EQUINOX
7200

MANUAL

STEAM WAY
INTERNATIONAL LLC

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(800) 447-8326 www.steamway.com

Equipment Specification Information

EQUINOX 7200

Machine Specifications

- **Engine:** Kohler Command VX 22 H.P. (675 cc) energy efficient industrial air cooled engine.
- **Vacuum:** Series 4900 Ultra-Whisper Vacuum Blower System creates up to 400 cfm airflow, with 340 cfm at 10" Hg.
- **Heater:** MAXTEMP™ High Efficiency Fuel Oil Heating System maintains 250°F *(121°C)* at carpet, with over 2.1 gpm *(7.56 lpm)* of cleaning solution flow. Maintains 200°F at a constant 3.0 gpm water flow for hard surface pressure washing
- **PUMP:** CAT Solution Pump produces adjustable pressures up to 1500 P.S.I. *(86 bar)* with water flow up to 4.5 gpm *(17.03 lpm)*. With clutch system and thermal bypass for protection.
- Usable 70 Gallon *(265 liters)* Marine Aluminum Waste Recovery Tank.
- Harmonic™ Noise Reduction And Tone Control System for quieter performance.
- Construction
  - Industrial Grade Marine Aluminum Frame
  - Powdered Epoxy Coated Finishing Paint
  - Industrial Rated Fittings, Bolts
  - Centralized Positioning Control Panel
  - Machine Safety Enclosure
- Instrumentation
  - Advanced Chemical Feed System
  - Inlet Water Control System
  - Cleaning Solution Pressure Gauge
  - Pressure Regulator
  - Tach/Hour Meter
  - Volt Meter
  - Vacuum Gauge
  - Clutch Control
  - Temperature Control
  - High Temperature Safety Pressure Release
- Dimensions: 25"W x 41"H x 40"L *(63.5cm W x 104cm H x 102cm L).*
- Weight: 540 lbs *(245 kg)*

Performance Enhancing Features

✔ MAXTEMP™ HIGH EFFICIENCY HEATING SYSTEM

(Patent Pending) Uses a double pass tight wound coil technology that uses 50% less fuel to produce 30% more heat. ***(Steam Way Exclusive)***

✔ HARMONIC™ NOISE REDUCTION AND TONE CONTROL SYSTEM

A new noise muffling technology that not only reduces the overall decibel level, but also eliminates the most prominent level of annoying tones.

✔ FOCUS ON SAFETY

Machine design and engineering features include better exhaust directional control mechanisms, reduced exhaust emissions, and access safety panels.

✔ CONVENIENT TO SERVICE

Design CAD programming make all areas of the machine easier to access for service and maintenance work. Everything is accessible from the perimeter.

STEAM WAY® EQUINOX™ 7200 MAXTEMP™ HEATING SYSTEM

STEAM WAY® INTERNATIONAL INCORPORATED
www.steamway.com

4550 Jackson Street 800-447-8326
Denver, CO USA 80216 Fax (303) 355-3516
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EQUINOX 7200
STANDARD FEATURES

The Equinox 7200 is power packed with performance enhancement features that bring together worldwide technology and create world class performance in a smaller, lighter, safer, and quieter package. It brings together all the features you want, without sacrificing the cleaning, sanitizing, and drying performance you really need.

With redesigned and engineered front instrument panels and power drive systems, the Equinox 7200 provides you with cleaning performance unparalleled in the industry.

It also introduces entirely new technology in heating and noise reduction never before used in our industry. Safety of operation is enhanced by many features. Removable side access panels provide safe operation, while also allowing ease of access for maintenance. Directional control over exhaust emissions, as well as tight wound heating coil technology are just a couple of the built-in safety and efficiency features.

Standard Starter Kit

- Steam Way EQUINOX 7200 Cleaning Plant
- 12" *(30.5 cm)* Stainless Steel "Protection Shield" Scrub Wand
- 100' *(30.5 meters)* Lightweight High Pressure and Temperature Solution Hose
- 100' *(30.5 meters)* Industrial Vacuum Hose
- 50' *(15.2 meters)*Water Hose With Input Valve Assembly
- Two Fuel Tanks with Hoses
- 70 *(265 liters)* Gallon Marine Aluminum Waste Recovery Tank
- Hardware For Installation
- Machine Operations and Maintenance Manual
- Platinum Plus™ Protection Plan Warranty
- Steam Way Cleaning Procedures Manual
- 5 Gallon *(18.9 liters)* Solution Container with Connection Line

Optional Enhancement Features

- 100 *(379 liters)* or 50 *(190 liters)* Gallon Usable Marine Aluminum Recovery Tank
- High Performance Waste Water Pumping Syste
- Hose Reels
- Auxiliary Water Tanks
- Dual Wand Conversion Kit
- Truck Pan

Authorized Steam Way® Distributor:

STEAM WAY® EQUINOX™ 7200 MAXTEMP™ HEATING SYSTEM

STEAM WAY® INTERNATIONAL INCORPORATED

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Part # 7207200 3/99

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Before operating your Equinox 7200, THOROUGHLY READ and STUDY this manual.

6/9/99

SECTION 1
INDEX OF FIGURES AND TABLES

SECTION 2
INTRODUCTION

The Steam Way EQUINOX 7200 Truck Mounted Carpet and Upholstery Cleaning Unit by Steam Way International, Inc., is built for simplicity and ease of operation, plus low maintenance. Even though simple to operate and easy to maintain, it delivers a superb job on carpet and upholstery cleaning along with the ability to perform as a high pressure steam cleaner.

This unit comes with the newest innovations of Kohler Engine technology. The power plant is a 22 horsepower Command V twin cylinder engine with hydraulic operated over head valves. Overhead valves yield a higher compression ratio which will cause more complete fuel combustion, even burning for greater fuel efficiency and almost no carbon buildup. The interval between oil and oil filter changes are 100 and 200 hours respectively, which makes routine maintenance a breeze! The engine is equipped with an oil Sentry® switch to stop the engine in the event of low oil pressure.

The new 7200 unit comes equipped with an automotive alternator and clutch operated pump, that can be turned off when water pressure is not required.

The model 7200 uses a fuel oil burner that heats the water. The recommended fuel is kerosene with a consumption of approximately one-half gallon per hour. The temperature is thermostatically controlled and has a safety device, the water flow switch, which allows the heater to fire only when water is moving.

The standard waste recovery tank holds 70 gallons of water, with an optional 100 gallon waste tank available. It is made of aluminum and has baffles for reinforcement and reduced splashing. A screen mounted inside the tank insures that no debris can ever enter the vacuum blower. A cutoff switch is installed near the top of the tank to stop the engine when the tank is full to prevent a blowover. A 2 inch dump valve allows rapid dumping of waste water from the tank.

Remember that water does freeze at 32° F; so whether or not the unit is in use, in transit, or parked, it MUST be protected from freezing.

SAFETY

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

2. Carbon Monoxide is emitted by the gasoline engine and could become lethal if the unit is operated in a confined area. Carbon Monoxide is odorless, colorless and can cause death if inhaled. Never run the engine in a closed garage or similar area. Look for and consider the following:
   A. Location of the vehicle
   B. Wind direction
   C. Dizziness
   D. Unexplained headaches
   E. Symptoms of others who are exposed to this situation

3. Hot exhaust tubes will cause burns to the hands and arms if touched while they are hot. These are all confined to the machine interior, but when performing service or maintenance, use much caution.

4. Moving parts can cause injuries if safety precautions are ignored Always keep loose clothing away from pulleys, belts and shafts when maintenance procedures must be performed with the engine operating. Loose clothing can become tangled and caught in the machine's moving parts and can pull the hand or arm into pulleys or belts, causing personal injury.

5. The battery contains sulfuric acid. To prevent acid burns, avoid contact with skin, eyes and clothing. Batteries produce and explosive hydrogen gas while being charged. To prevent a fire or explosion, charge battery only in a well ventilated area. Keep sparks, open flames and other sources of ignition away from the battery at all times.

6. Gasoline is an explosive fuel. Gasoline is extremely flammable and its vapors can explode if ignited. Do not fill the fuel tank while the engine is running, since spilled fuel could ignite if it comes in contact with sparks. When removing the fuel cap to fill the tank or venting the tank. Use extreme caution to assure that no cigarette smokers and other live flames or sparks are near. If gasoline comes in contact with the skin, wash it off immediately.

7. Kerosene is also a fuel that should be treated with respect, but is not nearly so volatile as gasoline. Use the same precaution with kerosene as discussed in the paragraph above. The kerosene tank should be vented during operation.

8. This unit uses a 12V DC power for the engine that has high voltage spark plug leads, like that of an automobile. Use the same electrical safety precautions observed on an automobile. A high voltage ignitor is used to produce an arc to ignite the fuel in the burner. Much care should be used to prevent electrical shock.

SECTION 3
INSTALLATION OF UNIT

The unit can be either side-mounted or rear-mounted. In either location, it is imperative that the exhaust scoop outlet be located visibly outside the van's interior. There are two very important reasons for this, first to protect occupants that might be in the van's interior, and secondly to keep the hot exhaust air from entering the engine's intake. Also, make sure that when the exhaust scoop is pushed in so that the van doors will close.

Closely inspect that all is clear beneath the vehicle before drilling holes to bolt the unit to the vehicle. Look for such things as gasoline tanks, brake and gas lines, and cross members; and be certain that no damage will result when drilling holes at that spot.

Install your unit in a safe manner, securing the unit so that in the event of an accident, the machine will not advance into the driver or passenger seat. A minimum of three 3/8" bolts should be used with large washers used beneath the floor of the vehicle, so that the bolts will not be pulled through the floor in the event of an accident.

Since the waste tank is not attached to the basic unit, its location can be where desired or applicable. It must be secured as described in the previous paragraph for the machine, using the four bolts to secure the tank. Other equipment in the vehicle should be secure while the vehicle is in motion.

To maintain cooler operating temperatures in the van, a roof vent may be installed. Roof vents are available through your Steam Way distributor or Steam Way International.

SECTION 4
PREOPERATIONAL INSTRUCTIONS

Before starting the machine, several operations must be complied with:

4-1 Fill the gasoline tank (red) with regular unleaded fuel, 87 octane or higher (Kohler's recommendation). The connection hose has a female connector that connects to Point H-1 (Figure 4-2) on the left side of the machine. Fill the kerosene tank (green) with recommended kerosene or #1 diesel fuel. With its connecting hose which goes to Point H-2 (Figure 4-2), bleed it by pushing the male connector against something solid; and by pumping the squeeze ball. All air can be dispensed before making connection to female connector H-2 (Figure 4-2).

CAUTION:

For safety, always leave the supply hoses on the fuel tanks. When it is necessary to remove a tank for filling, remove the hose at the quick disconnect (H-1 or H-2) on the side of the machine. In this way, no incorrect connection can be made. Gasoline must never be applied to the heater, nor kerosene to the Kohler engine.

Condensation of water in the burner fuel tank causes a rapid deterioration of the fuel pump. As condensation of water in the fuel tank cannot be prevented, the addition of a fuel additive is suggested. A standard gas-line antifreeze may be used at a ratio of 2 to 4 ounces per 6 gallons of fuel. The additive is available under many brand names, one of which is Heet®. Another very effective method of removing water from the tank is by dumping the fuel occasionally, especially when the tank is very low on fuel; and by rinsing with a pint of clean fuel, this will remove water and debris from the tank.

Throughout this manual you will find reference numbers on figures, diagrams and drawings. These reference numbers are listed in: Tables 14-1 Controls; 14-2 Gauges; 14-3 Hook-ups, drains and hoses; 14-4 Major components.

4-2 **FLUSHING PROCEDURE** (Before first start-up)

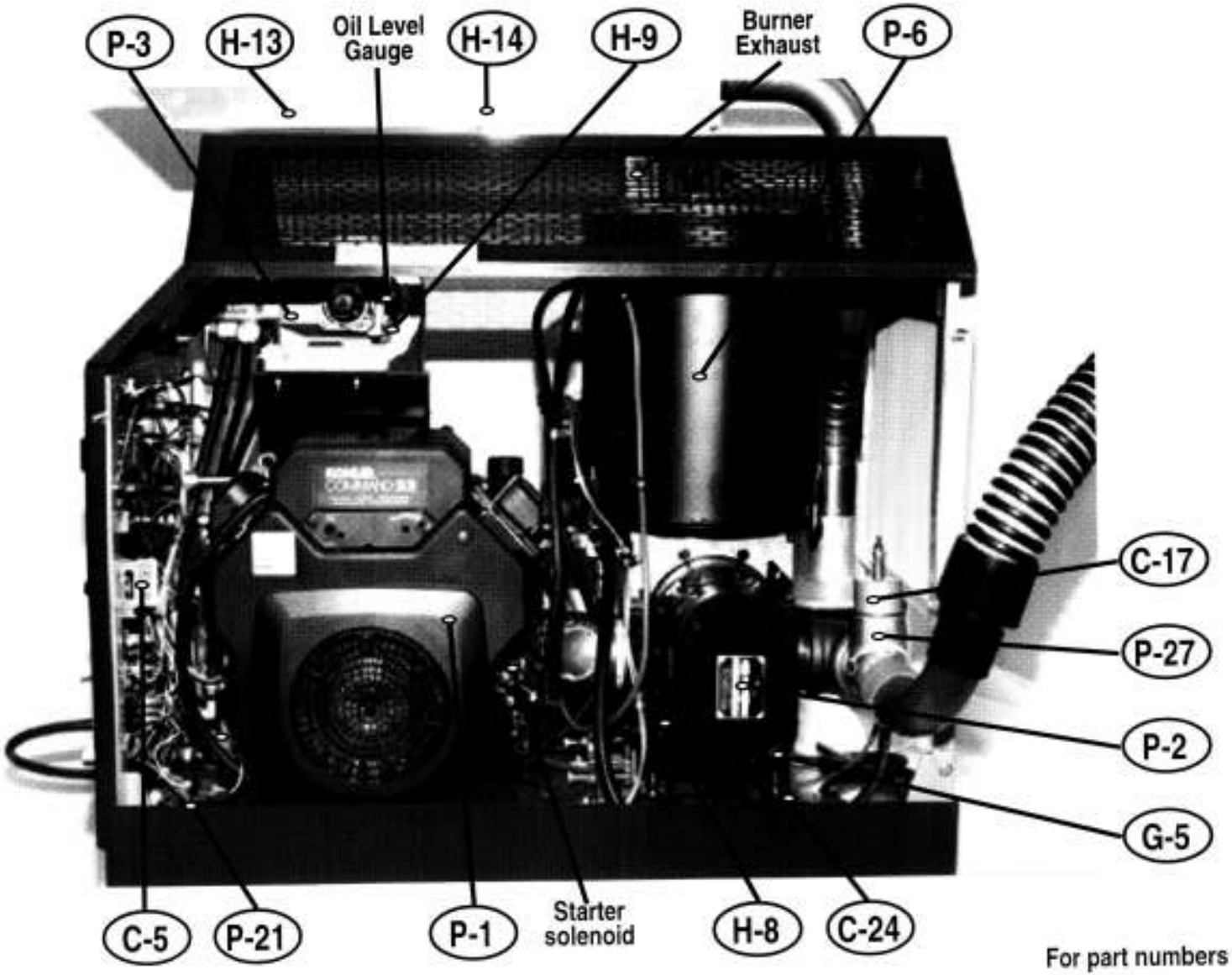
Before filling the water holding tank (P-5, Figure 4-2), disconnect the Q.D. (H-11, Figure 4-2), then connect the water hose assembly that was supplied with the starter package, to the female Q.D. of H-11. Turn the warm-up valve C-23 Fig 4-3 to the on (open) position. Now, turn the water on with the input valve assembly that is plugged into H-11, and the water will flush out antifreeze or stale water that was in the machine during shipping. Within a few seconds, clean fresh water will be observed at the point C-23 Fig 4-3 which will indicate that the flushing procedure is complete. Reconnect H-11 to the water holding tank (P-5) and insert the water input valve assembly to H-3 to fill the water holding tank.

4-3 With the input valve assembly and garden hose attached to the water faucet, you now must fill the water holding tank (P-5) by inserting it into H-3 (Figure 4-3). When the tank is filled to a predetermined level, the float control valve (C-13) will shut the water off.

4-4 Fill the chemical container (P-19) with the desired cleaning agent premixed as instructed by the chemical manual supplied with your standard basic starter kit. Connect the chemical line from the chemical container (P-19) to connector (H-6, Figure 4-2).

