | | Green Light |
| 3 | G-3 | Vacuum Gauge | 18 | | Orange Light |
| 4 | G-1 | Frequency Gauge | 19 | | Ignition Coil |
| 5 | G-8 | AC Volt Meter | 20 | | Flywheel Alternator |
| 6 | G-6 | Hour Meter | 21 | C-20 | Voltage Regulator |
| 7 | G-4 | DC Amp Meter | 22 | C-23 | Oil Press Kill Switch |
| 8 | G-5 | Oil Pressure Gauge | 23 | | Starter |
| 9 | C-5 | Temperature Control | 24 | | Starter Solenoid |
| 10 | C-4 | Heater Switch | 25 | P-17 | Electric Fuel Pump |
| 11 | C-1 | Ignition Switch | 26 | | Coil - Pump Clutch |
| 12 | C-22 | Push Button Switch
(Oil Pressure By Pass) | 27 | C-30 | Float Switch-Waste Tank |
| 13 | | Fuse | 28 | C-19 | Relay (Volt Reg Cut Off) |
| 14 | | Relay Socket | 29 | | Water Temp. Sender |
| 15 | | Red Light | 30 | | Oil Press. Sender |
| | | | 31 | | Flow Switch |

MODEL 1150 POWER-MATIC WIRING SCHEMATIC
Figure 11-2



MAINTENANCE CHECK LIST
Figure 12-1

EVERY	JOB	DAY	WEEK	SIX MONTHS	50 HOURS	100 HOURS	500 HOURS	NOTES	
	Lint Screen - Waste Recov. Tank								
	Dump Valve Closed								
	Supply Water On								
	Start Engine								
	Speed 60 Hertz								
	Pressure - 400 psi								
	Engine - Oil	Check	*First Change		Change			Dangerous if 500 psi is exceeded for carpet cleaning 30W or equivalent	
	Oil Filter	Check	*First Change			Change		Check tightness each job	
	Air Filter								
	Gasoline Filter								
	Decarbon Engine		Check						
	CAT PUMP-OIL								
	Condition of Clutch Surface	Check			*First Change		Yes	250 hrs when using leaded gasoline	
	Belt Tension	Check			Check		Change	Special Formula Cat Pump Oil Steam Way Part No. 4810106	
	Vac Blower							3/4" Deflection Maximum	
	Bearing Grease							Lubriplate #630AA	
	Crank Case Oil	Check					Grease	Lubriplate #4	
	Impellers	Lube					Change	Spray Cable Fluid or Light weight motor oil	
	Heater - Fuel Filter							Refer to Section 5.1 for water condensation	
	Alternator - Belt Tension	Check			Check			1/2" Deflection maximum	
	Solution Tank Level	Check						Preferably not over half full when moving	
	Tightness of:								
	Pulley & Sprocket Set Screws		Check						
	Bolts & Nuts - Major		Check						
	Condition of Coupler & Sleeve		Check						
	Hour Meter	Check	Check (Check hours indicated on meter and schedule necessary maintenance as indicated above)						See Section 10 Figure 10-1 for proper alignment

where first change is noted, this is a one-time operation. Follow regular maintenance schedule after this change. The engine valve lash must be reset every 200 hours. This is a good time to check for carbon as the heads should be removed to check valve and seat condition before setting valve lash.

KEEP UNIT CLEAN - AS NEEDED

Section 13

TROUBLESHOOTING

There is a wide variety of things that can happen during operation of your unit. Here we cover very typical problems that may occur, and tell you what to do about them. We have not covered all possible problems; but with the manual, our suggestions, and your ingenuity, you should be able to identify correctly almost any possible problem and its solution.

Before going to the troubleshooting charts, it may be helpful to study your problem on the control panel. It has been found that our instruments can tell a definite story if we learn to read them.

INSTRUMENT TALK

Pressure Gauge Readings:

In all the following cases, the idle pressure will hold steady at the top-end setting of 450 psi.

If, when the jets are opened:

- A. Pressure drops to 400 psi operating, then slowly falls to as low as 275 psi, this indicates a regulator problem.
- B. Pressure drops to approximately 300 psi and bounces rapidly, this indicates air in the pump inlet line. The greater the bounce, the closer the air leak is to the pump inlet port.
- C. Pressure drops to normal 400 psi, then rapidly drops to 200 psi, starts rapid bounces and continues to drop to 0 psi (with jets off, pressure returns to 450 psi), clogging of the line strainer screen is indicated.
- D. Pressure drops to 100 psi or less and bounces rapidly, this indicates that one or more pump cups are worn out, or that there is a pressure leak in the tool being used below the control valve.

Vacuum Gauge Readings:

Poor recovery of water or low vacuum readings indicate one of the problems noted in Section 13.13. A systematic sealing off of the system, starting with the center pipe in the waste separation tank, is generally the fastest method of locating the problem. Good gauge reading with poor head recovery generally indicates a clogged lint screen in the waste tank.

