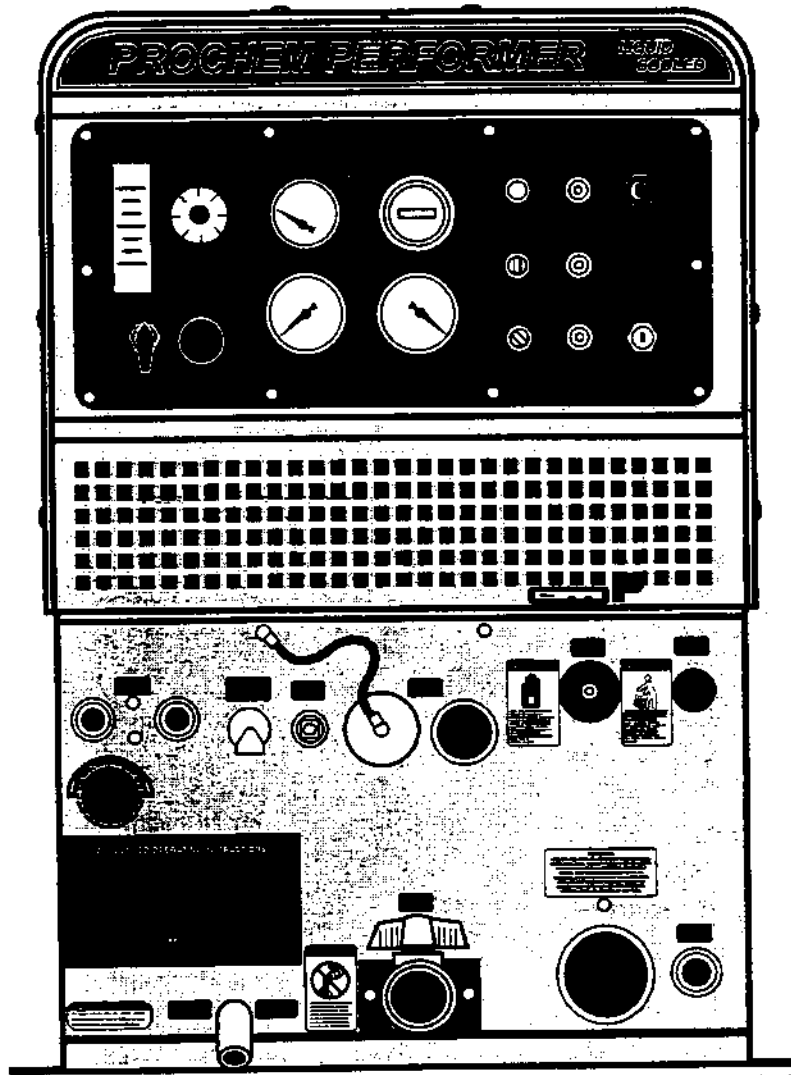


PERFORMER & PERFORMER 405

Mobile Cleaning Unit



March 1999

OPERATION & SERVICE MANUAL



67-945324

MANUAL • INSTRUCT PRF/PRF4

UM: EA

*Welcome...*and congratulations on your purchase of the **PERFORMER/PERFORMER 405** Mobile Cleaning Unit. This instruction manual is a guide for operating and servicing your PROCHEM unit. **Read this manual completely before installing or operating this unit.**

This unit offers you personal convenience. All of your instrumentation and controls have been positioned to give you easy access for operation and daily maintenance.

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

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

The headings: **CAUTION** or **WARNING** are used to warn you that steps must be taken to prevent damage to the unit and/or personal injury. Make certain that you read all instructions entirely before proceeding with the operation of the unit.

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

MAKE CERTAIN THAT THE WARRANTY CARD IS FILLED OUT BY THE DISTRIBUTOR FROM WHOM YOU PURCHASED THIS UNIT AND RETURNED TO PROCHEM!

Please record your unit serial number here for future information or if you should need to contact the factory for any reason.

This operation and service manual is written specifically for the **PROCHEM PERFORMER/PERFORMER 405** Mobile Cleaning Units which are manufactured by:

PROFESSIONAL CHEMICALS
CORPORATION
325 SOUTH PRICE ROAD
CHANDLER, ARIZONA 85224

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**PERFORMER &
PERFORMER 405 MANUAL
#67-945324**

LIMITED WARRANTY

PROCHEM warrants your machine to be free of defects in material and workmanship. This warranty shall extend to the designated parts for the specific time period listed from the date of delivery to the user. If PROCHEM receives notice of such defects during the warranty period, PROCHEM will either, at its option, repair or replace products which prove to be defective. Any local or distant transportation, related service labor, normal maintenance, and diagnostic calls are not included.