4-5 Pull the exhaust scoop to the OUT position. NEVER OPERATE IT IN THE IN POSITION! (H-3 Figures 4-4)

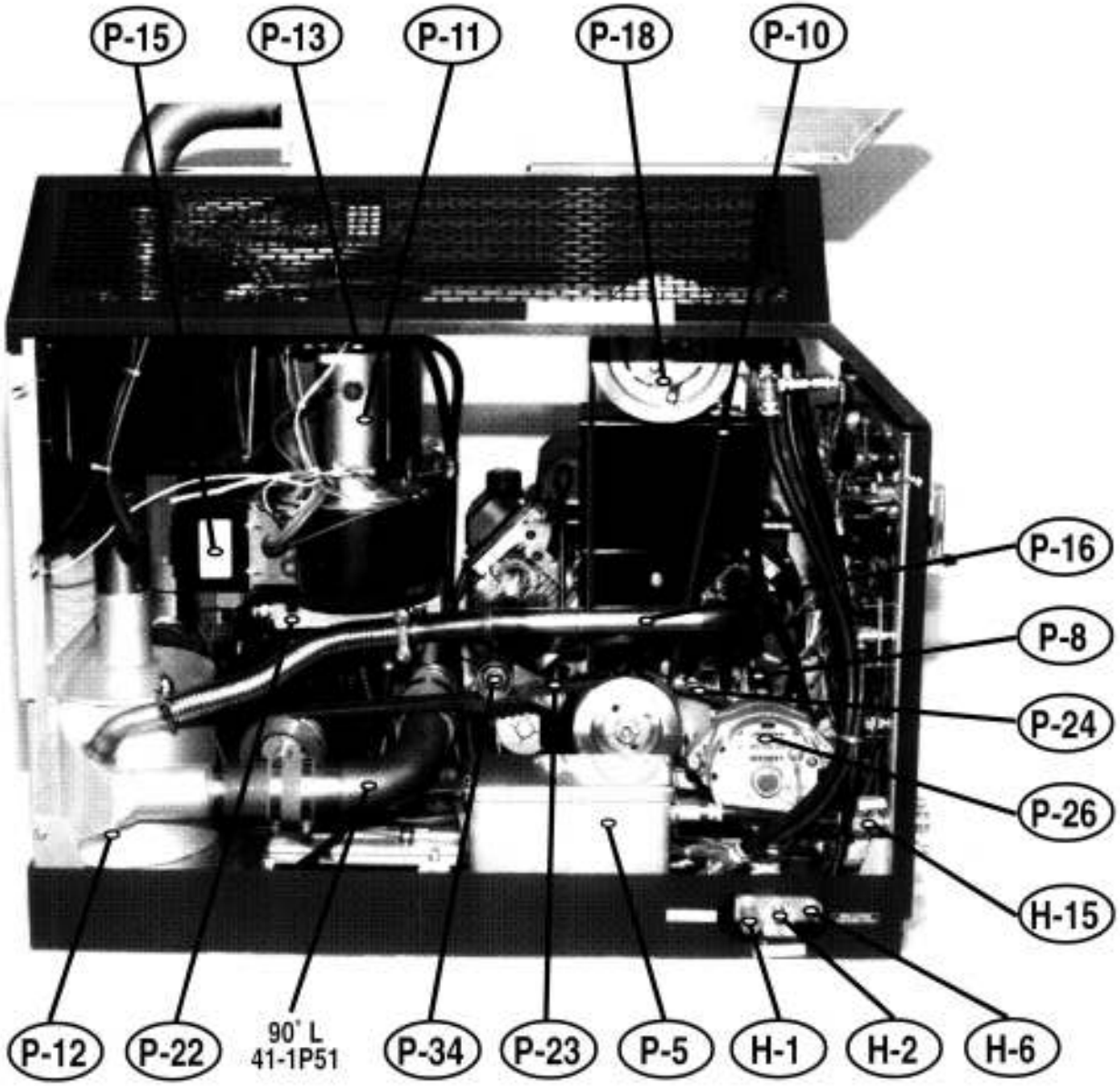
FIGURE 4-1
Unit Right Side View



For part numbers see pages 48-50

FIGURE 4-2

Unit Left Side View

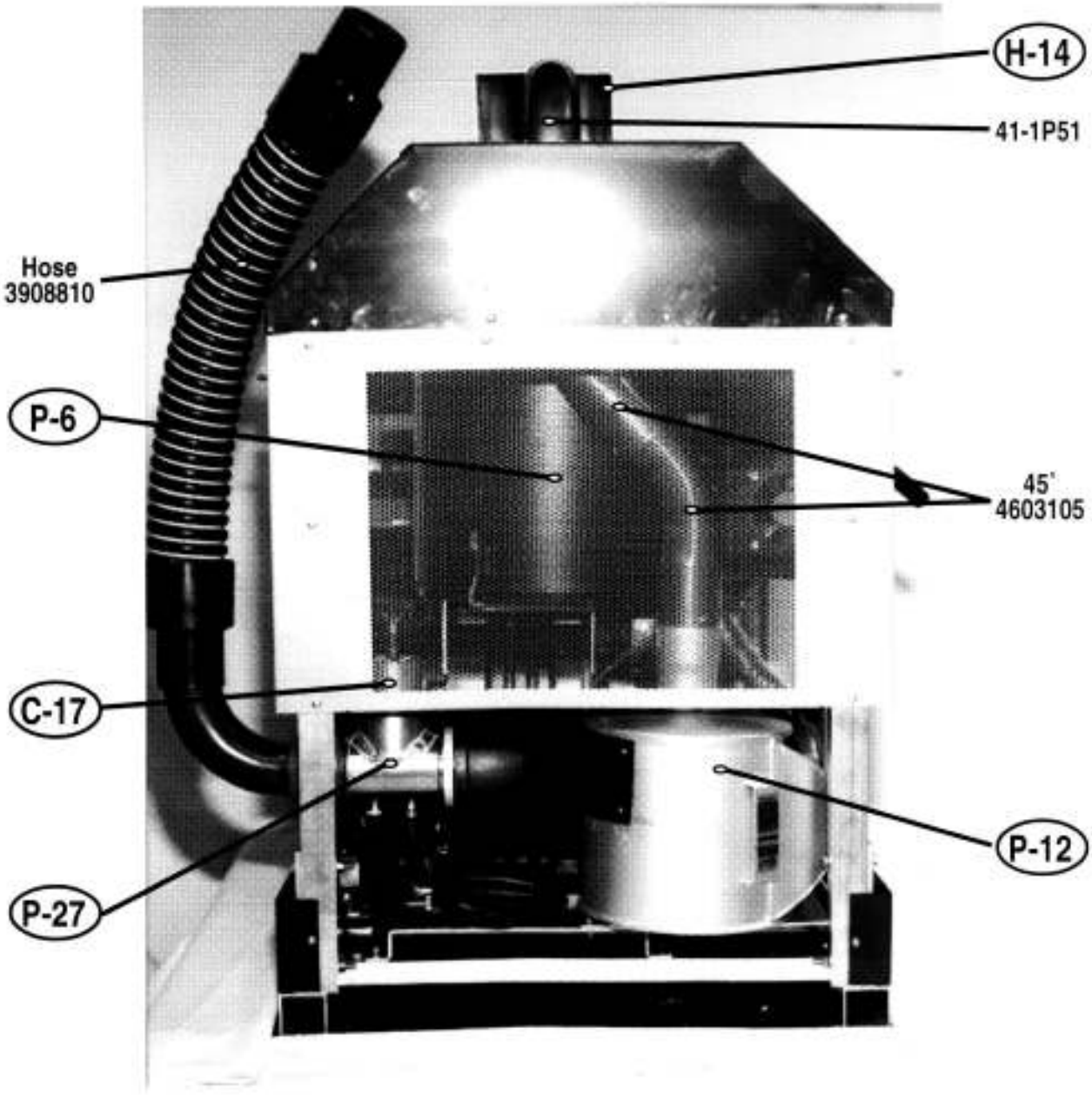


For part numbers see pages 48-50

FIGURE 4-3
Unit Front View

For part numbers see pages 48-50

FIGURE 4-4
Unit Rear View



For part numbers see pages 48-50

SECTION 5
OPERATING PROCEDURES

5-1 PREOPERATIONAL CONTROL SETTINGS

Control	Number	Figure	Set To
Engine Ignition Switch	C-1	4-3	Off
Engine Throttle	C-2	4-3	Closed
Engine Choke	C-3	4-3	In
Heater Switch	C-4	4-3	Off
Temperature Control	C-5	4-3	Desired Temp
Dump Valve	H-10	8-1	Closed
Soap Flow Meter	C-7	4-3	As Desired
Pressure Regulator	C-6	4-3	As Desired
Exhaust Scoop	H-13	4-4	Out
Pump Switch	C-21	4-3	Off
Warm-Up Valve	C-23	4-3	Off

5-1.1 Check engine oil, blower oil and Cat pump oil levels

5 - 2 STARTING

5-2.1 Connect input water to H-3 (Figure 4-3) and turn on.

5-2.2 Attach vacuum hose from H-5 (Figure 8-1) to cleaning tool.

5-2.3 Connect the high pressure hose, that delivers solution to the cleaning tool, to H-4. If it is the first job of the day, turn the warm-up valve to warm-up (open) for 2 or 3 minutes to discharge possible rusty water from the heater coils. The flushing procedure in paragraph 4-2 will accomplish the same. The warm-up valve when on will allow the heater to operate, if the temperature control (C-5) is still calling for heat.

5-2.4 The engine is now ready to start. Open the throttle slightly. Pull the choke closed (if engine is cold). Turn the ignition switch to the start position. When the engine starts, push the choke back in.

5-2.5 Bring the engine up to operating speed (2650 RPM) as displayed on the tach hour meter (G-2).

5-2.5A Turn the pump switch on. Observe whether the green light (G-7) is lit.

5-2.6 With the warm-up valve C-23 Fig 4-3 in the open position, the movement of water can be observed, and the pump can flush the heater coils. This would constitute water flow, and the heater operation could be tested at the same time.

5-2.7 Turn the heater switch (C-4) on and select the desired safe cleaning temperature with the temperature ocntrol (C-5). The burner should NOT come on until water is made to flow and the red solenoid voltage light is on (G-6).

5-2.8 The soap solution control (C-7) may have to be reset after the carpet procedure cleaning operation begins to get to the desired results.

5-3 **RUNNING**

Control	Number	Figure	Position
Engine Ignition Switch	C-1	4-3	ON
Engine Throttle	C-2	4-3	OPEN to (2650 RPM)
Engine Choke	C-3	4-3	IN
Pump Switch	C-21	4-3	ON - Green light
Heater Switch	C-4	4-3	ON for heat
Temperature Control	C-5	4-3	As desired
Pressure Regulator	C-6	4-3	Set desired pressure while the cleaning tool is activated
DC Volt Meter	G-4	4-3	IN - Green
Warm-Up Valve	C-23	4-3	On for flushing and pre-heating

PRESSURE EXAMPLES

A. Pressure Washing 1000 p.s.i. (1250 MAX)
B. Carpet Cleaning 425 p.s.i.
C. Upholstery Cleaning 175 p.s.i.

Control	Number	Figure	Position
Soap Flow Meter	C-7	4-3	As needed
Dump Valve	H-10	8-1	CLOSED
Vacuum Relief Breaker	C-17	8-1	Factory Adjusted to 13 Hg

5-3.1 During the cleaning operation or water recovery operation, if the engine stops suddenly, it is likely that the waste recovery tank has filled, and the float switch (C-16) has stopped the engine.

5-3.2 Observe closely the fuel quantities during operation, especially during big jobs.

5-3.3 Pay close attention to the amount of soap solution in the solution container (P-19). Running out of solution will result in a loss of pressure and could do serious damage to the water pressure pump (P-3)

5-3.4 When this unit is used for water extraction ONLY, the pump switch (C-21) MUST be turned **off** and the heater switch (C-4) must be **off.**

5 - 4 SHUTDOWN

5-4A Turn pump switch off (C-21).

5-4.1 Turn heater switch (C-4) off.

5-4.2 Last job of the day or after a blowover, allow about 1 or 2 pints of water to be drawn into the blower oiler (H-12 Figure 4-3) slowly. Allow the blower to air dry for approximately 3 minutes. Then apply a small amount of light weight oil or spray WD-40 for into the oiler for 5 - 8 seconds.

5-4.3 Move engine throttle control (C-2) to idle.

5-4.4 Turn ignition switch (C-1) to off.

5-4.5 A. Retrieve tools from job site and store.

B. Disconnect vacuum hose and place in vehicle.

C. Disconnect pressure hose and roll it up or store it.

5-4.6 In cold weather, use the most expedient method to get hoses and tools into the vehicle to keep from freezing.

5-4.7 Inspect the waste recovery tank.

A. Drain when and where appropriate. NOTE: Dumping waste water in the street is prohibited by law in some areas. Check with local authorities.

* **B. <u>THOROUGHLY CLEAN THE LINT SCREEN.</u> This system must be free of lint to perform optimum cleaning and drying.**

C. Rinse out the waste tank <u>FREQUENTLY</u> while the dump valve is open. Disconnect the water input valve assembly from H-3 to rinse the waste recovery tank while the water input hose is still connected to the water faucet.

D. Turn water faucet off, relieve the pressure in the hose roll up and place in vehicle.

5-4.8 Push the hood scoop in so the door will close.

* **<u>VERY IMPORTANT</u>**
This is the most <u>abused</u> maintenance procedure observed by machine technicians.

SECTION 6
WATER FLOW SYSTEM

6-1 The water pump (P-3) has two reservoirs of liquids to draw from. (A & B below)

A. The water holding tank (P-5), which is continuously refilled by the water input hose assembly. The hose assembly is attached to H-3, a female Q.D. in front of the machine.

B. The cleaning solution container (P-19), which contains the premixed solution required must be attached to the machine at (H-6 Figure 6-1) the solution connection. Failure to connect this hose to the chemical container will allow air to be drawn into the system, which will cause a loss of water pressure and could cause damage to the pump.

C. When the pump switch (C-21) is turned on , the clutch is engaged and starts the action of the pump.

6-2 When a demand for water by the pump (P-3) is made (cleaning tool turned on or warm-up on), water and solution will be drawn from the two tanks mentioned above. The amount of detergent solution is controlled by the visi-float control (C-7).

6-3 Chemicals are drawn into the 4 way cross connector just prior to entering the water pump (P-3). Note that a one way check valve (C-14) is installed in the chemical line just before the mixing tee. This will prevent water from backing into the solution container when water is forced into the mixing tee during special testing or flushing procedures. Water is normally drawn into the water pump from the water holding tank (P-5).

6-4 As the Cat pump (P-3) is being driven by the engine, three plungers are drawing water and solution on the back stroke and is pushing or pressurizing water on the forward stroke. This causes a movement of approximately 3.5 gallons of water per minute. The water goes from the output of the pump, located on the discharge manifold, and flows to the pressure regulator (unloader C-6).

6-5 It is very important to note that the oil level sight gauge which has a red dot in the center is for checking the oil when the unit is NOT in operation. The oil level should be adjacent to the red dot. The Cat Pump (P-3) uses a special Cat Pump Oil (Part #4810106).

6-6 As the water reaches the pressure regulator (C-6), back pressure is produced, causing the excess water to bypass back to the pump; however, the pressurized usable water is directed through the water flow switch (C-8) then into the heater coils and out through the heater output block (P-22) where temperature sensing is done and then to the pressure out connector (H-4). Note that a gauge line is connected to the water flow switch (C-8) so that the water pressure can be monitored on the water pressure gauge (G-1). NOTE: Water pressure can only be read on the gauge when the cleaning tool is turned on and water is flowing.