The TROUBLESHOOTING CHART is organized in three columns:

1. The problem, as it is likely to appear to you.
2. Our identification of probable causes of that problem.
3. Suitable actions to solve the problem.

The problems are listed in convenient order, representative of an order-of-occurrence as you run the unit. The causes are grouped under the identifying problem. Very similar causes may be listed under different problems, if appropriate. The actions suggested to solve the problems are our best judgments and are a result of fielding many inquiries and of considerable experience with steam cleaners and steam cleaning. However, the action suggested may not always be the best under some circumstances. Use your own knowledge and good judgment.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
<p><u>13.1</u> Low pressure at water supply source</p>	<p>Inadequate supply</p> <p>Partially frozen supply</p>	<p>Preferably find another source. If none is available, connect directly to bottom (#7) of cluster block (figures 7-2 and 7-4)</p> <p>When operating with the outside connection to #7 there is no automatic solution feed.</p> <p>Let water run for a while--if you can get some hot water, it may help thaw pipes; <u>or</u> find another source; <u>or</u> connect directly to bottom of cluster block--see previous paragraph.</p>
<p><u>13.2</u> Low pressure at water supply connection to unit</p>	<p>Water faucet not fully open</p> <p>Hose screen clogged</p> <p>Low source pressure</p> <p>Water supply hose kinked or collapsed</p> <p>Air trapped in hose</p> <p>Partially frozen hose or supply</p>	<p>Open faucet fully.</p> <p>Remove, clean, and replace.</p> <p>Preferably find another source. If none is available, connect to bottom (#7) of cluster block (figures 7-2 and 7-4); refer to Section 16.2 for instruction to run heater.</p> <p>Straighten or replace hose.</p> <p>Let water run until air is out of hose before connecting to unit.</p> <p>Keep hose warm in storage. Let water run for a while; if you can get some hot water, it may help thaw pipes or hoses.</p>
<p><u>13.3</u> Low operating pressure or no pressure at all (Also see 13.4)</p>	<p>Inadequate water supply</p> <p>Solution tank dry</p> <p>Pump clutch switch OFF.</p> <p>Faulty clutch relay</p> <p>Burned out clutch coil or lose wire</p> <p>Pump filter clogged</p> <p>Waste separation tank float stuck in up position.</p> <p>Air lock in inlet hose to cluster block</p>	<p>Same as Section 13.2 also see "pump cups" below.</p> <p>Fill tank, or close meter valve.</p> <p>Turn switch ON.</p> <p>Check for replacement</p> <p>Check for repair or replacement</p> <p>Remove, clean, and replace.</p> <p>Clean lint from float switch shaft.</p> <p>Open warm-up valve before turning on pump clutch switch. Connect input water hose to #7 and turn on water with the warm-up valve open to purge the system.</p>

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
<p><u>13.3</u> (Continued)</p>	<p>Excess water escape (very small leaks can cause significant pressure drops)</p> <p>Foreign matter caught in seat of pressure regulator or face and seat surfaces pitted and scarred from water hammer.</p> <p>Waste separation tank full.</p> <p>Pump cups worn, or destroyed from running dry</p>	<p>Close warm-up valve; close upholstery pressure reduction valve; find leak in hose or fittings and tighten or repair; find leak in floor tool and tighten or repair.</p> <p>Loosen lock nut, open the regulator all the way and allow 2 to 3 minutes of water flow to flush valve; reset regulator, and tighten lock nut. May have to repeat setting 4 to 5 times.</p> <p>Drain tank.</p> <p>Replace cups: See Hypro Pump Manual</p>
<p><u>13.4</u> Low Operating pressure with large fluctuations in gauge readings (also see 13.3)</p>	<p>Air in pump intake line</p> <p>Airlock in suction side pump</p> <p>Pump valve stuck or cups worn</p> <p>Too much grease in pressure regulator valve.</p>	<p>Find leak, fix or tighten connection (there are over 40 connections in the solution water lines); open warm-up valve to flush air; see previous sections if supply is inadequate. Relieve trapped air in cluster through fitting at position #10. You can hook into #7 on the cluster block, drawing from a bucket of water, to help isolate trouble, if this helps, the problem is between #7 and the holding tank.</p> <p>Open warm-up valve, connect water supply purge system, reconnect hoses for normal operation, restart engine.</p> <p>Replace cup, or clean valve.</p> <p>Open valve and wipe out excess.</p>
<p><u>13.5</u> Pressure higher than 450 psi WARNING: Open warm-up valve <u>immediately</u></p>	<p>Wrong setting on pressure regulator valve</p> <p>Improper operation of pressure regulator valve</p> <p>Heater running continuously (temperature indicating higher than 250° F)</p>	<p>Reset the pressure regulator valve to 450 psi or lower.</p> <p>Loosen lock nut, back pressure regulator valve setting off completely, reset.</p> <p>Heater <u>OFF</u>, at once! Trouble Shoot flow switch, fuel solenoid valve, temperature control; if water is flowing causing heater system operation find leak and reseal.</p>