Gasoline Engine (through manufacturer or local dealer)	_____	1 year
Vacuum Pump (through manufacturer or local dealer)	_____	18 months
Engine Heat Exchanger	_____	1 year
Water Pump	_____	2 years
Waste Pump	_____	1 year
Wands (Except shut off valve and orifices)	_____	1 year
Waste & Water Tanks	_____	1 year
Pressure Regulator	_____	1 year
All other components	_____	1 year
Battery (through dealer only, pro-rated)	_____	1 year (1-800-350-8068)

This warranty shall not apply to defects resulting from improper installation or operation, inadequate maintenance by the customer, unauthorized modification, misuse, a unit which is improperly repaired, exposure to freezing temperature conditions, or damage due to hard water scaling.

Disposable filters, electrical components, belts, fittings, hoses, o-rings, and other maintenance items are not under warranty. Components provided by PROCHEM, but supplied by other manufacturers, will only be warranted to the extent that they shall be warranted to PROCHEM.

To obtain warranty service, products must be returned to a service facility designated by PROCHEM. Customer shall prepay shipping charges for products returned to PROCHEM for warranty service and PROCHEM shall pay for return of the products to customer.

PROCHEM makes no other warranty, either expressed or implied, with respect to this product. PROCHEM disclaims the implied warranties of merchantability and fitness for a particular purpose. Any implied warranty of merchantability or fitness is limited to the specific duration of this limited warranty.

This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state, or province to province.

The remedies provided herein are the customer's sole and exclusive remedies. In no event shall PROCHEM be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Your PROCHEM unit is designed to give you years of reliable service. However, if a problem should arise after the warranty period, follow the troubleshooting procedures in the Operation and Service Manual. If you are still unable to determine the cause and solution to the problem, contact your nearest PROCHEM Service Center for details of the services available.

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SECTION 1: GENERAL INFORMATION

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2 RECEIVING YOUR UNIT

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1 SAFETY



WARNING: For Your Safety!

The following **WARNING LABELS** are found on your **PERFORMER/PERFORMER 405** console. These labels point out important **Warnings and Cautions** which should be followed at **all times**. Failure to follow warnings and cautions could result in fatality, personal injury to yourself and/or others, or property damage. Follow these instructions carefully! **DO NOT** remove these labels.

⚠ WARNING

ELECTRICAL SHOCK COULD CAUSE SEVERE BURNS OR INJURY. DO NOT TOUCH ELECTRICAL WIRES OR COMPONENTS WHILE THE ENGINE IS RUNNING. DISCONNECT THE BATTERY BEFORE SERVICING THIS UNIT TO PREVENT ACCIDENTAL STARTING.

⚠ DANGER

WATER UNDER HIGH PRESSURE AT HIGH TEMPERATURE CAN CAUSE BURNS, SEVERE PERSONAL INJURY, OR COULD BE FATAL. SHUT DOWN MACHINE, ALLOW TO COOL DOWN, AND RELIEVE SYSTEM OF ALL PRESSURE BEFORE REMOVING VALVES, CAPS, PLUGS, FITTINGS, FILTERS AND BOLTS.

⚠ WARNING

READ THE OPERATORS MANUAL BEFORE INSTALLING OR STARTING THIS UNIT. FAILURE TO ADHERE TO INSTRUCTION CAN RESULT IN SEVERE PERSONAL INJURY OR COULD BE FATAL. REPLACEMENT MANUALS CAN BE PURCHASED FROM:
Professional Chemicals Corporation
325 S. Price Rd.
Chandler, AZ 85224

⚠ WARNING

ROTATING MACHINERY CAN CAUSE INJURY OR COULD BE FATAL. KEEP ALL GUARDS AND SAFETY DEVICES IN PLACE.

CAUTION

HOT SURFACE
DO NOT TOUCH

ROTATING MACHINERY. WATER UNDER PRESSURE AT HIGH TEMPERATURE. IMPROPER MODIFICATION OF EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR COULD BE FATAL.

⚠ DANGER

DO NOT MODIFY UNIT WITHOUT WRITTEN PERMISSION FROM MANUFACTURER

WARNING:

OPERATE THIS UNIT AND EQUIPMENT ONLY IN A WELL-VENTILATED AREA. EXHAUST FUMES CONTAIN CARBON MONOXIDE WHICH IS AN ODORLESS AND DEADLY POISON THAT CAN CAUSE SEVERE INJURY OR FATALITY. DO NOT RUN THIS UNIT IN AN ENCLOSED AREA. DO NOT OPERATE THIS UNIT WHERE THE EXHAUST MAY ENTER ANY BUILDING DOORWAY, WINDOW, VENT, OR OPENING OF ANY TYPE.

⚠

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, and other reproductive harm.

Order Part #48-941212 to get a complete set of decals (safety and instrumentation) for your **PROCHEM PERFORMER/PERFORMER 405** cleaning unit. The following decals must be placed in a prominent spot on the vehicle that your unit is to be installed in where access is given to operate the unit. See Figure 12 on page 22 for suggested locations for these decals.