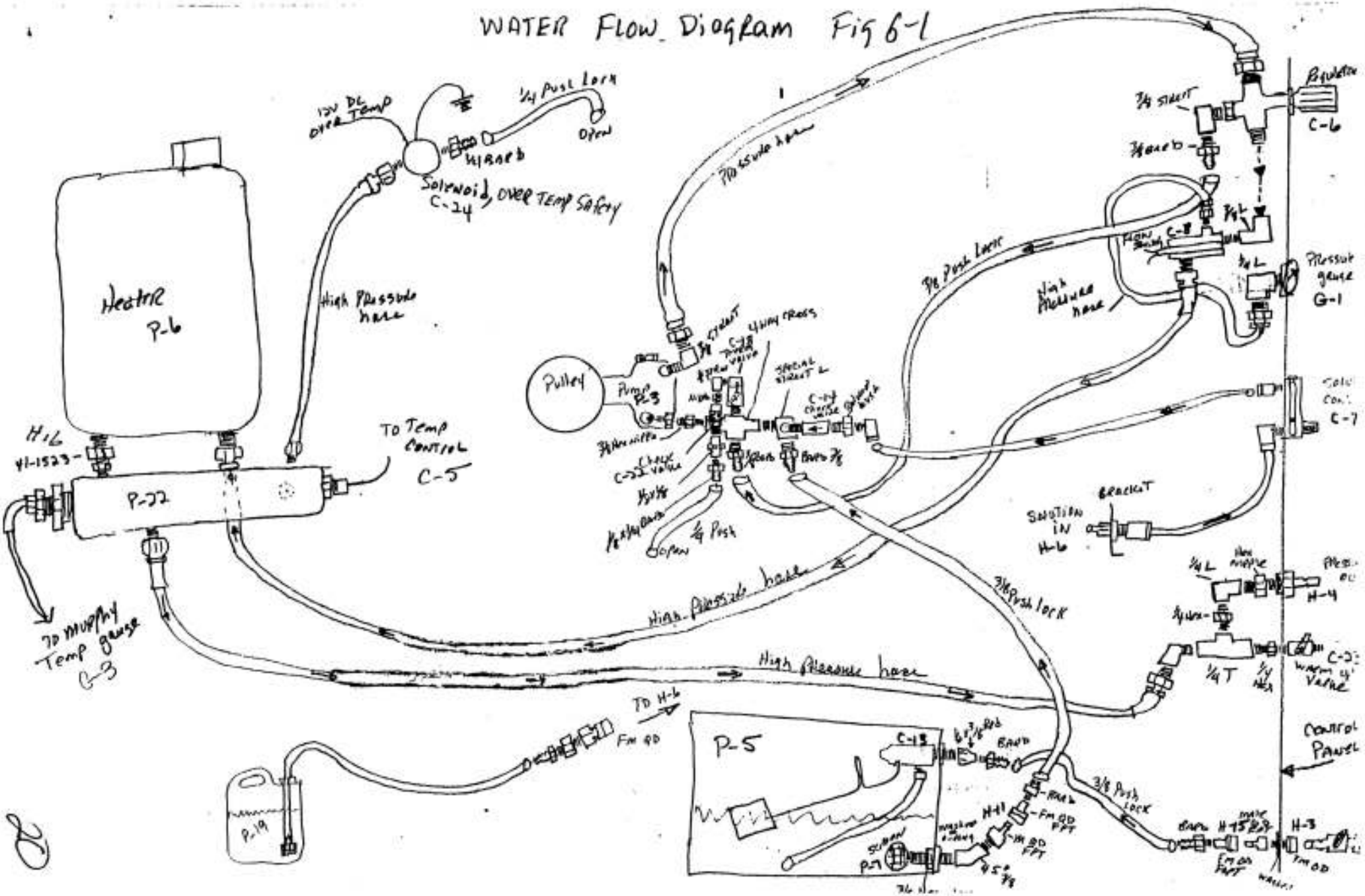
6-7 With the adjustment lug on the regulator (C-6), you may adjust the pressure to any desired pressure, within the limits of the pump and regulator (1250 PSI maximum).

6-8 As the water leaves the heater coils (P-6), it passes temperature sensors for the temperature gauge (G-3) and temperature control (C-5). The water exits the machine at the male connector (H-4), and is sent to the cleaning tool via braided high pressure hoses.

6-9 CAUTION: When the cleaning tool is not in use (i.e., drying, moving furniture), the pressure regulator is bypassing all of the water causing a rapid increase in water temperature in the pump, which will cause damage to the pump. The Cat Pump manufacturer suggests that a limit of SIX MINUTES is maximum for this situation.

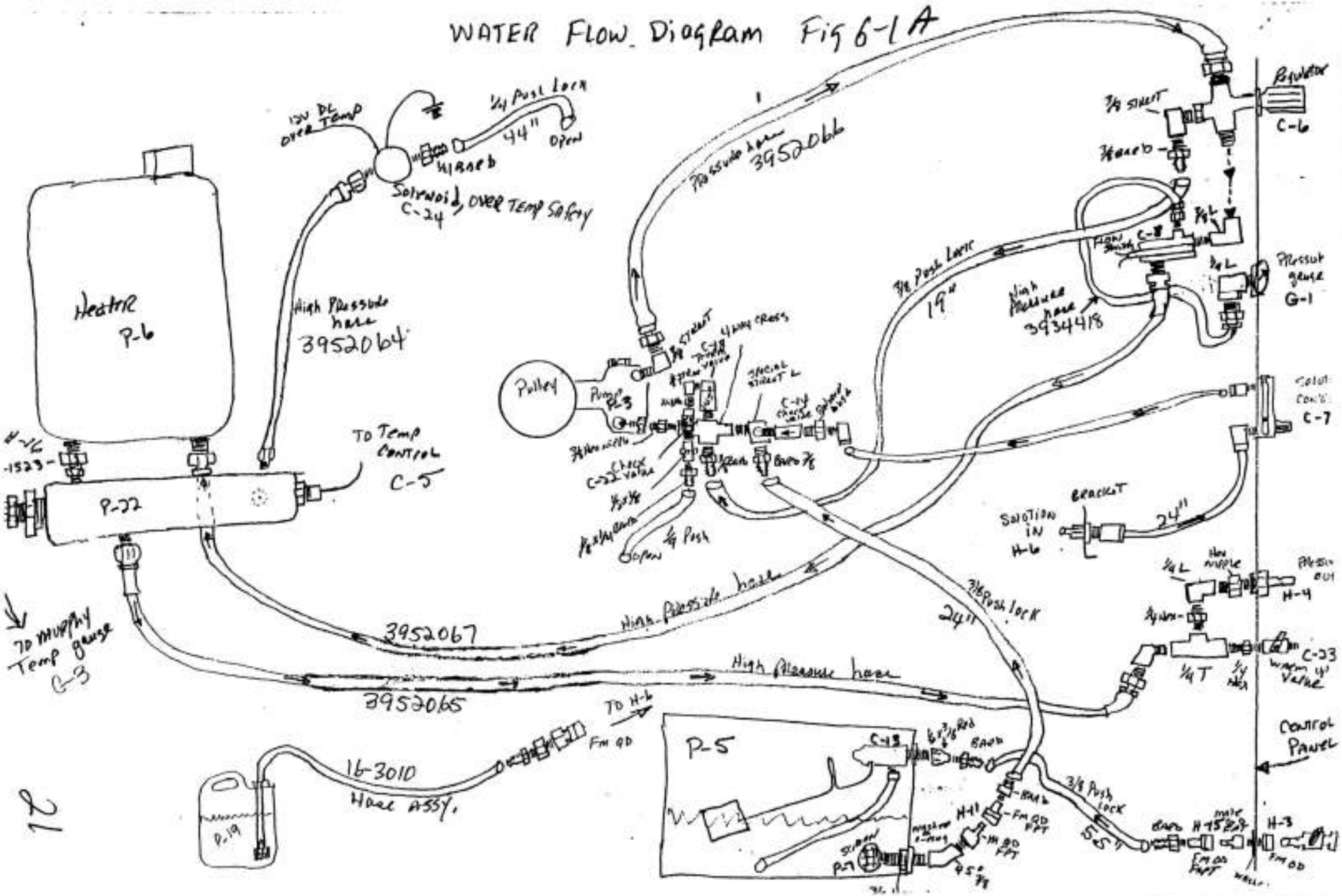
6-10 A Thermal Protection Valve (C-18) will protect the system for situations where the operator many not observe the six minute limit mentioned above. When the recirculated water reaches a temperature of 145˚F (still safe for the pump) the thermal valve (C-18) will open, dispensing the hot water into the waste tank (P-9). The pump will draw cold water from the water holding tank (P-5) to cool itself to a safe temperature.

WATER FLOW Diagram Fig 6-1



Complete With Part Numbers

WATER FLOW Diagram Fig 6-1A



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SECTION 7
HEATER SYSTEM

7-1 When the Kohler engine is running at operating speed, the alternator produces 12 Volt DC from (P-26 Fig 10-5) the charging system (automotive alternator). This supplies power for recharging the battery and providing power to run the components of the burner system. Please refer to Figure 7-2 as you read the operation of this heater circuit.

7-2 The components of the burner system that require 12 Volt DC are: the fuel solenoid (C-10), the igniter module (P-15), overheat safety solenoid (C-24), cooing fan (P-29), and the DC motor (P-11). They are also protected by a circuit breaker (C-19, Figure 7-2) with a reset button. Circuit breaker C-20 protects power to the over heat protection circuit.

7-3 Power for the heater circuits is taken from the starter solenoid terminal. Two sources of power is required for this.

A. 12Volt DC applied to the 25A circuit breaker (C-19) from the 2 wire connector (P-32).
B. 12Volt DC applied to the 15A circuit breaker (C-20) the yellow wire from the 2 wire connector (P-32).

7-4 Note that the main power to run the heater circuits is received from the 25A circuit breaker (C-19) and sent through the safety relay (P-30) via contacts 9 to 3 for power to the heater switch (C-4). When the heater switch is turned on power is sent to the temperature control (C-5), the green light (G-9) and to the bottom contact of the terminal board (P-31) via a red wire. The red wire continues on through a 3 wire connector (P-33) which supplies a 12 Volt DC to run the fan & fuel pump motor (P-11) and the ignitor cooling fan (P-29). The components of the heater, the motor (P-11), ignitor fan (P-29), ignitor (P-15) and the fuel solenoid (C-10) all share a common frame ground.

7-5 The high voltage ignitor (P-15) gets its power from the temperature control (C-5) if the control is demanding heat (turned up). Using Figure 7-2 follow the yellow wire from the temperature control (C-5) to the 3 wire connector (P-33) where the ignitor lead comes out as a red wire to operate the ignitor. When the desired temperature has been meet no power will be applied to the ignitor. When the ignitor is on it produces high voltage which will cause an arc of electricity between electrodes of the burner.

7-6 The fuel solenoid circuit is some what more involved than the above mentioned circuits but with the use of Figure 7-2 you will find it quite easy to follow through. When the heater switch (C-4) is on, power is sent to the temperature control (C-5). When heat is required (switch closed)) power is sent to the terminal board (P-31) to the top set of contacts following from left to right the power will be sent to the water flow switch through black wire in the gray cord. If water is flowing power will pass through the closed contacts of the water flow switch and sent back through another black wire of the gray cord to the second from top set of contacts of the terminal board (P-31) from right to left, coming out via the orange wire which goes through the 3 wire connector (P-33) to energize (open) the fuel solenoid (C-10) allowing fuel to be ignited by the spark produced between the high voltage electrodes. When power is available for the fuel solenoid the red light (G-6) will be lit.

7-7 **Over temperature protection circuit.** The second source of power mentioned in paragraph (7-3 B) above is used as a safety devise to turn the heater off and unload hot water in the unlikely event of a heater malfunction. If this condition should appear the water temp gauge (G-3) has a grounding circuit providing a ground if the temperature gauge experiences a condition above a preset value. Refer to (Figure 7-2 or Figure 10-6) starting with the 15A circuit breaker (C-20), note the yellow wire that goes to the safety relay (P-30) contact A and 4. If the temp gauge (G-3) becomes grounded (excessive heat) this circuit will become energized. contacts 1 and 3 will magnetically be pulled down to 6 and 4 (as shown in Figure 10-6). When contact 4 is down power will exit the relay via contact 7 and a black wire will supply power through the terminal board (P-31) to the safety solenoid (C-24) to dump hot water that exist within the heating system. When the other set of contacts of the relay (P-30) have been pulled from contact 3 to 6 the main DC power to the heater circuit will be grounded, causing and overload to the 25A circuit breaker (C-19) making all heater circuits to be inoperative until cause for the problem has been determined.

7-8 The burner will turn off automatically when:

A. Water ceases to flow (C-8) when the tool is off.
B. Temperature demand has been met (C-5).
C. Heater switch is turned off (C-4).
D. An overheat condition exist

To gain access to the high voltage ignitor item P-15 Fig 7-4, remove the four (4) screws that secure the ignitor to the fan housing. Caution: High voltage is being

produced when he heater switch is on and the thermostat is asking for heat. The high voltage is sent to the burner gun electrodes, item 20 of Figure 7-1, by the two red high voltage leads.

7-9 Fuel pressure can be changed by turning the adjusting screw C-15 of Figure 7-4. Each 1/4 turn will increase or decrease fuel pressure by approximately 3 to 4 PSI (clockwise increases counter clockwise decreases).

7-10 The air (oxygen) being drawn into the burner assembly can be adjusted by two methods. At the bottom of the fan housing is an adjustable lever, item 39 of Figure 7-1, which will increase or decrease the opening for air to be drawn into the burner by the blower fan, item 35 of Figure 7-1. A locking screw is used to secure the adjustment lever, (C-11, Figure 7-1).

Another lever located on the top of the fan housing assembly, item 28 of Figure 7-1, is a damper in the air channel. It is factory set for approximately 50% open. The lever is parallel with the damper in the air channel.
If it is set cross wise, i.e.,  minimum air is allowed to flow. If the lever is set in line, i.e., with the air channel  maximum air is allowed to flow. NOTE: Small adjustments make large temperature changes. The initial setting for this adjustment is approximately 50% open/closed. A white line has been drawn to show the approximate 50% open/close position.

7-11 A bleed valve (C-9 Figure 7-4) is located on the fuel pump (P-13). When the need to bleed air from the pump is necessary, follow the instructions below:

A. Turn the heater switch (C-4) on.
B. Use a 3/8" wrench to turn the bleed valve (C-9) counterclockwise slightly, and this will discharge the air and fuel out through the rubber tube to the bottom of the machine where a cup or container can catch the discharged fuel.
C. Turn the bleed valve fully clockwise after a few seconds.
D. Turn heater switch off.
E. Test run unit to see if bleeding the pump corrected the situation.

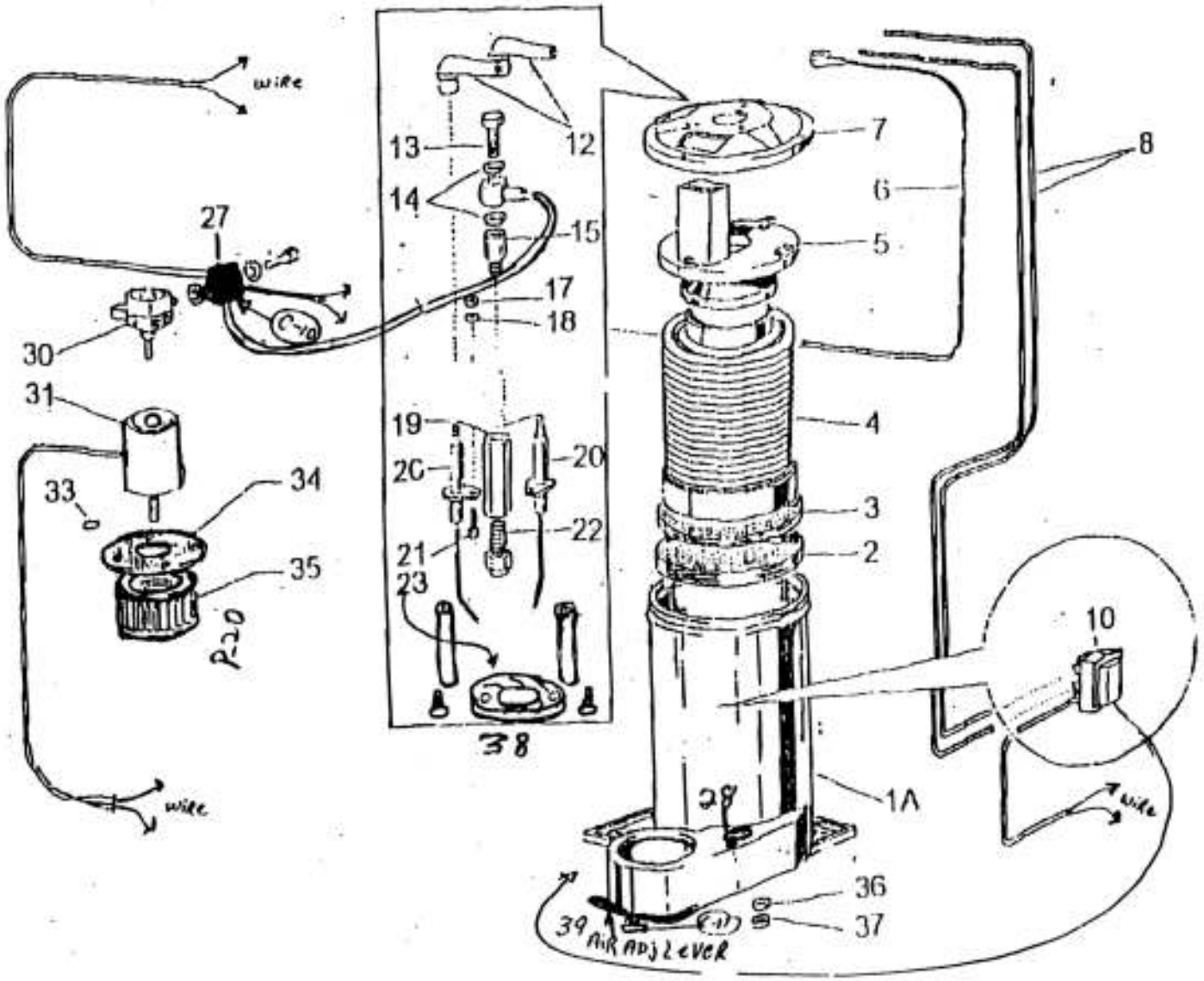
7-12 Electrode spacing is shown on Figure 7-3.