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
<u>13.5</u> (Continued)	Water supply connected directly to bottom of cluster block (#7) and supply pressure improves	If pressure increase is less than 50 psi, there is no problem (see Section 7.7.2). Reset regulator during this operation. If increase is over 50 psi, reset regulator or reconnect to normal water supply to holding tank.
<u>13.6</u> No cleaning action	Low Pressure Scaling in water system Water Temperature Low Solution Tank line clogged Solution strength too weak.	Refer to 13.3 and 13.4 Descale machine (refer to Section 16.3) Clean solution tank line by draining solution tank and flushing with very hot water; if necessary, remove line and open with wire.
<u>13.7</u> Holding tank overfills (pressure too high)	Angle of truck Improper adjustment of float Float valve stuck or dirt on seat	Set in most level place available. Clean valve, make sure float runs free.
<u>13.8</u> Burner will not fire	No electrical power Heater Switch OFF Thermal reset on burner blower motor TRIPPED Temperature control set too low No water flow No fuel Fuel Solenoid failed (no fuel flow even when solenoid clicks, or no click even when power applied) Weak ignition transformer	Establish 110 VAC power to heater system. Turn ON. RESET it. (Trouble shoot burner fuel pump for seizure). Set desired temperature at 12:00 O'Clock on dial. Turn on pump clutch. Turn warm-up valve or head valve ON; if water supply is inadequate, see Section 13.1. Fill tank and bleed air, or clear fuel line and filter, check Q.D.'s for proper connection (tank and machine), check all fittings for tightness. Replace solenoid. Replace transformer if spark is weak.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
<u>13.8</u> (Continued)	Heater fuel pump fails to pump fuel	Water in fuel oil. Trouble shoot flow switch, fuel solenoid valve, and temperature control.
<u>13.9</u> Heater comes on, but water does not get hot.	Boiler scale in heater coil	Descale heater coil: See Descaling Section, Appendix 16.3.
<u>13.10</u> Heater does not go OFF when solution flow stops or when temperature is above setting	Solenoid valve stuck; <u>CAUTION:</u> Danger of overheating Faulty flow switch Faulty microswitch in Temperature Control	Turn on warm-up valve to maintain water flow; turn heater switch OFF to stop heater fuel pump; remove and repair, or replace, solenoid valve. Replace flow switch. Replace microswitch in Temperature Control
<u>13.11</u> No 110 AC Voltage	Engine speed too low Open circuit Lost Polarization Belt broken Pulley loose Engine coupling sleeve failed Tie-downs loose Alternator failed Plug loose or not connected in alternator power receptacle.	Adjust throttle. Fix circuit, tighten connections, replace meter, as appropriate. Check fuse. Flash the field, Flow instruction given on page 7 in the Onan Alternator Manual (use the orange wire supplied in the box on the alternator for contact to positive brush). Replace belt. Align and tighten pulley. Replace Sleeve. Reposition alternator and tighten. Repair or replace alternator; the auxiliary power cord may be used while the alternator is out of service; see Section 10.6. Contact local Onan Service Center. Plug it in.
<u>13.12</u> Low Vacuum	Dump valve OPEN Vacuum screen filter restricted. Waste recovery lid not on waste recovery tank, crooked. Vacuum gauge connecting tube broken	CLOSE dump valve. Clean or replace filter Replace lid or position squarely on tank. Replace tube to vacuum gauge.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
<u>13.12</u> (Continued)	Faulty vacuum relief valve Vacuum hoses or connections leaking Loose or slipping engine drive coupling Faulty gauge 18" floor head vacuum relief cap stuck open Silencer output restricted. Clogging of vacuum input tube of machine	Check valve for shaft or seat wear. Replace faulty valve. Be sure hoses are connected properly; repair or replace hoses or connectors. Realign and tighten, or replace. Replace gauge. Unstick cap, or replace Remove restriction Insert one end of the 2" vac hose in the muffler output with the machine running. Stand clear of the input pipe and put the other end of vac hose into the waste tank riser pipe. The clog will be blown out with definite force.
<u>13.13</u> No fuel to engine	If engine switch ON and no green light--open circuit, faulty switch, or blown fuse If engine switch ON and Green light ON---open fuel pump circuit, or faulty fuel pump	Find break in circuit and fix, or replace switch, or replace 12V fuse. Find break in circuit and fix, or replace fuel pump.
<u>13.14</u> No oil pressure CAUTION: Extreme damage can occur!	No oil in engine Plugged oil line Faulty oil pressure gauge. Oil pump not working Engine oil too light weight.	Fill to proper level Find and remove restriction in oil line. Replace gauge. See Onan Service Center. Replace with heavier oil.
<u>13.15</u> Oil pressure high	Oil dirty Oil passages clogged	Change oil See Onan Service Center.
<u>13.16</u> Engine Drive Coupling failure	Shaft misalignment Some deck plate bolts loose (causes deck warpage)	Realign engine/vacuum pump shafts Put accurate straight edge full length of deck plate, tighten deck plate bolts to straighten deck plate.