⚠ WARNING

CLEANUP ANY SPILLED FUEL INSIDE VEHICLE PRIOR TO OPERATION OF ANY EQUIPMENT IN VEHICLE. GASOLINE IS EXTREMELY FLAMMABLE AND ITS VAPORS CAN EXPLODE IF IGNITED.

⚠ DANGER

ENGINES PRODUCT CARBON MONOXIDE WHICH IS AN ODORLESS DEADLY POISON. DO NOT OPERATE IN AN ENCLOSED AREA.

Decal, Fuel Clean-up
Part #48-941317

Decal, Carbon Monoxide
Part #48-941316



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



WARNING!

1. *Read the operator's manual before installing or starting this unit. Failure to adhere to instructions could result in severe personal injury or could be fatal.*
2. *Operate this unit and equipment only in a well-ventilated area. Exhaust fumes contain carbon monoxide which is an odorless and deadly poison that can cause severe injury or fatality. DO NOT run this unit in an enclosed area. DO NOT operate this unit where the exhaust may enter any building doorway, window, vent, or opening of any type.*
3. *Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well-ventilated, unoccupied buildings away from sparks or flames. Never carry any gasoline or flammable material in the vehicle. Fumes may accumulate inside the vehicle and ignite, causing an explosion. DO NOT store any type of flammable material in the vehicle.*
4. *This unit must be operated with the vehicle or trailer doors open in order to ensure adequate engine ventilation.*
5. *DO NOT operate engine if gasoline is spilled. Avoid creating any ignition until the gasoline has been cleaned up. Never use gasoline as a cleaning agent.*
6. *DO NOT place hands, feet, hair, or clothing near rotating or moving parts. Avoid*

any contact with moving parts! Rotating machinery can cause injury or fatality.

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

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

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

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

11. *DO NOT touch the exhaust diverter valve or any part of the exhaust system while this unit is running. Severe burns may result.*

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

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

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

15. *Dangerous Acid, Explosive Gases! Batteries contain sulfuric acid. To prevent acid burns, avoid contact with skin, eyes and clothing. Batteries produce explosive hydrogen gas while being charged. To prevent a fire or*

explosion, charge batteries only in well ventilated areas. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries.

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

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

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

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

19. DO NOT exceed your vehicle's weight limit. The console with waste tank and accessories weighs approximately 1209 lbs. (Performer 405 is 1255 lbs.) Make certain that the vehicle has the correct axle rating. This will prevent unsafe vehicle driving conditions.

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

21. DO NOT operate this unit without the water supply attached and turned on. The water pump and other vital components may be seriously damaged if this unit is permitted to operate dry without water. This unit is equipped with a low pressure shut-down device. DO NOT bypass or operate this unit without the low pressure shut-down switch.

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

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

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

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

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

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

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

SPECIFICATIONS:

Engine speed	2400 rpm (high speed in H.E. position) 1900 rpm (low speed in Muffler position - water pump "OFF") 900 rpm (idle speed in Muffler position - water pump "OFF")
Water pump rpm	1625 rpm
Vacuum pump rpm	2650 rpm
Water flow rate	5.0 GPM (maximum)
Water pump pressure	1000 PSI (maximum)
Vacuum relief valve	14" Hg (13" Hg - Performer 405)
Waste tank capacity	66 Gallons (55 gallons to shut-off)
Console weight	964 lbs. (1010 lbs. - Performer 405)
Console weight (with waste tank and accessories)	1209 lbs. (1626 lbs. if waste tank is full) 1255 lbs. (1672 lbs. if waste tank is full - Performer 405)

TORQUE VALUES

Component	inch/lbs	foot/lbs
Engine hub	720	60
Vacuum pump hub	192	16

JET SIZING

PROCHEM recommends floor tool tip sizing not exceed a total of ".06". Using larger jet sizes on your PERFORMER/PERFORMER 405 may reduce cleaning temperatures.

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

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

Example: Tri-jet wand uses three 95015 jets (95° spray angle w/ 015 orifice).
 $015 \times 3 = 045$ $045 \times 2 \text{ tools} = 09$

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

1. INSTALLATION REQUIREMENTS

Prior to starting the installation, first read the ENTIRE "Installation" section of this manual. Since the PERFORMER cleaning unit (with waste tank and accessories) weighs 1209 pounds (PERFORMER 405 weighs 1255 lbs.), consider the following recommendations before installing this unit.