7-13 The fuel pump (P-13 Figure 7-4) contains a very fine mesh fuel strainer to ensure that no debris can enter the pump. To gain access to the strainer, remove the four (4) screws that hold the cover for the filter, located on the top of the pump. After inspection or cleaning, retighten the screws securely. A new gasket may be required, part # W53779801.

7-14 The brushes on the DC motor (Figure 7-4) must be checked every 200 hours for wear. Failing to change the brushes when worn may cause serious damage to the motor. The part # for new brushes is W31862-001.

FIGURE 7-1

Burner Assembly Illustrated



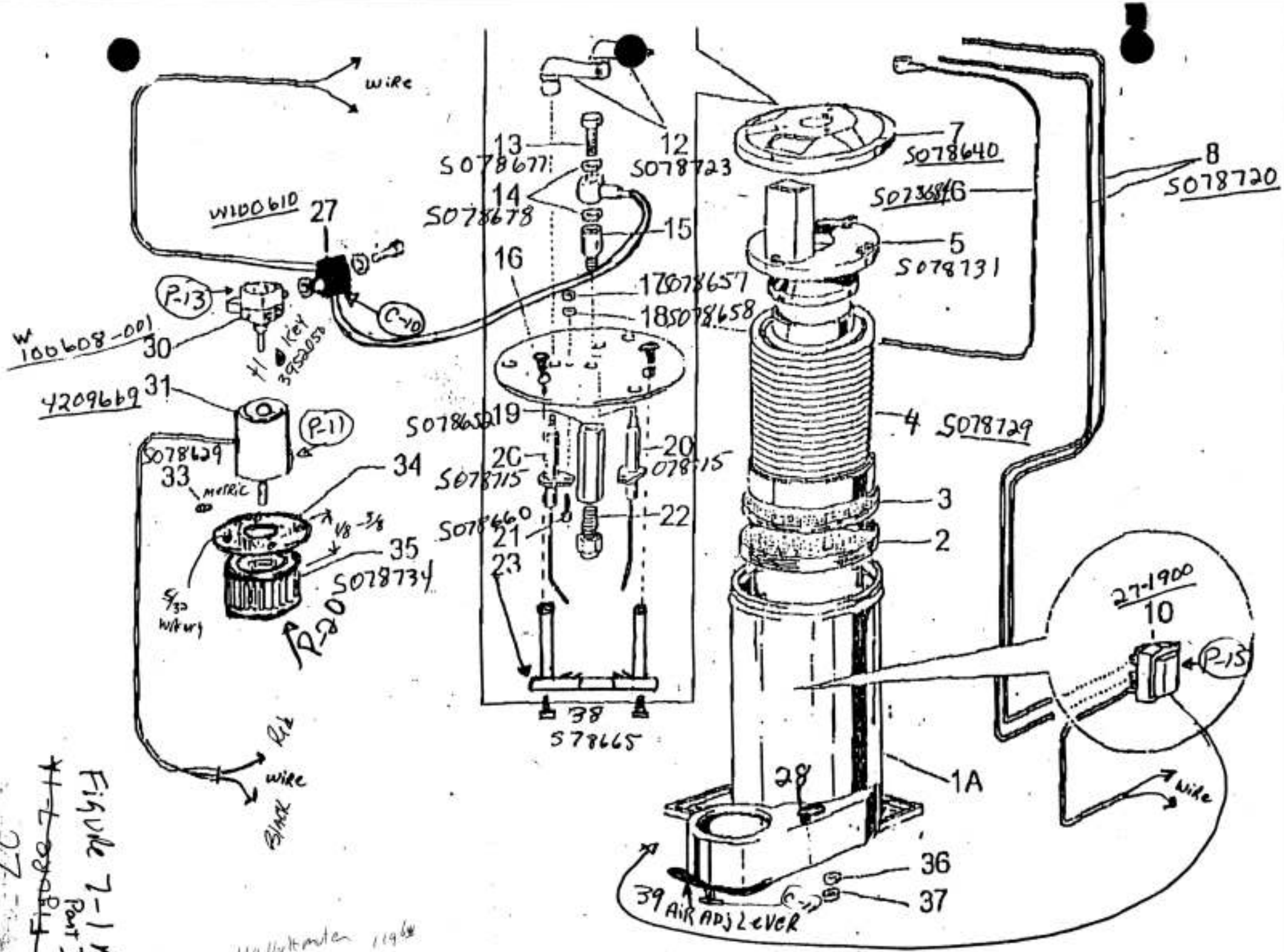


Figure 7-14 Part I

see figure 7-14

110 Ultimate 1196
078680 2155

FIGURE 7-1A Part II

Parts Breakdown

Reference #	Description	Part #
1A	Heater Housing	
2	Insulation disc (Soft)	S078725
3	Insulation Disc (Rigid)	S078726
4	Coil, Heat Exchanger	S078729
5	Coil Head with flute	S078731
6	Fuel Line High Pressure 911-918NS	S078684
7	Top Cover	S078640
8	Ignition Cable	S078720
Not Shown	Ignitor Plate	Part of Junction Box
10	High Voltage, Ignitor Mount (P-15)	4209671
Not Shown	Junction Box, Ignitor Mount	3952016
12	Connector Ignition Cable	S078723
13	Fuel Line Connector Bolt (Hollow)	S078677
14	Seal Washer Copper	S078578
15	Fuel Line Coupling	S078674
16	Disc Burner Head	S078738
17	Nut 4mm (Electrode)	S078657
18	Washer 4x9 mm	S078658
19	Fuel Nozzle Coupler	S078652
20	Electrode Ignition	S078715
21	Screw (Electrode Mount)	S078660
22	Nozzle Burner	41-5A08-3
23	Diffuser Head	S078662
24	Screws, Diffuser Mounting	S078661
27	Fuel Solenoid (C-10)	W100610
28	Air Adjust Lever (Top)	
30	*Kerosene Fuel Pump (P-13)	W100608-001
31	* DC Motor (P-11)	4209669
33	Set Screw Blower Wheel	S078629
34	Flange Motor Mount	3951983
35	Blower Wheel (Fan)	S078734
36	Washer 18 - 24 mm	S078663
37	Lock Nut	S078718
38	Burner Head (Complete)	S78665
39	Air Adjust Lever (Bottom)	2909989
40	Air Adjust Locking Screw (C-11)	Metric
no ref #	Burner mounting plate (Bottom)	1909751
no ref #	Burner mounting J Bolt	4009354
41	Key Motor/Fuel Pump	3952050
	*Kerosene Fuel Pump An DC Motor When Replaced As An Assembly	1909775

HEATING SYSTEM ELECTRICAL DIAGRAM 7-2

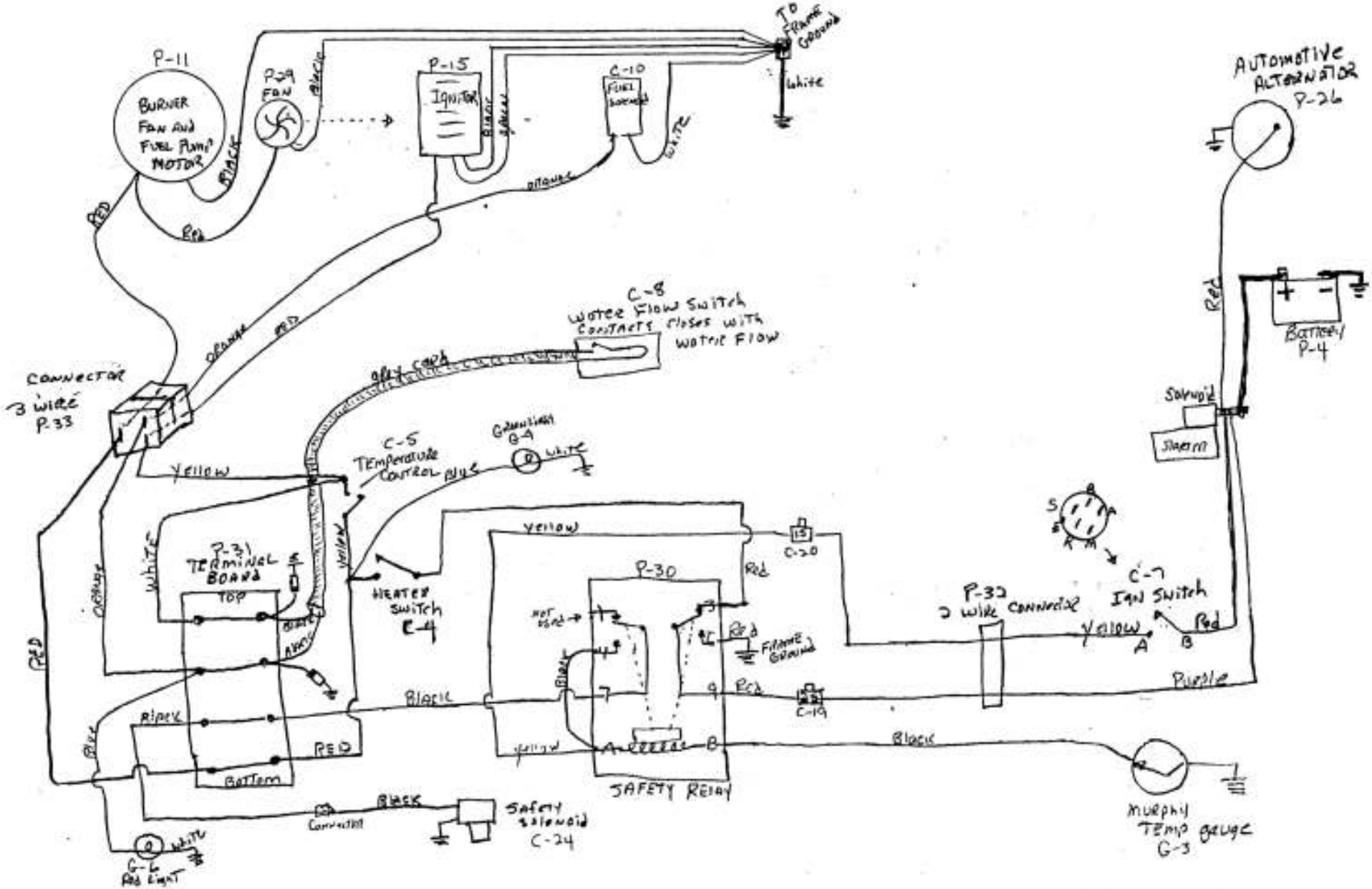


FIGURE 7-3
Burner Electrode Spacing

ELECTRODES 1/8" APART
ELECTRODES 1/4" BELOW NOZZLE
ELECTRODES 3/8" AWAY FROM CENTER LINE of NOZZLE
NOZZLE 1/2" FROM BOTTOM of DIFFUSER

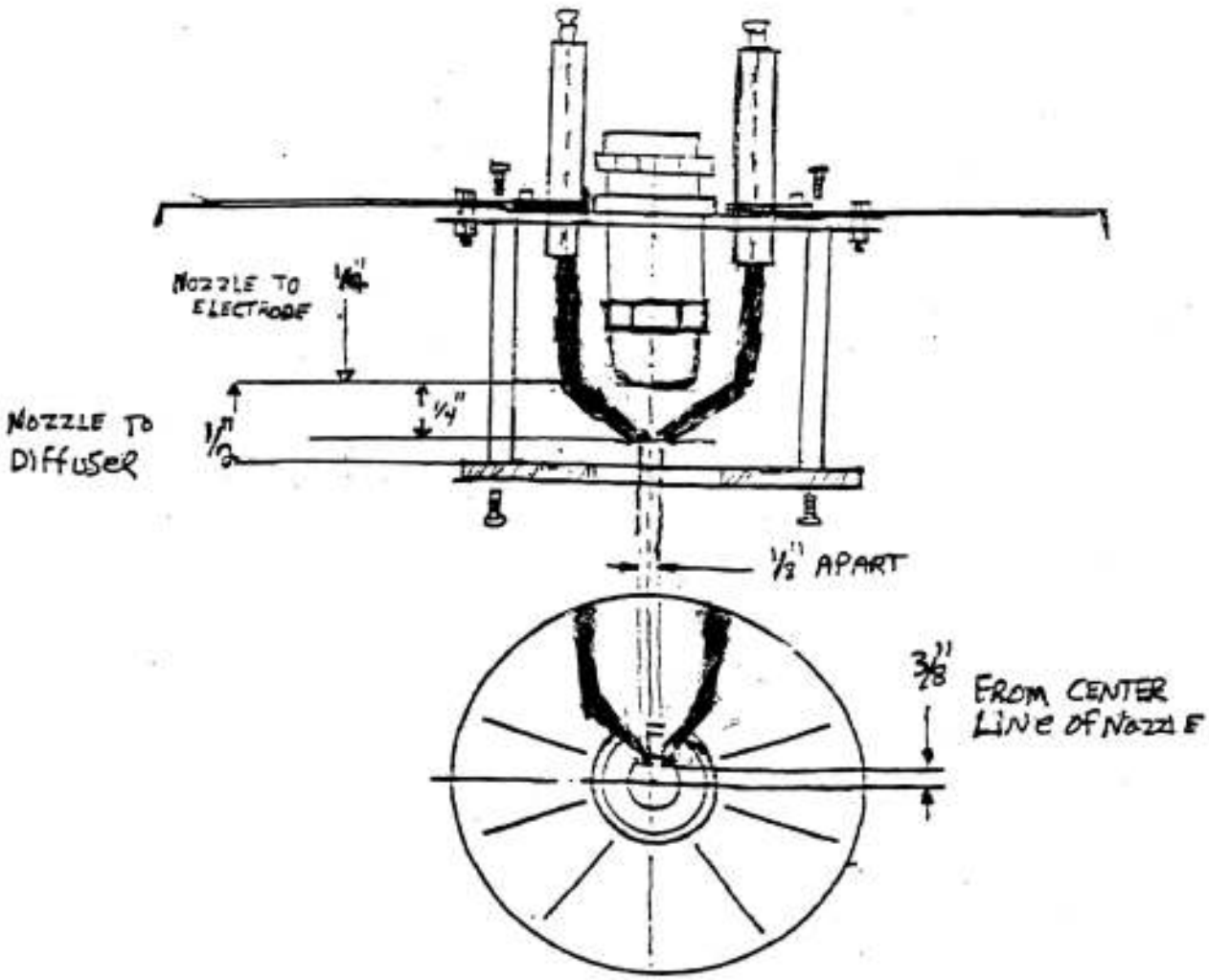
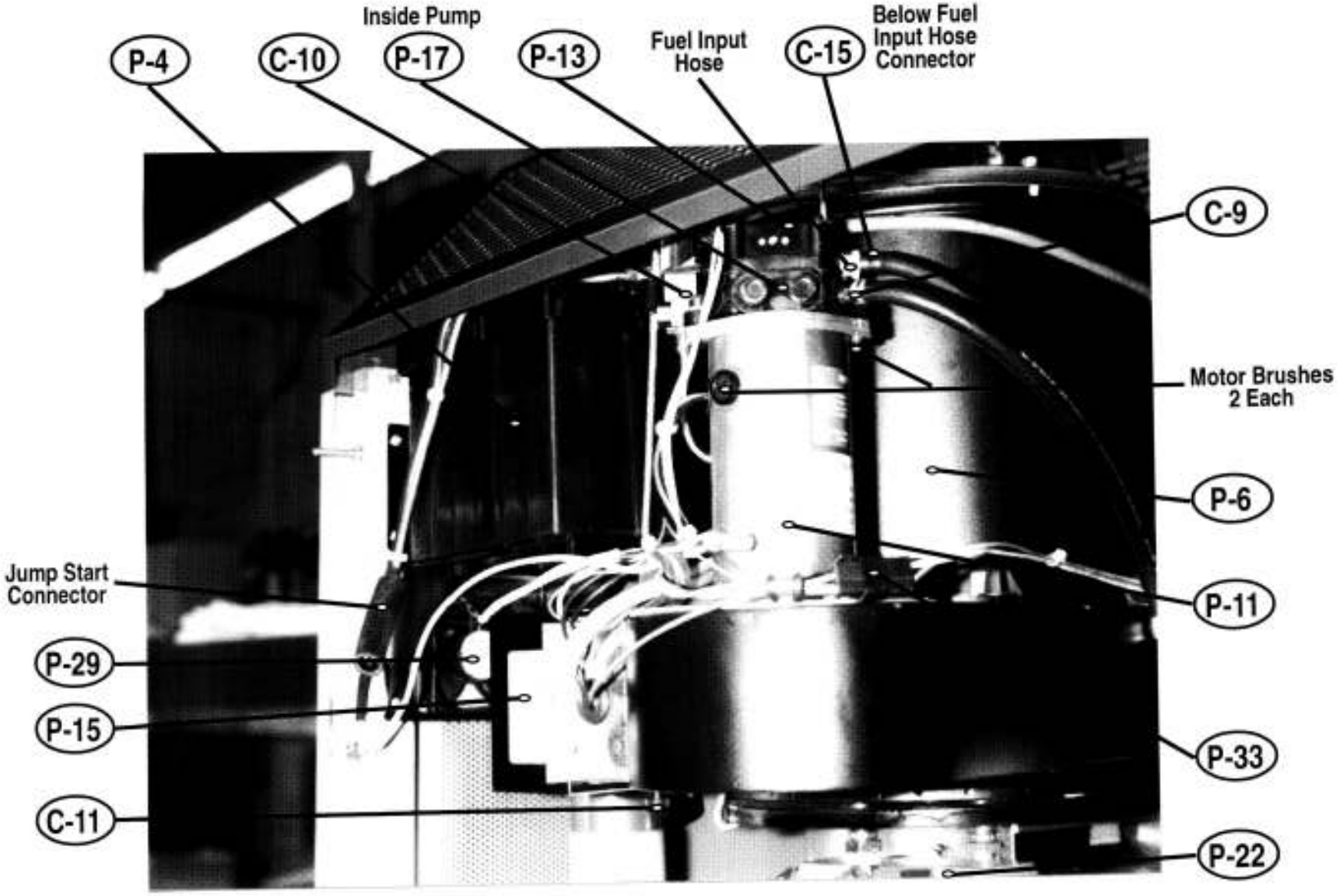


FIGURE 7-4

Burner Assembly (Enlarged View)



For part numbers see pages 48-50

SECTION 8
RECOVERY SYSTEM

8-1 If it could be determined which specific part of the cleaning process (pressure, heat, or vacuum) is the most important one, probably the recovery (vacuum) would head the list. Even with the superb water pressure, cleaning agents and heat, if you can't recover soil that has been dislodged, the cleaning process has NOT been accomplished. A thorough knowledge of the recovery system is very important to keep this system at its peak performance.