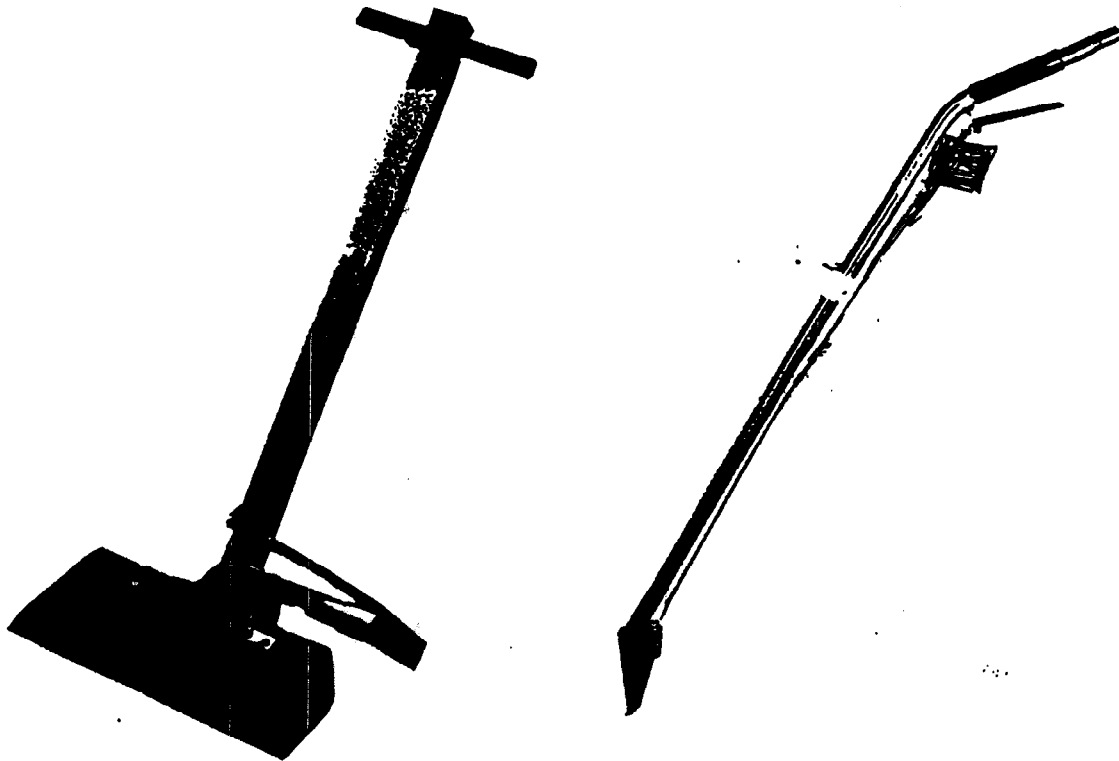
PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
<u>13.16</u> (Continued)	Taper lock bushing or flange loose.	Realign and tighten.
<u>13.17</u> Excessive machine vi- bration	Rough running engine Worn pump V-Belt Alternator mounting bolts loose Deck plate bolts loose Misaligned engine drive coupling	See Onan Dealer Check for wear, replace if neces- sary Align and tighten Check, retighten as under 13.16. Check, realign, retighten. Refer to Section 10, Figure 10-1.

Section 14

CLEANING HEADS, HOSES, ACCESSORIES

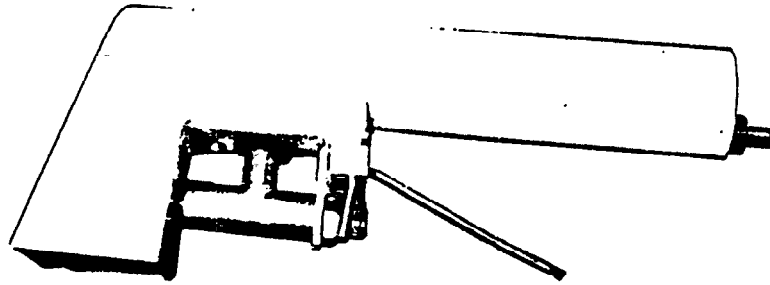
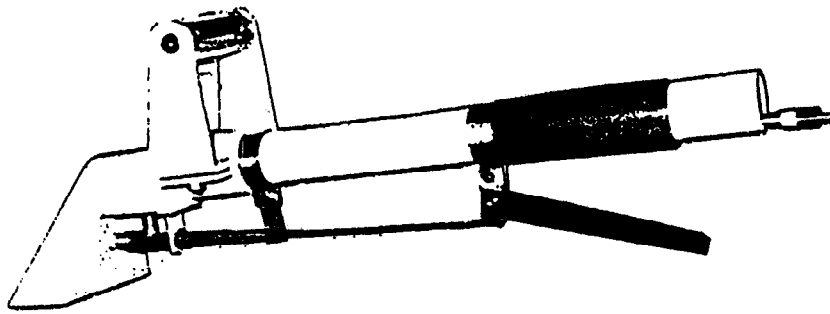
This section briefly describes the various cleaning heads, hoses and accessories available for use with the truck-mounted units.

Carpet cleaning can be accomplished with either the 10" scrub wand or the 18" floor unit (drag wand). Both are heavy duty industrial tools often selected strictly by individual operator preference.

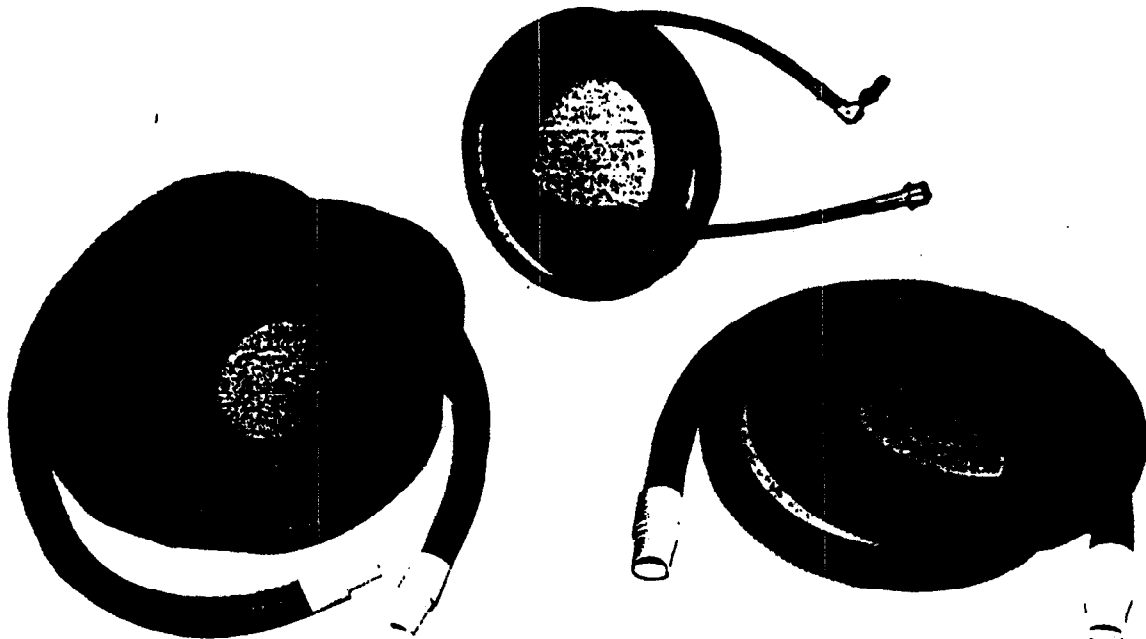


Stair cleaning is most conveniently accomplished with the light weight stair tool. The use of this tool requires the use of the mini-head adapter, a unit designed to transfer the solution hose inside the vacuum hose for less cumbersome operation.

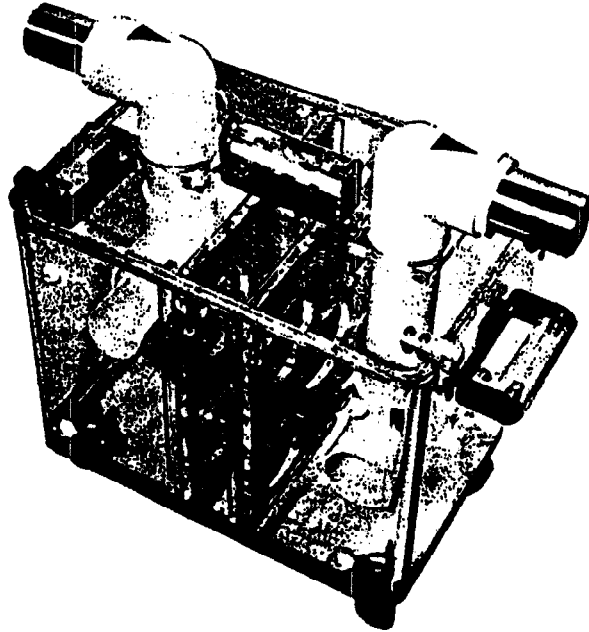
A light weight upholstery tool is offered for upholstery cleaning. This tool also requires the mini-head adapter for connection.



Working hoses consist of industrial vacuum hose and special high temperature and pressure solution hoses. The hoses are selected to give maximum wear life with a minimum of care.