8-2 The vacuum blower (P-2, Figure 8-1) is the heart of the recovery system. While the engine operates at 2650 RPM, it turns the blower shaft at a stepped up operating speed. This causes the Sutorbilt blower to pull a large volume of air. When the engine is running at 2650 RPM, the blower will be turning approximately 3375 RPM.

8-2.1 To sustain long life for the vacuum blower, it must be serviced properly. The gears must be lubricated with gear oil (Lubriplate #4) and bearings must be greased (630 AA Lubriplate). The maintenance check list (Figure 11-1) suggests the frequency for services and the part number of the recommended product.

8-2.2 The level for the oil in the gear case can be checked by observing the oil level gauge (G-5) of Figure 8-1. If the window is black the oil level is sufficiently high enough. The two grease fittings for the bearings are located on the opposite side of the blower near the drive shaft. NOTE: Paragraph 8-2.1 above.

8-3 In referring to Figure 8-1, it shows that air enters the waste recovery tank at H-5 by attaching vacuum hoses, and is emptied into the waste recovery tank (P-9). At this point, water, soil, and debris are dropped to the bottom of the tank, but the air continues on into the vacuum blower (P-2). With the positive displacement action of the blower, the air is pushed into the silencer (P-12). The silencer not only receives the air from the blower, but also receives the exhaust from the Kohler engine. All of the air and exhaust are expelled into the exhaust scoop on top of the machine along with output of the heater burner assembly (P-6). All of the gases are exhausted away from the machine and vehicle.

8-4 A vacuum relief breaker (C-17) is installed on vacuum "T" (P-27 Figure 8-1). The vacuum breaker is normally set to approximately 13 hg. To readjust the break point the spring on the breaker can be made tighter or looser as desired. As adjustments are made, monitor the vacuum gauge (G-8) for the desired inches of mercury Hg to be set in. NOTE: Adjust with full vacuum load (vacuum input covered (H-5).

8-5 To check the recovery (vacuum) system to ensure peak performance, inspect the following:

A. Clean lint screen (P-14).
B. Dump valve closed (H-10).
C. Seal around the lid of waste tank (P-9).
D. Condition of vacuum hoses and cuffs.
E. Inspect the cleaning tool for clogged air passage.

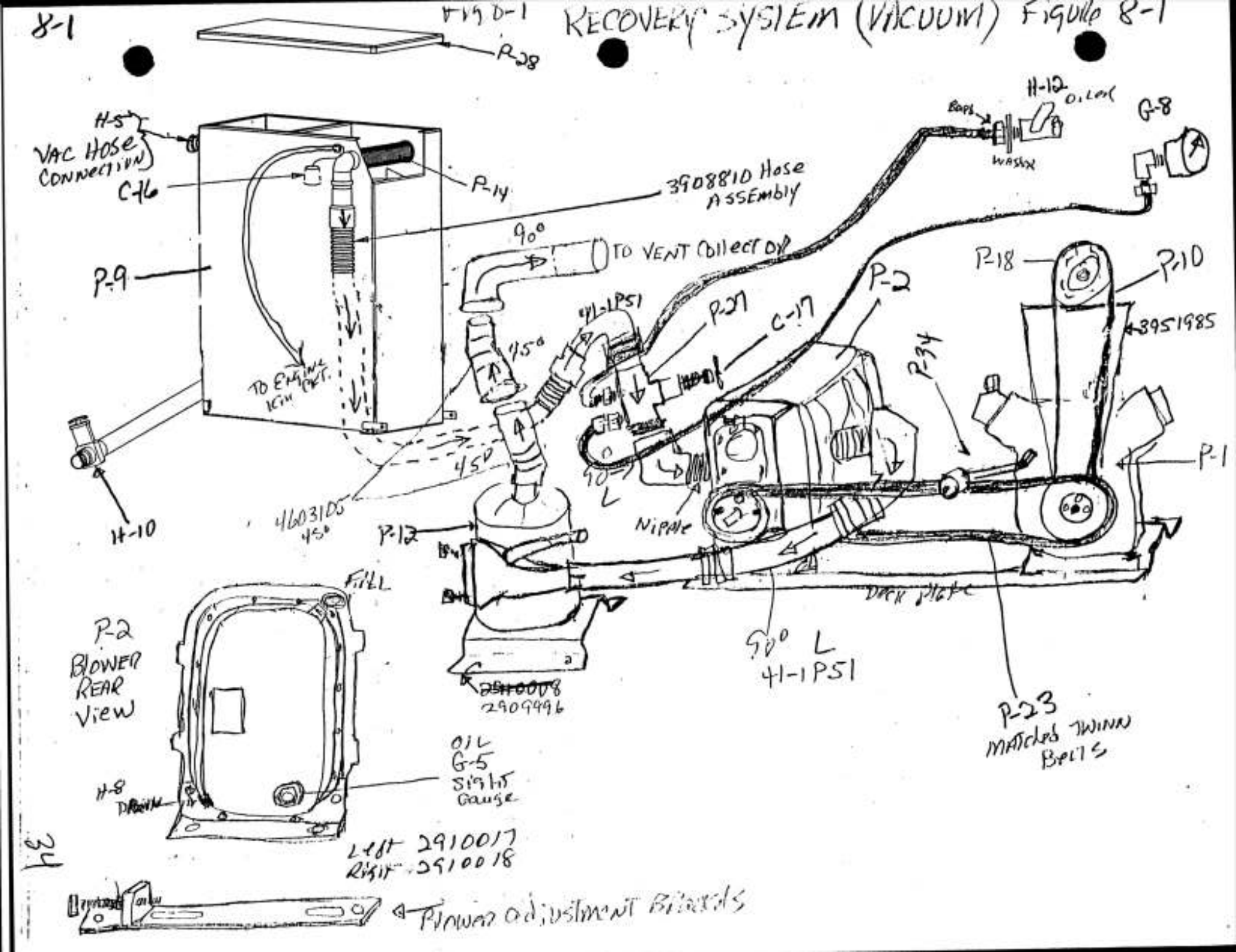
8-6 After a known blow-over (dirty water being pulled into and through the blower), the impellers should be cleaned and oiled. Open the blower oiler valve (H-12) and allow water from the water input hose to be drawn into the blower at a slow rate. After approximately one or two pints of water has been inserted into the vacuum blower, allow the blower to air dry for about three minutes. After the blower has dried, insert a small amount of oil or spray WD-4 into the blower to lubricate the impellers. Oiling the blower after the last job of the day is highly recommended to preserve the life of the blower and to prevent lock-up due to rust.

8-7 A float switch (C-16) is installed in the waste recovery tank (P-9), to cause the engine to stop just before water would be drawn into the blower. This prevents dirty water from entering the blower which would be thrown out through the silencer and vent system. The float switch grounds out the ignition modules causing the engine to stop. **NOTE:** if this condition should occur drain all of the water from the tank.

CAUTION: DO NOT LET THE BLOWER PULL ANYTHING INTO THE TUBE, (i.e., LOOSE OBJECTS, ETC.) SERIOUS DAMAGE WILL RESULT.

8-1

Fig 8-1 RECOVERY SYSTEM (VACUUM) Figure 8-1



SECTION 9
BELT AND DRIVE SYSTEM

9-1 The Kohler engine shaft has two double "V" pulleys. The inner double "V" pulley drives the alternator and the water pump. The outer "V" pulley drives the vacuum blower by the use of matched twin belts (they are only sold in sets of two). Should it become necessary to remove a pulley from the engine shaft or blower shaft, remove the two allen screws which are 180° apart then insert one screw in the odd hole where no screw was located. As the screw is tightened this will cause the pulley and bushing to sperate so that the pulley can be removed. Added security is assured by the use of rectangular key between the shaft and the bushing.

9-2 The blower shaft has one double "V" pulley that is secured to the shaft in the same manner as the engine in paragraph 9-1 above. Any time it is anticipated that a pulley may have to be removed, make exact measurement of their present location, so they can be replaced to the same location on the shaft. Failure to follow these instructions will cause a misalignment between components which will decrease belt life and cause excessive vibration.

9-3 Belt Replacement can be accomplished by loosening the 4 blower mounting bolts, then loosen the two jack screws on the blower mounting brackets (see Fig 8-1) so the vacuum blower (P-2) is moved closer to the engine, this will free the 2 belts that drive the blower. If the pump belt (P-10) or alternator belt (P-24) is to be replaced the same procedure is required because the blower belts must be removed in preparation for replacement of these two components. After belt replacement, it is very important to realign and tighten the belts by use of the jack screws of the blower alignment brackets (Fig 8-1).

9-4 The water pump drive belt (P-10) can be tightened by loosening the water pump mounting bolts so the pump can be moved either left or right as needed. Pay close attention that a visual alignment is made as close as possible to provide longer life for the belt. The alternator belt can be tightened by loosening the bolt in the slotted part of the adjustment arm, so the alternator can be moved in manner that will make the belt tighter. Retighten the bolt securely when the proper tension is felt.

FIGURE 9-1
Belt and Drive System

For part numbers see pages 48-50

SECTION 10
WIRING SYSTEM

In this sectionyou will find the following diagrams:

10-1 Explanation of the heater circuit was discussed in paragraphs 7-3 through 7-7 for detailed information. When power is sent through the ignition switch (C-7) the contact points will be listed with a diagram of that approximate location on the switch of this Figure and others to follow.

10-2 The water pump clutch circuit (Figure 10-2) receives its voltage from the 15A circuit breaker (C-20). The 12Volt DC power is sent to the pump switch (C-21) by a black wire. When the pump switch is turned on the green lite (G-7) will light indicating power has been applied to the clutch to cause the water pump to turn. A diode has been placed in this circuit as a surge protector to protect switch contacts and light bulbs.

10-3 When the ignition switch (C-7) is on power will pass through the switch contacts B to A as illustrated on figure (10-2), that supplies power to 15A circuit breaker (C-20). For this fuel pump circuit the power is sent to the fuel pump (P-21) by a purple wire, see (Fig 10-3) for complete details.

10-4 The tach/hour meter (G-2) will display the rpm of the engine when the engine is running, and will display the hours operated when the key is off. The electrical hook-up is illustrated in the diagram of (Figure 10-4).

10-5 The battery is recharged on your Equinox 7200 by an automotive alternator (P-26) which is more than adequate to supply all the DC power required for this unit. Refer to Figure 10-5 as you study this circuit. If the battery voltage is in need of recharging, the alternators (P-26) voltage regulator will detect this situation and will recharge the battery to the desired voltage potential. During the charging process the DC volt

meter (G-4) can be monitored to assure that approximately 14 volts is being applied to the battery. You will note that the ignition switch (C-7) must be on to get power to the DC volt meter and other circuits on the machine. At the bottom of Figure 10-5 an illustration details all positions of the ignition switch, showing the input and all out puts of the switch with position letters, wire color and destination of each.

Jump Start. Should it become necessary to jump start our unit an easy access cable has been added to the positive (+) terminal of the battery. Simply hook-up jumper cables from the good battery, connect the positive jumper cable to the positive (+) emergency lead, then hook the negative (-) lead to a good frame ground of the machine to supply power for starting the unit with a dead battery.

10-6 The over heat protection circuit is shown on Figure 10-6. It is shown in an overheat condition with the overheat relay energized because the temperature gauge (G-3) has reached its maximum preset value. Read paragraph 7-7 as you review this circuit.

Fig-10-1

HEATING SYSTEM ELECTRICAL DIAGRAM (WITH PART NUMBERS)

Add Part Numbers
Wire
Re Drawn

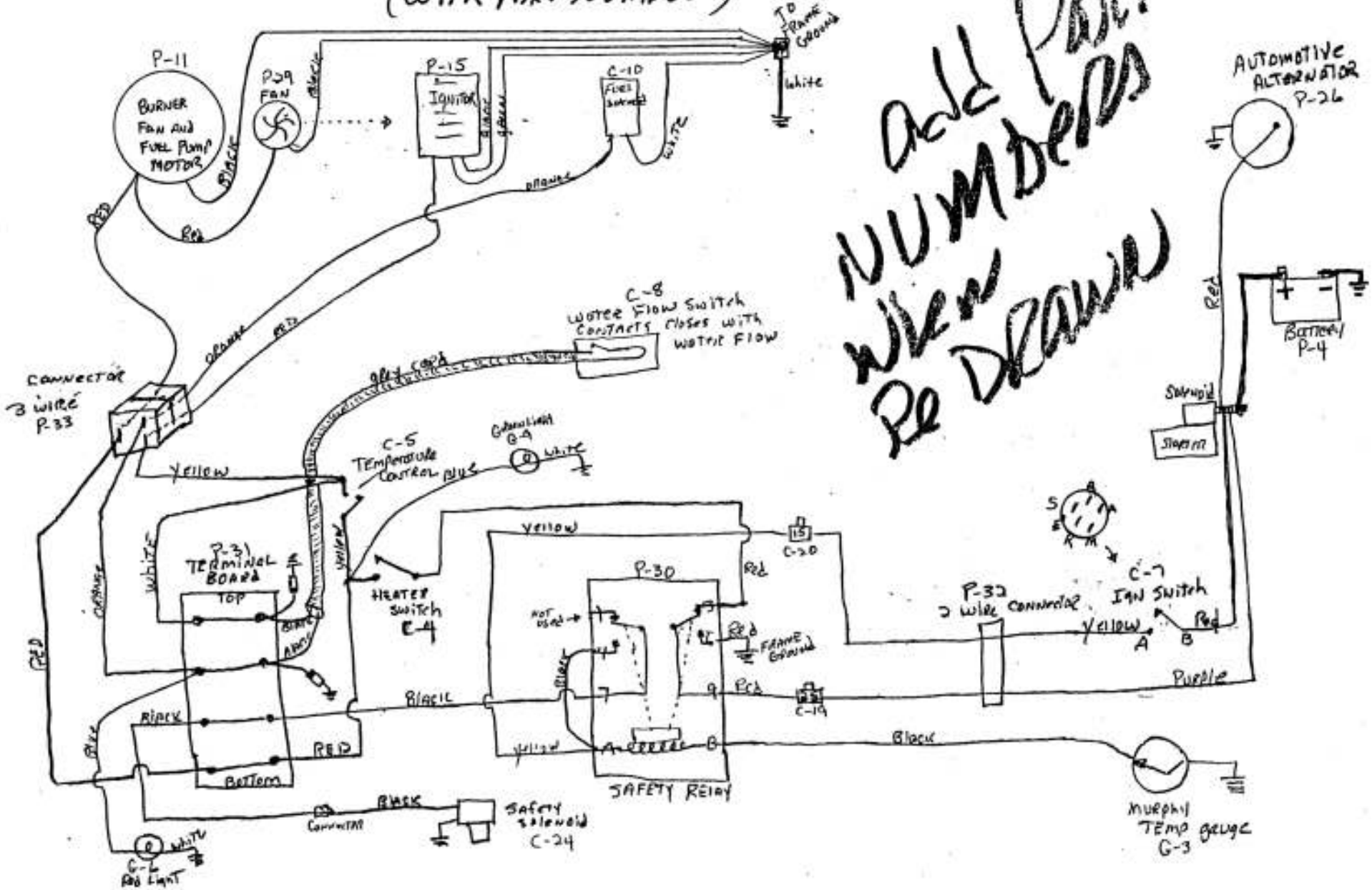


Fig 10-2 WATER PUMP CLUTCH CIRCUIT (BELOW)