Accessories available include a view-master filter unit. This is a clear plastic filter unit that can be connected in any 2" vacuum line and serves two purposes. The first and most important function is the collection of sand and lint. The filter can be placed in an easily visible location so that the operator can watch to prevent clogging from occurring. This keeps clogging materials out of the waste tank. Second, and very important from a business standpoint, is the access to a continuing view of the cleaning action by the customer and/or passersby who might stop and watch.



Other accessories available include a two-gallon pressure sprayer for various chemical applications, a shag comb, a carpet comb for grooming just-cleaned carpets, and furniture tabs to protect a damp carpet from furniture contact. Additional accessories available are listed on the supply price list.

Section 15

FIXED SETTINGS - ADJUSTMENTS

Your Power-Matic unit is set by the factory for proper operation. There are several settings that normally do not need adjustment; however, each may require adjustment under some circumstances. Each adjustment is covered in this section.

15.1 PRESSURE SETTINGS

15.1.1 Carpet cleaning pressure adjustment is accomplished by adjusting the C-7 pressure regulator - medium pressure. This pressure is preset at 400 psi with the jets off and 350 to 375 psi with the jets on. Keep the operating pressure for carpet cleaning below 450 psi.

15.1.2 The upholstery pressure adjustment valve C-12 is set to run 100 psi into upholstery tools. It may be reset as high as 150 psi (MAXIMUM!). Normal upholstery requires 100 psi and 175°F. Higher pressure and temperature should be used with caution.

15.1.3 Pressure cleaning pressure adjustment is accomplished by adjusting the C-32 pressure regulator - high pressure. This pressure can be preset to any desired pressure for pressure washing. 800 psi is an average usage pressure, however, up to 900 psi can be obtained with the proper pressure gun jet.

15.2 The heater fuel oil pressure control (C-21, Figure 8-3) is set at 110 psi operating pressure. To make this adjustment, a "T" must be added to the line with a pressure gauge on the branch. All six operating conditions for the heater (See Section 8.1) must be met. With the heater ON and the pressure gauge in the line between the valve and the heater, unlock the adjustment and adjust the screw to 110 psi (115 to 120 psi with the heater OFF but the fuel pump running). A one-quarter turn changes the pressure 3 to 4 psi; so be careful. After setting the pressure, you may need to reset the air control (see Section 8.6.4 for instructions).

15.3 The vacuum relief valve is preset to relieve at 13 inches of mercury. This is a recommended setting for best air flow (CFM) and blower life.

Section 16

GENERAL DATA

Included in this heading are sections of useful information on your unit as well as the technical manuals compiled by the original manufacturers of components. Read these sections, too, before operating your Power-Matic unit. In case of problems with the engine, Hypro Pump, alternator, or vacuum blower, refer to the appropriate manual in addition to Section 13, Trouble-shooting. There is a great deal of useful and helpful information in this manual; it is available to those who read and use it.

16.1 CHEMICAL USAGE

The chemical manual discusses the chemicals as used with the portable direct cleaning units. The truck mount unit requires a concentrate in the solution tank that is then cut by a metering valve into the water stream. This causes differences in chemical usage and requires several chemicals be used totally different.

16.1.1. Primary Cleaning Agent:

Formula "A" - powder -- Mix in Hot water 5 to 10 oz. per gallon and put in solution tank.

L-1200 - liquid -- Use 1/2 to 1 gallon per eight (8) gallons of water. This chemical will mix cold.

16.1.2. Water Conditioner (Hard Water)

Formula "P" - powder -- Never use this chemical in truck unit. If hard water is a problem install a water conditioner.

16.1.3. Brown-out Controls

Formula "B" - powder (synthetic or cotton)

Formula "D" - liquid (Wool or Wool Content)

A: To prevent brown-out mix one (1) oz. of chemical per gallon of room temperature water and spray lightly on carpet with pressure sprayer after cleaning in normal manner.

B. To correct a "brown-out" mix 2 or 3 ozs. of chemical per gallon of room temperature water and spray heavily on carpet with pressure sprayer. Allow to stand 10 to 15 minutes then vacuum with floor head or scrub wand.

16.1.4. Defoamer

A. Pour 1/4 to 1/2 cup of defoamer into vacuum hose with the machine running. This may need to be repeated several times during the job.

- B. A sponge may be saturated with defoamer and placed near the waste tank input allowing the incoming foam to contact the sponge and break down the foam. The sponge must be secured to the tank in a manner it will not clog in the drain system. Use a wire or strong string to secure the sponge.

16.2 UNUSUAL OPERATING CONDITION FOR LOW WATER SUPPLY PRESSURE PROBLEMS

- 16.2.1. This procedure may be used when the water supply pressure is too low for normal operation. On occasion, particularly in rural areas, the water supply pressure may be too low to furnish an adequate flow to the holding tank. In such a case, the Hypro pump may be capable of drawing, directly from the supply hose, sufficient water for cleaning. To accomplish this, the holding tank hose may be disconnected from the bottom of the cluster Block (#7) and the water supply hose connected directly to the connection. The quick disconnects were made to match to permit this connection. There may be a noticeable reduction or possible total loss of solution draw in this mode of operation. Run your unit very carefully in this case, when the job is completed return connections to normal.

16.3 DESCALING

Scale will slowly form in the heater coil. The actual formation rate depends on several water conditions and on the cleaning agents used. Eventually scale will have to be removed from the heater coil. Descaling is required if the solution flow is restricted, if excessive jet clogging is occurring due to scale flakes, or if the burner heats poorly even when properly adjusted. After descaling, the solution flow should be improved, jet clogging eliminated for a time, and the efficiency of the heater increased. Descaling may be required every 60 to 90 days, possibly even every 30 days in areas with very hard water.

16.3.1. Required equipment.

- 1 Descaling Solution input hose.
- 1 Descaling solution bucket, 5-gallon size.
- 1 Descaler Chemical.
- 1 Descaling solution output hose. (Optional)

16.3.2. Descaling Procedure

1. If the unit has recently been running, cool the unit completely. If it has sat overnight, cooling will not be necessary.

2. Remove water supply hose from the holding tank at the cluster connection #7. Attach the descaling solution input hose and extend outside the truck.
3. Connect together all pressure hoses and remove the quick disconnect from the free end of the last hose.
4. Thoroughly rinse a bucket (5 gallon bucket should be used). Position the pressure hose end about two inches from the bottom of the bucket, and position the solution input hose two to three inches below the water line when the bucket is filled.
5. Fill the bucket with approximately five (5) gallons of COLD water, and add one-half (1/2) gallon of descaling solution. Avoid skin contact by either full strength or cut solution. Rubber gloves are suggested.
6. Start the engine and pull throttle to fast idle. Turn on the pump clutch and watch output hose for flow of solution. If the flow does not start quickly, SHUT OFF engine, as the pump will run dry. Move bucket inside truck so that pump draw is not so great, and restart engine. After flow is established, watch the solution level and make sure the input hose does not suck air. Add cold water, if necessary, to maintain a 3/4 full level. Allow solution to circulate for approximately twenty (20) minutes; then shut off the unit.

NOTICE: No 110 VAC electrical power will be needed.

7. IMMEDIATELY remove the input hose from #7 and allow the hose to drain back into the bucket. Attach the water supply hose to #7 with the valve off. Remove the pressure hose from the bucket and lay it near a drain or run-off area that will not be damaged by the acid solution (keep away from grass or plants). Turn on the water supply to flush. Flush for 10 to 15 minutes. While the machine is flushing dispose of the bucket of descaler and rinse the bucket and input supply hose thoroughly. Before shutting the water supply off open the warm-up valve for 1 to 2 minutes to clear that system of any descaler that migrated in to it. Shut off water supply, close warm-up valve and the flush procedure is complete.
8. Reinstall quick disonnect on the pressure hose end, and unit is ready to go.

- CAUTION:
1. DO NOT USE HOT WATER.
 2. MACHINE MUST BE COLD.
 3. DO NOT BREATHE FUMES OF SOLUTION.
 4. USE RUBBER GLOVES TO PROTECT AGAINST SKIN CONTACT.

Optional Operation:

If the floor unit or scrub wand is suspected of being scaled, change the bucket to a pan or tray into which the jet openings can be directed. If the pan is substantially larger, use ten (10) gallons water and one (1) gallon compound. Remove the jets and connect the last hose to the head, rather than removing the quick disconnect. If both floor tools need flushing, connect the scrub wand and run for five to seven (5 to 7) minutes. Shut off the unit, change to the floor head, and complete the descaling cycle. For flushing following this optional operation, follow step 7 above, except allow the first head to remain for the first fifteen (15) minutes of the flushing, the second head for the balance of five (5) minutes. Then shut off the unit-descaling of unit and heads is complete.

While the descaling procedure is in operation, the jets that have been removed from the heads can be cleaned by dropping them into the bucket or pan during the operation. After the procedure is complete, retrieve the jets and rinse thoroughly with cold water. The jets do not have to be disassembled for cleaning.

If scale is a serious problem, it is possible to reduce the rate of scale build-up by installing a water softener. The water supply is run through the softener to the holding tank and the unit. According to the manufacturer, this will appreciably reduce the rate of scale build-up in the coil.