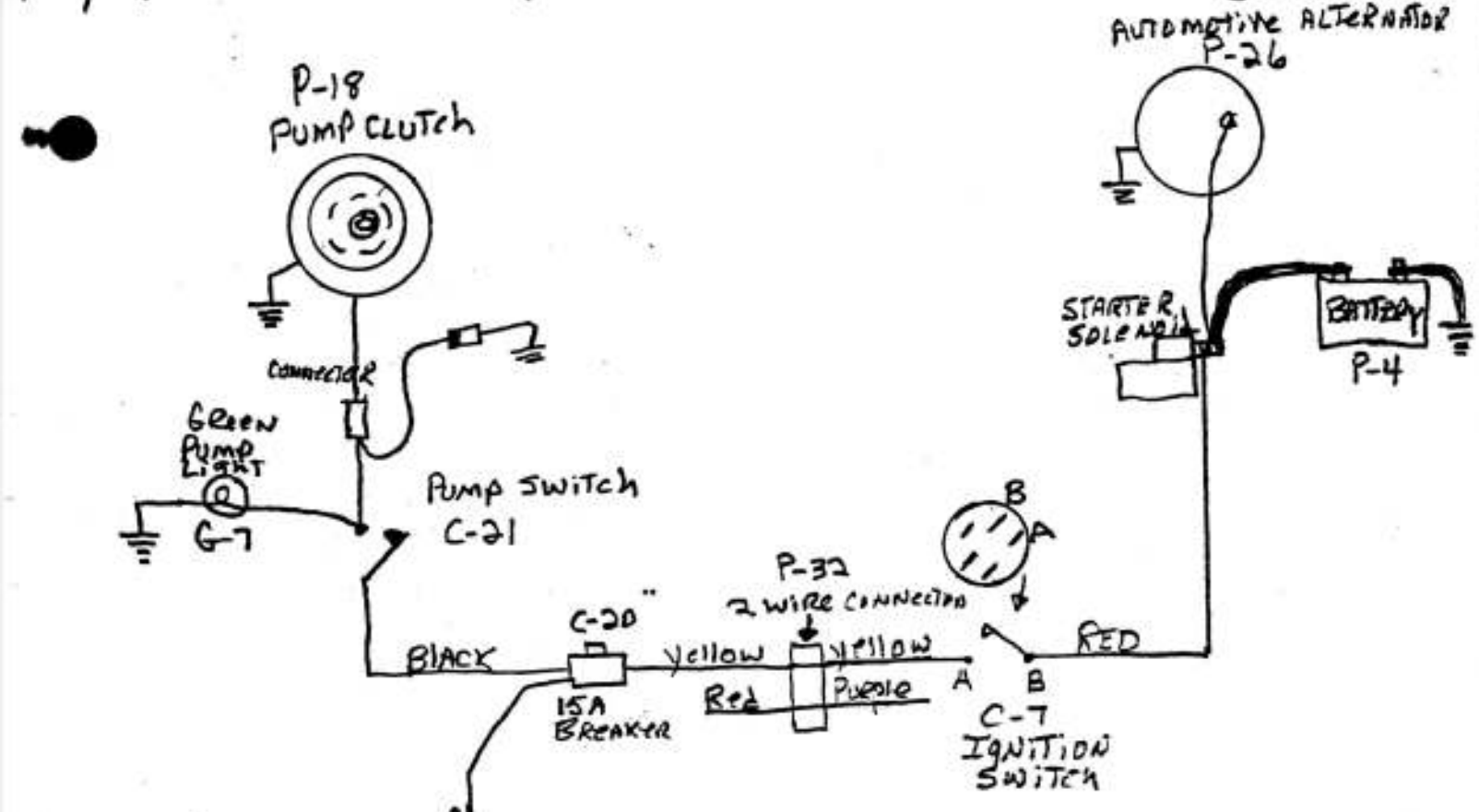


Fig 10-3 GASOLINE FUEL PUMP CIRCUIT (BELOW)

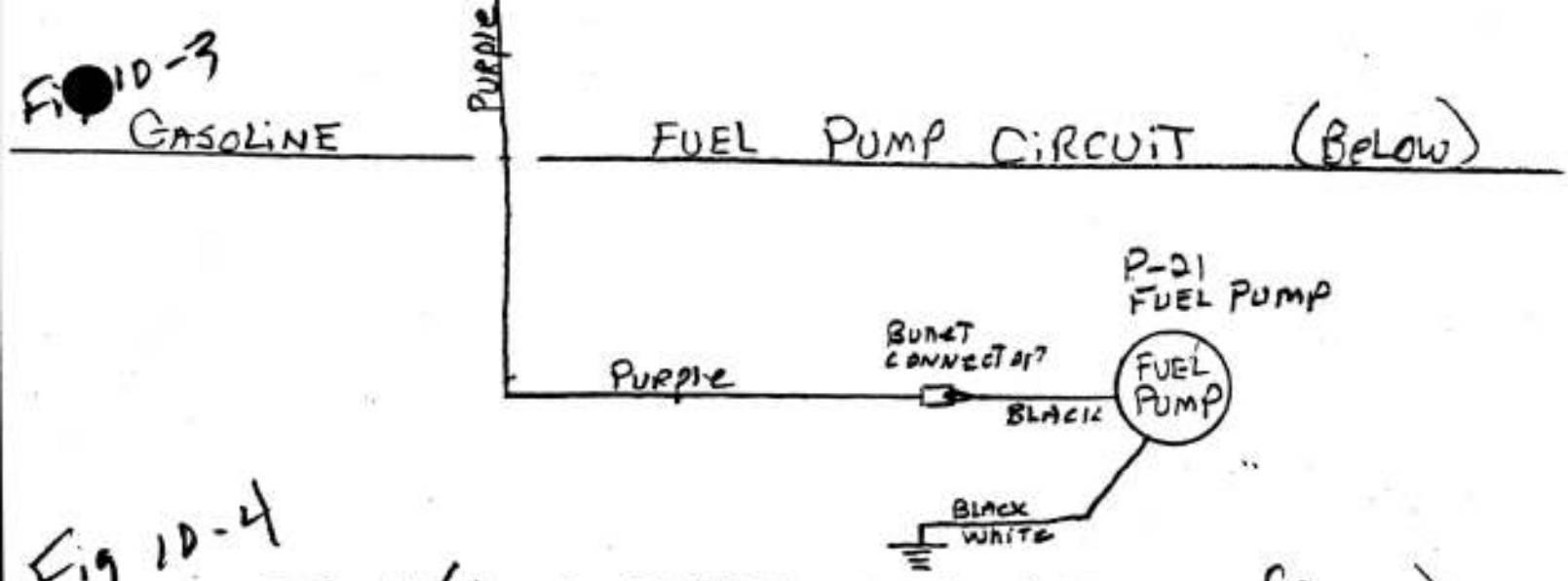
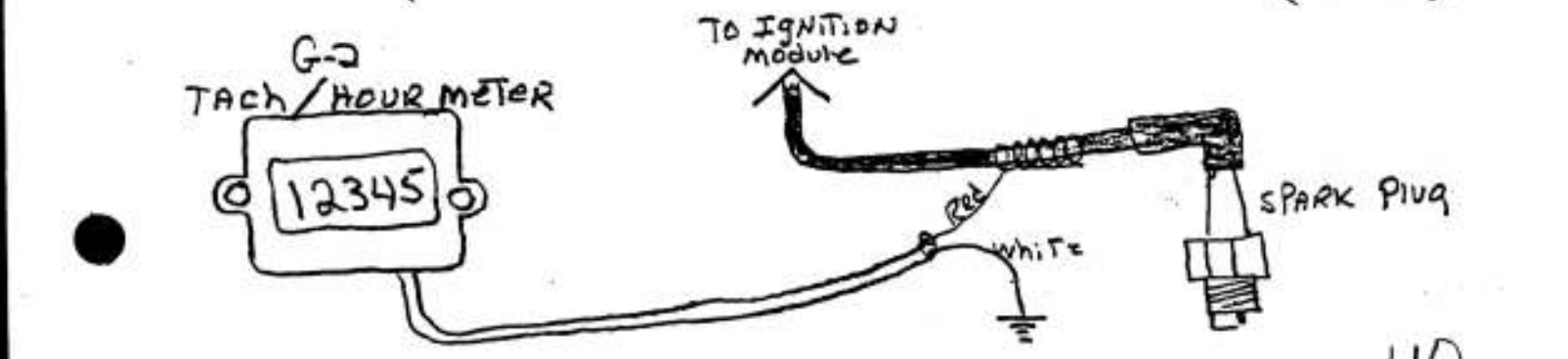
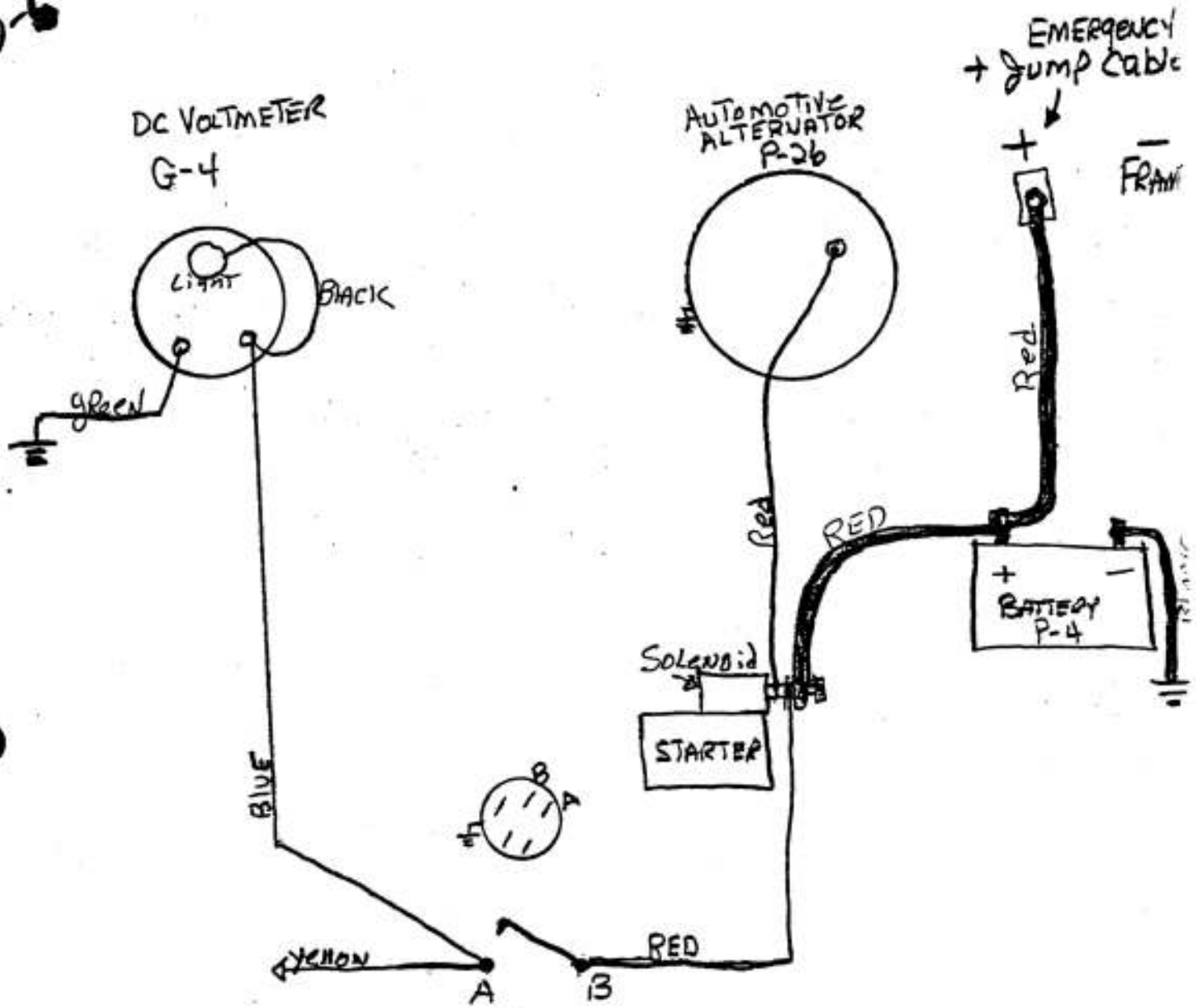


Fig 10-4 TACH/HOUR METER CIRCUIT (BELOW)

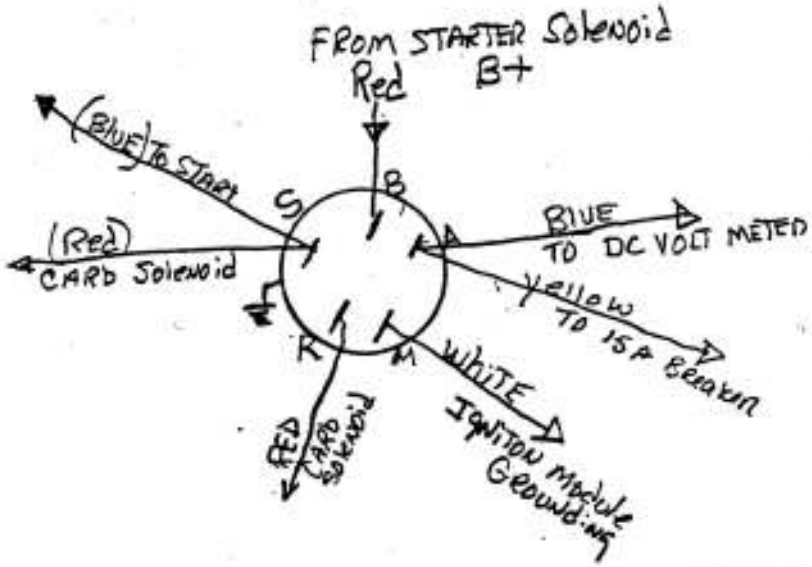


BATTERY RECHARGING & EMERGENCY JUMP START

Fig 10-5

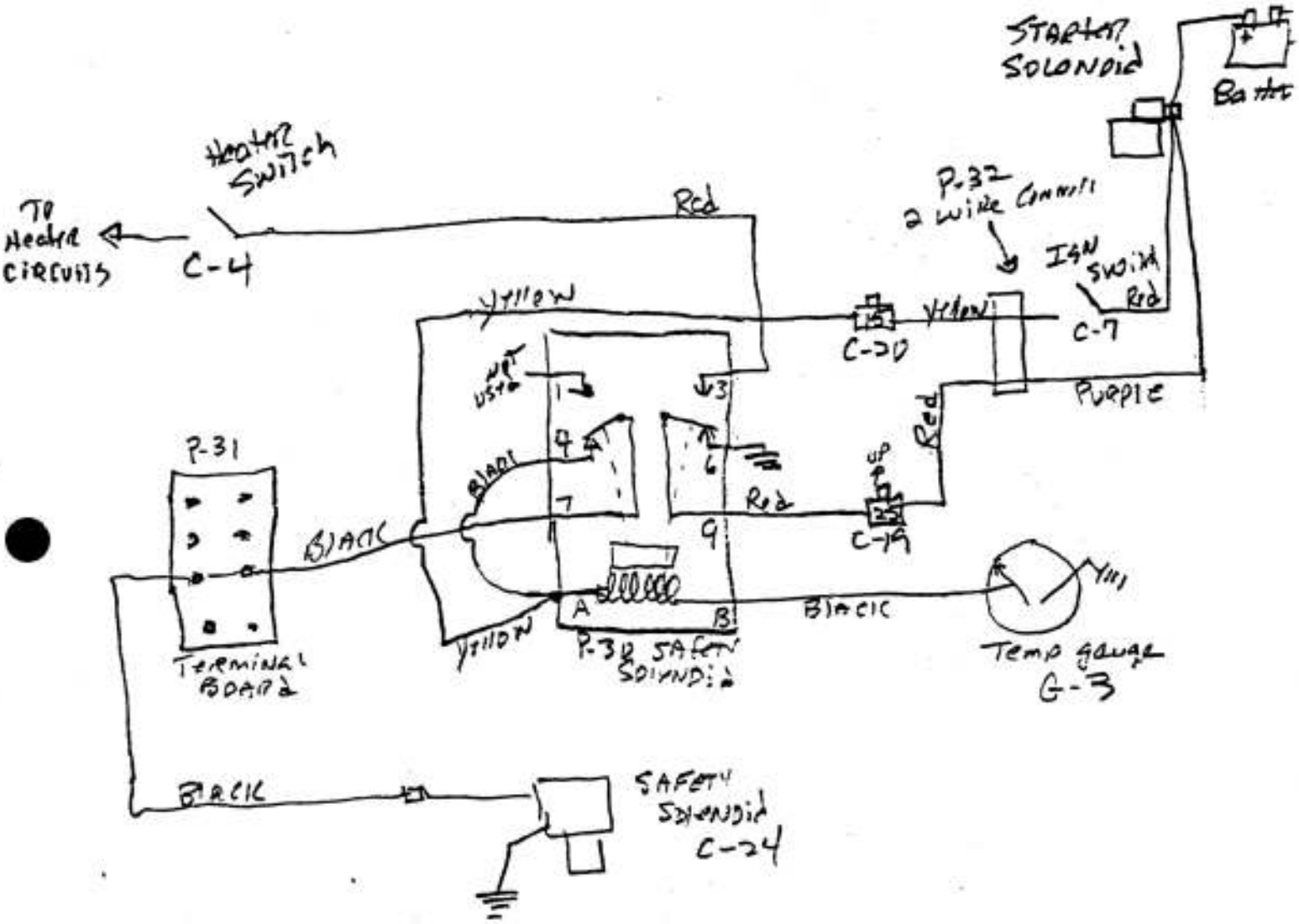


C-7
IGNITION SWITCH



Overheat Protection Circuit Fig 10-6

(Relay P-30 shown in overheat condition)



NOTE:

① Grounded condition will pop circuit breaker C-19 where power has been diverted from heater circuits

② Power is now available from contact A through the jumper to contact 4 which will energize the safety solenoid C-24

SECTION 11
SCHEDULED MAINTENANCE

11-1 Your Equinox 7200 unit is a machine that has many moving parts; but with proper maintenance they are designed for long life and relatively trouble-free service. The key to this unit, as with any other piece of equipment, depends upon the type of service that it receives.

When you purchase an automobile, tractor or any other piece of highly technical equipment, you also receive a maintenance schedule; and all interested new owners are eager to perform these procedures to insure good operation and long life for their new investment. It is imperative that you follow the maintenance schedule shown on Figure 11-1 and become thoroughly familiar with the individual owner manuals of the specific components of this unit, located in the appendix of this manual. A maintenance log should be started at the very beginning, so that accurate records of service are readily available (See **Figure 11-1 on page ??).**

FIGURE 11-1 MAINTENANCE CHECK LIST (Equinox 7200)

Item	Every Job	Every Day	Every Week	6 Months	50 Hours	100 Hours	200 Hours	500 Hours	Product (Available At Steam Way Intl.)
Lint Screen Waste Tank	Clean								16-1101
Kohler Engine Oil		Check	1st Change 5 hours			Change			SAE 10W40 (API SF or SG) (2.1 Quarts with filter)
Oil Filter			1st Change 5 hours				Change		Kohler Pt# K12 050 01
Carb Foam Precleaner		(Service Each 25 Hours)		(In some instances this filter may not be uesed.)			Kohler Pt# K2408302		
Air Cleaner Element						Check			K4708303
Spark Plugs						Check			RC 12 YC (Champion) #K1213202
Gasoline Filter				Check					Pt# 41-5C42
Cat Pump Oil		Check (red dot)			First Change			Change	Special Cat Oil S/W Pt# 4810106 (11.8oz)
Vac Blower Oil		Check (inspection window G-5 Figure 8-1)						Change	#4 Lubriplate S/W Pt# 4810105 (12oz)
Bearing Grease								Lube	High Temperature Grease - S/W Pt# 4810102
Lube Impellers		Lube		(Refer to paragraph 8-6)					
Burner Fuel Strainer				Check					W 3715732 / Gasket W3779801
D.C. Motor Brushes				(See Figure 7-4)			Check		Brush Kit S/W Pt# W31862-001
Electrode Spacing				Check		(See Fig. 7-3)			

SECTION 12
DESCALING PROCEDURE

12-1 The EQUINOX 7200, like any other unit, has the inherent ability to collect calcium and other mineral deposits within the tubes, hoses and coils which will restrict the water flow within the machine. When this condition is noted or suspected, a very simple and inexpensive method of descaling has been established.

12-2 Items needed:

1. A five gallon plastic bucket (45# Formula A container).
2. At least 1/2 gallon of Descaler Chemical Part Number 9950100 (Quarts).
3. A Descaler hose, Part Number 15-8002.
4. A high pressure hose or hoses, with the male connector removed from the end of the last hose.

12-3 Procedure: **(See Precautions Before Using)**

1. Mix 1/2 gallon of Descaler solution with five gallons of water in the plastic bucket.
2. Connect the high pressure hose or hoses to pressure out connection H-4 on the machine, then remove the male end on the opposite end of the hose. (You may desire to descale all hoses during the procedure.)
3. Connect the descaler hose (15-8002) to the female connector H-11 on left side of the machine with the other end in the bucket of descaling solution. Turn the chemical control meter (C-7) off (fully clockwise).
4. Start the engine turn the pump switch (C-21) on and note that the solution is being drawn from the bucket. When approximately 1/2 of the solution has been drawn into the machine, put the open end of the high pressure hose into the bucket so that the bucket will not become empty.
5. After approximately 25 minutes, you should observe that the return flow rate back into the bucket has increased. This indicates that the procedure has been effective and the descaling procedure is almost complete. Stop the engine.

6. Now the descaling solution MUST be removed from the system. To accomplish this:
   a. Remove the descaler hose.
   b. Reconnect H-11 to original configuration.
   c. Reinsert the input water supply hose to H-3 "water in" and turn on.
   d. Start the engine and monitor the discharge coming out of the open high pressure hose (male end removed). When clean water is being discharged through the hose, the descaling procedure is complete.

PRECAUTIONS WHEN USING DESCALER:

CAUTION: CORROSIVE. USE THE FOLLOWING PRECAUTIONS WHEN USING DESCALER.

Harmful or fatal if swallowed. Contains Hydrochloric Acid. Do not mix with other chemicals. Do not use on aluminum parts. Use only with adequate ventilation. Wear respirator, goggles and gloves when applying. Dispose of wastes properly. Apply only in well ventilated areas. Avoid breathing spray mist or vapors. Avoid contact with skin. Keep out of the reach of children at all times. Avoid eye contact. As with all chemicals, use only with adequate ventilation. Professional chemicals should always be under the complete control of the technician at all times.

PLEASE READ MATERIAL SAFETY DATA SHEET BEFORE USING THIS PRODUCT.

SECTION 13
TROUBLE SHOOTING

13-1 Kohler engine problems - See the Kohler Engine Manual, located in the appendix of this technical manual. A list of Kohler Engine Sales and Service Centers is listed in the back of the Kohler Manual. (See "machine parts" section of this manual)

13-2 Water pump problems - See the Cat Pump Manual, last paragraph, for diagnosis and maintenance for the Cat Pump. The manual is located in the Appendix of this technical manual. (See "machine parts" section of this manual)

13-3 For the information concerning troubleshooting the Sutorbilt blower, refer to the Blower Manual, page 9, located in the Appendix Section of this manual. (See "machine parts" section of this manual)

13-4 When trouble shooting the water pressure system of the EQUINOX 7200 unit, refer to Figure 6-1 of this manual.

13-5 Remember that the system cannot draw water if an air leak exists in the suction side of the pump. To check for air leaks, insert your garden hose assembly with city water pressure applied into the female QD of H-11, Figure 6-1, while looking for leaks.

13-6 Restriction in the system will result in low or no water pressure.

13-7 To trouble shoot the heater system, refer to Section 7 of this manual. Insure that adequate fuel is available, the Ignitor Module is developing a spark, and that 12 volt DC is applied to the fuel solenoid. (Red fuel solenoid light G-6)

13-8 Recovery system problems are covered in Section 8 of this manual.

SECTION 14

PART NUMBER REFERENCE LISTS
TABLE 14-1
Controls

CONTROL#	PART NO.	NAME	FIGURE
C-1	K2509904	IGNITION SWITCH	4-3
C-2	43-9A11	THROTTLE	4-3
C-3	43-9A03	ENGINE CHOKE	4-3
C-4	42-2A11	HEATER SWITCH	4-3, 7-2
C-5	44-C027	TEMPERATURE CONTROL	4-1, 4-3
C-6	4144205	PRESSURE REGULATOR	4-3, 6-1
C-7	4146110	CHEMICAL CONTROL	4-3, 6-1, 7-2
C-8	42-1008	WATER FLOW SWITCH	7-2
C-9	PUMP PART	KERO BLEED VALVE	7-4
C-10	W100610	FUEL SOLENOID	7-1A, 7-2, 7-4
C-11	(METRIC)	LOCK SCREW, AIR CONTROL	7-1A, 7-4
C-13	2910029	FLOAT CONTROL, WATER HOLDING TANK	6-1
C-14	4146505	CHECK VALVE, SOAP FLOW	6-1
C-15	KERO PUMP PART	KERO FUEL PRESS ADJ.	7-4
C-16	42-1C11	FLOAT SWITCH, WASTE TANK	8-1
C-17	16-2400	VACUUM BREAKER	4-1, 4-4, 8-1
C-18	C7140	THERMO VALVE	6-1
C-19	4209680	25 AMP CIRCUIT BREAKER	4-3, 7-2, 10-6
C-20	4209679	15 AMP CIRCUIT BREAKER	4-3, 7-2, 10-2, 10-6
C-21	42-2A12	PUMP SWITCH	4-3, 10-2
C-22	4146505	CHECK VALVE, THERMAL PROTECTION	6-1
C-23	4141107	WARM-UP VALVE	4-3, 6-1
C-24	4209677	OVER TEMP, SAFETY SOLENOID	4-1, 6-1, 7-2

TABLE 14-2
Gauges

GAUGE	PART NO.	NAME	FIGURE NO.
G-1	44-C010	PRESSURE GAUGE	4-3, 6-1
G-2	K2544902	TACH/HOUR METER	4-3, 10-4
G-3	4603122	WATER TEMP GAUGE	4-3, 7-2, 9-1
G-4	44-C035	DC VOLT METER	4-3, 10-5
G-5	PART VAC BLOWER	OIL LEVEL SIGHT GAUGE	4-1, 8-1
G-6	4209667	SOLENOID VOLT LIGHT (RED)	4-3, 7-2
G-7	4209666	WTR PUMP ON LIGHT (GREEN)	4-3, 10-2
G-8	44-C011	VACUUM GAUGE	4-3, 8-1
G-9	4209666	HEATER SWITCH ON LIGHT (GREEN)	4-3, 7-2

TABLE 14-3
Hookups, Drains, And Hoses

HOOKUP POINT	PART NUMBER (Male)	(Female)	NAME	FIGURE NO.
H-1	4131210	4132210	GASOLINE CONNECTION	4-2
H-2	4131210	4132210	KEROSENE CONNECTION	4-2
H-3	4131660	4132665	WATER IN CONNECTION	4-3, 6-1
H-4	4131420		PRESSURE OUT CONNECTION	4-3, 6-1
H-5	PART WASTE TANK		VACUUM HOSE CONNECTION	8-1
H-6	4131260	4132260	SOLUTION CONNECTION	4-2, 6-1
H-7	41-1N33	CAP 3/8	ENGINE OIL DRAIN	4-3
H-8	PART BLOWER		BLOWER OIL DRAIN	4-1, 8-1
H-9	C25625		CAT PUMP OIL DRAIN	4-1
H-10	4142021		WASTE TANK DUMP VALVE	8-1
H-11	4131660	4132660	QD, WATER HOLDING TANK	6-1
H-12	2909835		BLOWER OILER	4-3, 8-1
H-13	3952000		VENT EXTENSION	4-1
H-14	3952003		VENT COLLECTOR	4-1, 4-4
H-15	4131660	4132660	WATER INPUT (PANEL TO TANK)	4-2, 6-1
H-16	41-1S23		HEATER OUTPUT SWIVEL	6-1

NOTE: FOR ALL HOSE PART NUMBERS REFER TO FIGURE 6-1A
(LOW PRESSURE HOSES ARE SOLD BY THE FOOT.
THE LENGTH OF THE LOW PRESSURE HOSE IS NOTED ON THE DIAGRAM.)

TABLE 14-4

Major Components

MAJOR	PART NO.	NAME	FIGURE NO.
P-1	4300115	KOHLER ENGINE	4-1, 8-1
P-2	41-0B14	VACUUM BLOWER	4-1, 8-1
P-3	4100153	WATER PUMP	4-1, 6-1
P-4	42-9M22	12 VOLT BATTERY	7-4, 10-5
P-5	2910023	WATER HOLDING TANK	4-2, 6-1
P-6	4603107	HEAT EXCHANGER	4-1, 4-4, 6-1,7-4
P-7	41-5C14	WATER FILTER	6-1
P-8	K1205001	ENGINE OIL FILTER	4-2
P-9	17-3001	WASTE TANK (70 GALLON)	8-1, 9-1
P-10	4603104	PUMP DRIVE BELT	4-2, 8-1, 9-1
P-11	4209669	DC MOTOR	4-2, 7-1A, 7-2, 7-4-9-1
P-12	2910037	SILENCER	4-2, 4-4, 8-1
P-13	W100608-001	BURNER FUEL PUMP	4-2, 7-1A, 7-4
P-14	16-1101	LINT FILTER, WASTE TANK	8-1
P-15	4209671	HIGH VOLTAGE IGNITOR MODULE	4-2, 7-1A, 7-2, 7-4
P-16	2910010	ENGINE EXHAUST MANIFOLD	4-2, 9-1
P-17	W3715732	KEROSENE STRAINER	Located in fuel pump 7-4
P-18	4300114	CLUTCH, WATER PUMP	4-2, 8-1, 10-2
P-19	9980010	SOLUTION CONTAINER	6-1
P-20	5078734	BURNER FAN	7-1A
P-21	41-0A84	GASOLINE FUEL PUMP	4-1, 10-3
P-22	1909808	HEATER OUTPUT CLUSTER	4-2, 6-1, 7-4, 9-1
P-23	4603120	BLOWER BELTS	4-2, 8-1, 9-1
P-24	44-E514	ALTERNATOR BELT	4-2, 9-1
P-25	41-5C42	GASOLINE FILTER	4-3
P-26	42-0B08	AUTOMOTIVE ALTERNATOR	4-2, 7-2, 8-1, 9-1, 10-2
P-27	2190011	VACUUM T	4-1, 4-4, 8-1
P-28	17-3100	LID 70 GAL. WASTE TANK	8-1
P-29	4209670	FAN (IGN COOL)	7-2, 7-4
P-30	4209678	SAFETY RELAY	7-2
P-31	42-9M04	TERMINAL BOARD	7-2
P-32	SOC 42-5D10 PLUG 42-5011	PLUG 2 WIRE	7-2
P-33	SOC 42-5012 PLUG 42-5013	PLUG 3 WIRE	7-2
P-34	1909810	TENSION OR ASSYMBLY	4-2, 8-1, 9-1

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WASTE WATER DISPOSAL

WHERE SHOULD MY WASTEWATER GO?

Talk about a touchy issue. For many years, magazines, convention agendas, and newsletters have been filled with articles and speeches about the proper handling and disposal of industrial wastewater produced during the carpet cleaning process. What can this author say that hasn't been said before? Well, the truth of the matter is that most articles about wastewater management simply come down to "war stories" of large fines being levied against some poor carpet cleaner and how if you'll buy a waste pumping system all of your problems will be solved. We wish it were that simple.

WHY DO WE DISPOSE OF WASTE WATER PROPERLY?

How big is the problem? According to Dr. Michael Berry, when he was with the U.S. Environmental Protection Agency, wastewater produced by carpet cleaners represents less than 1/2 of 1% of the total wastewater problem. However, carpet cleaners are visible and easy to identify, especially when they open up their dump valve on main street. However large or small our contributions are to the total problem, our wastewater must be handled and disposed of properly. Why, you ask? To quote Wilford Brimley of Quaker Oats commercial fame, "Because it's the right thing to do." The truth is that most companies will never be stopped or fined for illegal wastewater disposal. The motivation for change has to come from inside. We must want to take better care of the planet that we live on because it is the right thing to do.