16.4 LIST OF COMPONENTS

Controls, Gauges, Hook-up and Drains, and Major Components

16.4.1. Controls

			Figure
C-1	42-2A13	Engine Ignition Switch (3 Positions)	6-1
C-2	43-9A10	Engine Throttle	6-1
C-3	43-9A03	Engine Choke	6-1
C-4	42-2A17	Heater Switch	6-1
C-5	44-C007	Temperature Control	6-1, 8-1
C-6	41-4A06	3-Way Valve - Warm-Up/Fill	6-1, 7-3, 8-1
C-7	41-4B06	Pressure Regulator - Medium Pressure	5-2, 7-3
C-8	41-9A15	Soap Flow Meter Valve	7-1, 7-3
C-9	41-4A06	3-Way Valve - Pressure Selection	6-1, 7-3
C-10	41-9A15	Upholstery Pressure Adjustment Valve	7-1, 7-3
C-11*	42-1C02	Flow Switch	7-1, 7-3
C-12		Bleeder Valve - Fuel Oil	7-1, 7-3, 8-1
C-13*	42-1C04	Fuel Oil Solenoid	8-3, 8-4
C-14		Lock Bolt - Air Control	8-1, 8-3
C-15		Reset Button - Heater Motor	8-3, 8-6
C-16	41-OB02	Dump Valve	On Motor
C-17*	41-4A16	Float Valve - Holding Tank	5-3, 9-1
C-18*	41-9A17	Check Valve - Soap Flow	7-3
C-19*	42-2B05	Relay - Engine Voltage Regulator	7-1, 7-3
C-20*		Voltage Regulator	
C-21		Fuel Oil Pressure Control	
C-22	42-2A05	By-Pass Button for C-23	8-3, 8-4
C-23*	42-9M35	Oil Pressure Kill Switch	6-1
C-26		Pump Clutch Switch	
C-27*		12V Fuse 15 Amp	6-1
C-28*	42-2C04	110V Fuse 8 Amp Slow Blow	6-1
C-29*	42-2B06	Clutch Relay	
C-30*	42-1C05	Float Switch - Waste Tank	
C-31		Pump Clutch	9-1
C-32	41-4B06	Pressure Regulator - Hi Pressure	7-2
			7-1, 7-3

*Not an operation or adjustable control; these are internal system controls

16.4.2. Gauges

			Figure
G-1	44-C017	Frequency Meter	
G-2	44-C010	Water Pressure Gauge	6-1
G-3	44-C011	Vacuum Gauge	6-1, 7-3
G-4	44-C015	DC Ammeter	6-1, 9-1
G-5	44-C014	Engine Oil Pressure	6-1
G-6	44-C016	Hour Meter	6-1
G-7	44-C007	Temperature Gauge	6-1
G-8	44-C022	AC Volt Meter	6-1, 7-3, 8-1
			6-1

16.4.3. Hookups and Drains

Figure

H-1	Gasoline Connection	5-3
H-2	Fuel Oil Connection	5-3, 8-1
H-3	Water Supply Connection	5-2, 7-3
H-4	Pressure Hose--Output Connection	5-2, 7-3
H-6	Vacuum Hose Connection	5-2, 9-1
H-7	Dump Hose Connection	5-2, 9-1
H-8	Engine Oil Drain	5-1
H-9	Silencer Drain Hose	5-2, 9-1
H-10	110 Volt AC Double Outlet	
H-11	Blower Oil Drain	
H-12	Hypro Pump Oil Drain	

16.4.4. Major Components

Figure

P-1	16-1010	Engine	5-2, 5-3
P-2	26-1001	Blower	5-3, 9-1
P-3	16-1001	AC Alternator	5-3
P-4	41-0A10	Hypro Pump	5-1, 7-2, 7-3
P-5	42-9M25	Battery	5-1
P-6	16-1005	Solution Tank	5-1, 5-2, 7-3
P-7	16-1006	Holding Tank	5-1, 7-3
P-8	15-1014	Heater Burner Assembly	5-1, 7-3, 8-1
P-9	15-1013	Heater Exchanger Coil	7-3, 8-1
P-10	41-9A04	Pump Input Line Filter	7-2, 7-3
P-11	25-1029	Pump Cluster Block	7-1, 7-3, 8-1
P-12	25-1030	Heater Output Cluster	7-3, 8-1, 8-2
P-13	11-1210	Lint Screen Assembly - Solution Tank	7-3
P-14	41-9M12	Hose Strainer	7-3
P-15	41-4B07	Vacuum Relief Valve	5-1, 7-2, 9-1
P-16	46-T050	Engine Oil Filter	5-3
P-17	43-9A11	Electric Fuel Pump - Gasoline	
P-18	16-1003	Waste Recovery Tank	5-1, 5-3, 9-1
P-19	16-1101	Vacuum Tank Filter	9-1
P-20	44-E407	Alternator Drive Belt	5-3
P-21	44-E507	Pump Drive Belt	7-2
P-22	16-1002	Blower Silencer	5-3, 9-1
P-23	46-T105	Heater Fuel Pump	8-1, 8-4, 8-6
P-24	16-1103	Stand Pipe - Waste Collection Tank	9-1
P-25		Filter System	5-1

16.5 TECHNICAL BULLETINS AND MANUALS

Following are technical bulletins from STEAM WAY INTERNATIONAL and component manufacturers' technical and service manuals. It is wise to review these manuals thoroughly, as mentioned in the text covering the various segments of the unit. In some instances, these manuals contain further detailed maintenance information.