So how do we dispose of our wastewater? Where should our wastewater go? Let's start with the absolute. Never, ever, ever, ever dispose of your wastewater directly into the storm sewer system. In most places, it's illegal. In all places, it is unnecessary and not wise. Now that we've gotten that out of the way, we can move on to the more complex issues. If we can't dump into the street and/or storm sewer, then where can we dump? Well, a proper understanding of that issue must first come from understanding what potential problems exist within the wastewater we are trying to dispose of.

Most cleaners simply think about what hazardous chemicals are contained in their wastewater. But there is more to it than that. In 1993, the city of Calgary, Alberta did an analysis of a professional cleaner's wastewater. You know what they were primarily concerned about? It wasn't any chemicals that were in the water—it was the fuzz, lint, and carpet fibers in the water. They were concerned that the large particle and fiber material would clog up the pumps of the sewage treatment system. They were making an excellent point. Fortunately, there are many easy ways for the professional cleaner to help solve this particular problem. Each professional cleaning company must take responsibility for doing some filtering of their wastewater. We're not talking about a $20,000 trailer mounted filtration system that is available in the high pressure washing industry. We're talking about simple filter devices such as lint socks, filtration screens, and even old panty hose. Quite simply, wastewater should be filtered in the waste tank by the use of a lint sock or filtering screen. But it should also be filtered by running it through filtration screens within the vacuum recovery line. This is usually accomplished by the use of a clear viewing filter or a metal filter. If you do both of those things, you will have pretty much solved the large particle, lint, fuzz, and carpet fiber problem.

DO OUR CLEANING CHEMICALS PRODUCE HAZARDOUS WASTE?

Now, let's focus on the chemical content of the wastewater itself. Are there hazardous chemicals in carpet cleaning wastewater? For our purposes, the wastewater that results from the cleaning process can be classified two ways. Industrial wastewater contains levels of no hazardous ingredients at part per million levels above government standards. Hazardous wastewater contains measurable hazardous ingredients that are measured at standards higher than government regulation allows. We can only determine what the cleaner used to clean the carpet with. In our industry, most preconditioners and carpet rinsing detergents do not contain any hazardous ingredients. Therefore, as long as no hazardous chemicals pre-existed in the carpet that was cleaned,

then the resulting wastewater is not hazardous. This discussion excludes the issue of butyl solvents. Some preconditioners contain butyl solvents such as Butyl Cellusolve. Butyl Cellusolve is considered to be a hazardous ingredient. However, it is also a commonly used solvent in many products. If it is contained in a carpet cleaning preconditioner in a quantity of 10% or less, its parts per million after use in a 100 gallon waste tank, classifies it as industrial waste rather than hazardous waste. However, the conscientious professional cleaner should be aware that many inexpensive carpet cleaning chemicals contain higher levels of butyl solvents; that's how they make them cheap. Also, when evaluating the resulting wastewater from a carpet cleaning chemical, it is important to keep in mind that just because a particular chemical has an ingredient listed as hazardous on its Material Safety Data Sheet, does not automatically mean the resulting wastewater would be classified as hazardous. Once the chemical is mixed and diluted in use application, and ends up as a minute percentage in a one hundred gallon waste tank, its parts per million classifies it as industrial waste. In general, carpet cleaning chemical usage results in industrial rather than hazardous wastewater. We will discuss proper disposal principles for industrial wastewater in a few moments.

However, there are a few chemicals that some carpet cleaners can or have used that might result in hazardous wastewater. Generally, these are chemicals used in spotting application. Rust removers that contain percentages of hydrofluoric or phosphoric acid greater than two percent could result in hazardous wastewater if they were used in large enough quantities. However, since the cleaner has usually used alkaline cleaning agents, these agents counteract and balance the acid ingredients resulting in industrial wastewater with a safe pH in the 7 - 9 range. One general rule that can apply here is to test the pH of your wastewater. In most places, for them to be classified as industrial wastewater, the pH should fall between 5 and 9. Take note if you are using highly alkaline cleaning agents (pH of 12 or higher); you may need to pH balance your resulting wastewater. Another category of spotting agents that we must consider are non-volatile solvent spotters. These usually contain amyl acetate and can be identified by their "banana oil" fragrance. As long as most of these chemicals are used in quantities of 8 ounces or less per 1000 square feet of carpet cleaned, they pose no danger to making the resulting cleaning wastewater hazardous. However, it is still good practice to use them in a post-spotting application and rinse them with volatile solvent spotters.

In general, it's a good practice that spotting agents only be used after basic cleaning procedures would not remove a spot or stain. A good general rule to keep yourself safe is to only use spotting chemicals bought from reputable chemical manufacturers that specialize in fabric cleaning.

SO WHAT ARE OUR DISPOSAL OPTIONS?

So now that we have determined that a large majority of the time our wastewater is not hazardous, what are our options for disposing of it? We have already eliminated dumping it onto the streets. A good general rule of practice is to always dispose of the wastewater into the sewage treatment system only after the large particle solids and carpet fibers have been filtered out. There are several ways of getting the wastewater into the sewage treatment system. The first, easiest, and least cumbersome and expensive way is to find drain access to the sewage treatment system. This may be through a garage drain, toilet, bathtub, shower, sink, or janitorial closet sink. Transporting the wastewater to these drains on-site is best accomplished by the use of a waste pumping system. Several different types of waste pumping systems exist. Some mount directly in the waste tank and some are attached to clear view or metal filter boxes. A second way to dispose of wastewater into the sewage treatment system is simply by using the waste tank collection system of your equipment to hold the wastewater so that you can transport them to a site where direct drain access to the sewage treatment system can be used. In this case, the filtered wastewater can directly be dumped into the drain. Obviously, in these cases, the larger the waste tank, the more efficiently you can do this. Some cleaners have taken their wastewater to dump at car washes. Most car washes filter and recycle their water. If not, then they do feed them into the sewage treatment system. Whatever the case, never dump at a car wash without first making arrangements with the car wash owner/operator. Also, make sure you filter the lint, large particles, and carpet fibers before you dump the water. These materials will clog up the drains and the recycling pumps at the car wash.

There are exceptions to this "dump your wastewater in the sewage treatment system" rule. An important item to remember is that when you dispose of industrial wastewater, you are literally under the jurisdiction of at least three government agencies. The local agency is usually a city or county wastewater management force. The state agency is usually a state environmental protection agency or industrial wastewater agency. The federal group is usually the United States Environmental Protection Agency. Hopefully, these groups are working together, but that is not always the case. Generally, local ordinances are more specific and stricter. It is usually a local or state agency that may contact you. We will discuss how to work with these agencies later. The best way to find out if you can legally put your filtered wastewater into the sewage treatment system is to ask your local wastewater management agency. What kinds of exception will you find? Plenty. For instance, in El Paso County, Colorado, it is illegal to dump into the storm drain. However, it is not illegal (in fact, it's recommended) to dispose of industrial wastewater onto grass and shrub covered land. A customer of ours in Alaska has really ran into difficulty. His city does not have a sewage treatment system (everyone uses septic tanks). It is illegal to dump into the storm drains or onto the land. So what is he supposed to do? Transport the wastewater to a disposal site in Utah? He has to build a treatment system in his back yard. This is a case of bureaucracy being unable to find a reasonable solution. On the issue of septic tanks, generally, your wastewater should only be disposed of into septic tanks and septic systems when you make sure the enzyme balance within that septic system has not been damaged. If it has,then you must restore that balance.

What about dumping your wastewater onto land? This should not necessarily be a "cut and dry" issue. Unfortunately, with many bureaucrats, it is. Obviously, a better solution is the sewage treatment system, but sometimes that is impossible, impractical, or too expensive. I don't think any well-meaning environmentalist or wastewater management enforcement executive really wants to put a conscientious professional cleaner at an extreme competitive disadvantage. What is the make up of the non-hazardous chemical ingredients within industrial wastewater? Basically, our cleaning chemicals contain anionic or nonionic surfactants and alkaline builders. None of these are harmful to plants. Most are vert biodegradable. In fact, many of the ingredients contained in our cleaning chemicals are also contained in fertilizers. There has been a lot of publicity surrounding phosphates that are contained in many carpet cleaning detergents. Phosphates themselves are not hazardous. They are actually a fertilizer. In too high a percentage in the water supply they can cause too much plant and algae growth. Theoretically, this growth of plants and algae could become too intense. This would harm water wildlife because the plant and algae growth would use up too much of the oxygen, not leaving enough for the wildlife. In addition, a lake could become more of a swamp because of too much algae and plant growth in the water. Therefore, these ingredients can be harmful to fish or other water life when too much phosphate is in the water supply. Only in Oregon are phosphates in industrial cleaning detergents prohibited. If you continue to use cleaning detergents that contain phosphates, never dispose of your waste water within two miles of a stream or other water flow. There is something else you should consider about waste water disposal: Picture your goldfish trying to breathe in your bath water after you've just shampooed your hair. The detergents inhibit the natural function of the gills, which could cause an oxygen shortage to the fish. That's why our wastewater must never be directly or even in close proximity, be dumped into the water supply. Some enforcement agencies use a "two mile" rule. In some places, you may dispose of industrial wastewater onto the ground as long as you are over two miles from a stream, river, or lake. Our industrial wastewater is probably not harmful to wildlife. However, many agencies feel that "probably" is not good enough. They may be right. However, many city and county sewage treatment systems are archaic in nature and/or overloaded. They would prefer that wastewater not be disposed of into the sewage treatment system. Many rural areas don't have sewage treatment systems. Many agencies feel that there are no ill effects of dumping industrial wastewater onto the ground. This is a complex issue. Whenever possible, your industrial wastewater should be disposed of in a sewage treatment system.

Other alternatives that sometimes are given are simply not realistic. Carpet cleaners cannot afford to transport their industrial wastewater to a hazardous disposal site. Most cities don't even have one. They can't afford to pay someone to take it away—that can cost up to $3,000.00 for a fifty-five gallon drum of soapy water. That's absurd! How can any agency fairly enforce waste disposal laws that prohibit dumping into the sewage treatment system to companies that only use portable equipment? Laws and regulations are only useful if they can be fairly enforced against every company. Environmentalists and agencies must work together with cleaning companies to develop reasonable solutions to this challenge. As stated earlier, no well-meaning environmentalist or agency wants to force a cleaning company which makes such positive health contributions to the indoor environment, out of business, by passing unreasonable rules and regulations.

HOW TO DEAL WITH A REGULATORY AGENCY?

That brings us to our discussion of what to do when you deal with a regulatory agency. First and foremost, be honest. The best defense is a good offense! When you show and demonstrate that you are genuinely concerned about being in compliance with regulations, they are much more likely to work with you. When you show and demonstrate that your company is environmentally conscious, then reasonable solutions seem to be found. Second, have your Material Safety Data Sheets ready for the chemicals you use to clean carpets. Explain to the agency what each chemical is and how it is used. Third, don't be afraid to let them test your wastewater. In fact, request it. Fourth, if you have been accused of a "wrongdoing", don't panic. Be courteous and helpful. If you are dealing with a totally unreasonable individual, (a bureaucrat who wants to save the world in two months or thinks all business people are trying to destroy the world with pollution) always ask for a meeting with his/her supervisor. Usually, more experienced regulatory people are better able to reach reasonable solutions. If you have to, go all the way to the mayor, county commissioner, or governor's office. Remember that government is for the people. Demonstrate a true willingness to reach solutions that are reasonable to everyone's needs. Fifth, have a posted waste water disposal policy for your company at your office, garage, and on each van, so that you and your employees know the proper procedures for the disposal of industrial wastewater. After reading this essay, if you get caught for illegal dumping of wastewater into the streets of your town, as they say, "Don't come crying to me." Finally, sell the fact that you, like they, are in the cleaning business. It's your job to clean up indoor environments. It's their job to clean up outdoor environments. You need to work together.

PRE-EXISTING CONDITIONS

A few important thoughts before we close. We all must deal with an important issue. That is what we can do about "pre-existing" conditions. "Pre-existing" conditions in this case are chemical residues that are left in the carpet by installers, pesticide applicators, or even by the homeowner, that may be picked up during the cleaning process, thus perhaps making the wastewater hazardous. Truthfully, the chance of any residue being enough to make one hundred gallons of wastewater hazardous are slim, but it could happen. What should we do? First of all, pesticides are becoming organic and safer. Second, installation people are now using cleaning solvents that are environmentally friendly. Thus, the main people who must take responsibility for what chemicals are put on their carpet are the carpet consumers.

WHAT IF OUR WASTE WATER IS HAZARDOUS?

Occasionally, the cleaning process can result in the production of hazardous wastewater. A professional cleaner must learn how to identify these situations and take appropriate actions. If the people who have hired you to do the work are not willing to pay to have the appropriate authorities and experts dispose of the hazardous wastes properly, then you must walk away from the job.

WHAT ABOUT OTHER CARPET CLEANING METHODS?

Finally, we need to take a close look at what kind of wastes other carpet cleaning methods produce. Obviously, in hot water extraction "steam" cleaning, water is the main carrying agent and ends up "holding" most of the soiling. Does that make so-called "dry" cleaning solution methods better for the outdoor environment? Not necessarily. The wastes produced by these dry cleaning methods may or may not always be disposed of into the sewage treatment system, but almost exactly the same sets of rules and regulations apply. In the case of dry extraction absorbent compounds, the resulting wastes, if disposed of in a trash can, will still end up in a sanitary landfill, where they will never be treated by anything. If they contain hazardous materials, then they have been illegally and improperly disposed of.

First, we must examine the ingredients of these cleaning solutions. Dry powder cleaning chemicals, usually consist of a carrier that is cellulose or urethane based. These carriers are saturated with anionic or nonionic detergents. The cleaner who is using dry powders is responsible for determining whether the resulting wastes are hazardous or not. Bonnet cleaning solutions include the use of water both in the mixing of the chemical as well as in the cleaning of the bonnet pads. Usually, bonnet cleaning solutions contain similar ingredients to preconditioning agents. Often times though, they have a higher solvent level. Since bonnet cleaning solutions are not extracted from the carpet, the only consideration is whether washing out the bonnet pad might produce hazardous waste. Normally, this will simply be industrial waste also. Dry foam shampoos are anionic and/or nonionic detergents. They are mixed with water before application. Dry foam application machines produce waste that must be properly disposed of. With the use of dry powder, bonnet cleaning solutions, and dry foam shampoos, sometimes preconditioners can be used in extreme soiling circumstances. The use of carpet shampoo involves anionic surfactants that are mixed with water. Shampoos are usually vacuumed out or wet extracted out resulting in cleaning wastes.

Second, with any cleaning method, the determination and classification of the wastes, as well as their proper disposal, must be made by the cleaner.

PRINCIPLES OF WASTE WATER DISPOSAL

In closing, let us summarize what we have learned:

1) Carpet cleaning wastewater makes up less than 1/2 of 1 percent of the total wastewater problem.
2) Wastewater should be disposed of properly, primarily because it is the right thing to do.
3) Never dispose of wastewater directly into the streets or storm sewer system.
4) Before disposing of wastewater, it should be filtered to remove fuzz, lint, carpet fibers and other large particles.
5) Wastewater that is produced by the cleaning process is classified as either industrial waste or hazardous waste.
6) The use of most preconditioners and carpet rinsing detergents in the hot water extraction cleaning process normally results in industrial wastewater that does not contain hazardous materials.
7) The pH of industrial wastewater should be between 5 and 10.
8) Spotting procedures should be performed after the regular cleaning process. Harsh alkaline or acid spotting solutions must be neutralized prior to being extracted. . Spotting solutions should not be used in quantities larger than 8 ounces per 1000 square feet cleaned.
9) The best way to dispose of cleaning industrial wastewater is by directly placing it into an outlet which directly goes to the sanitary sewage treatment system. This can best be accomplished by waste pumping systems or by large capacity wastewater holding tanks.
10) Cleaners who use portable cleaning equipment must follow the same rules.
11) Cleaning wastewater disposal falls under the jurisdiction of local, state, and federal regulations.
12) Some jurisdictions allow for the disposal of industrial cleaning wastewater onto the ground far from a water supply. In general, it is still better to dispose of it into the sewage treatment system.
13) Generally, do not dispose of industrial cleaning wastewater into septic tank systems without re-establishing the enzyme balance within the septic system.
14) Industrial cleaning wastewater can be harmful to fish and other water wildlife.
15) In dealing with regulatory agencies, you should:
    a. Be honest and demonstrate a commitment to being in compliance with regulations;
    b. Have Material Safety Data Sheets for the chemicals that you use to clean with ready to present at all times;
    c. Allow, even request, that they test your wastewater;
    d. If dealing with an unreasonable person, be courteous but ask to speak with his/her supervisor; and
    e. Maintain a posted and written policy for your company for disposing of wastewater.

16) Pre-existing chemical residues are the responsibility of the carpet owner.
17) If the cleaning wastewater is hazardous, it must be treated as such and disposed of properly and legally.
18) All carpet cleaning methods produce waste that must be handled and disposed of properly.
19) If you choose to ignore these rules, then you are on your own.