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



CAUTION:

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

2. If mounting in a trailer, make certain that the trailer is rated for the total weight of the **UNIT AND TRAILER**. Electric or hydraulic brakes should be provided, and a strict compliance with any State and Federal vehicle laws must be maintained.
3. The vehicle tires should have a load rating above the combined vehicle and unit weight.
4. We do not recommend using flooring materials that absorb water. This could result in rust and corrosion of the vehicle floor.
5. Padding under rubber floor mats should be removed before installing this unit.
6. We highly recommend using a galvanized drip tray under the console (Part #56-501845).
7. If using a trailer, the PERFORMER/PERFORMER 405 console should be positioned so that it balances properly with respect to the axle. Ten percent (10%) of the overall unit weight (without accessories or water) should be on the tongue.

2. FUEL REQUIREMENTS

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

3. ENGINE OIL REQUIREMENTS

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

RECOMMENDED SAE VISCOSITY GRADE

						20W-20, 20W-40, 20W-50
						10W-30, 10W-40, 10W-50, 15W-40, 15W-50
						10W
						5W-30
						5W-20
*F	-22	-4	14	32	59	104
°C	-30	-20	-10	0	15	40
TEMPERATURE RANGE EXPECTED BEFORE NEXT OIL CHANGE						

4. CHEMICAL REQUIREMENTS

The PROCHEM PERFORMER/PERFORMER 405, due to its chemical injection pump design, can be used with a variety of water-diluted chemical compounds (either acidic or alkaline), depending on the job to be done. However, to obtain optimum results with this unit, we recommend using the PROCHEM line of chemicals. For information on using the cleaning compounds, refer to the PROCHEM chemical manual.

5. WATER REQUIREMENTS

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



NOTE:




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

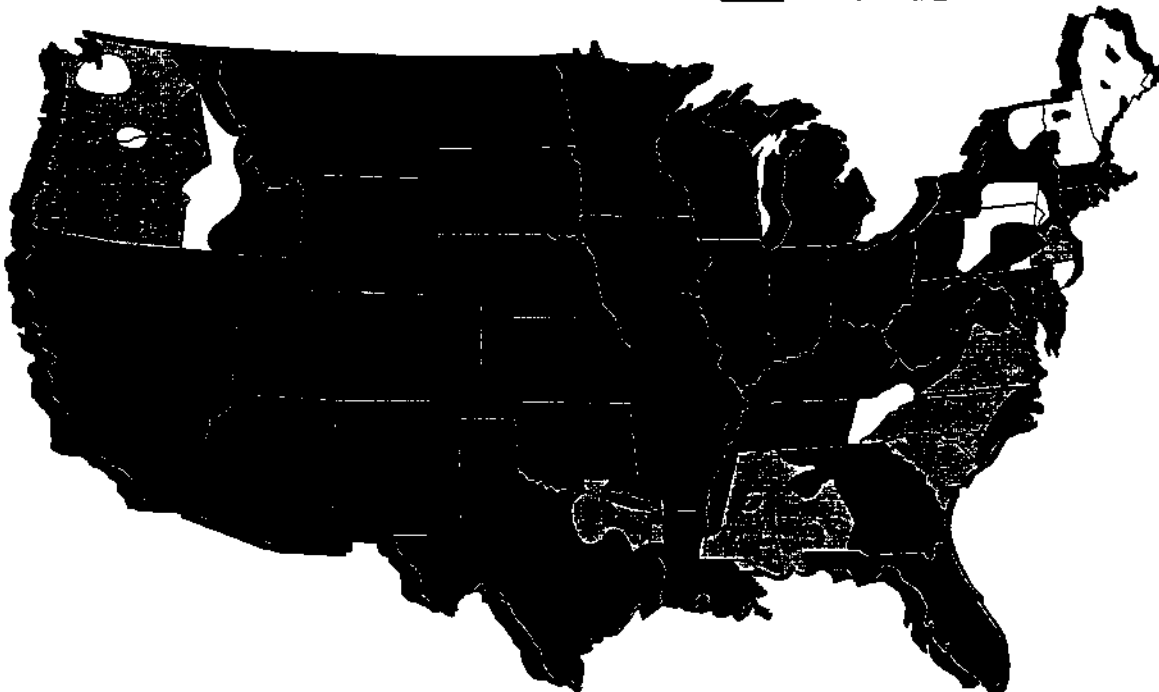
If you are operating this unit in an area where the unit will be using water in which the hardness exceeds 3-1/2 grains, we highly recommend a suitable water softener be installed. If using a water softener, it must have a five (5) GPM (or greater) flow capacity without any hose constrictions.

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

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

Figure 1 HARD WATER MAP

-  LESS THAN 3.5
-  3.5 TO 7
-  MORE THAN 7



2

RECEIVING YOUR UNIT

This chapter of the operator's manual contains information on receiving your PROCHEM PERFORMER/PERFORMER 405.

1. DEALER RESPONSIBILITY

THE PROCHEM DISTRIBUTOR FROM WHOM YOU PURCHASED THIS MOBILE CLEANING UNIT IS RESPONSIBLE FOR THE CORRECT INSTALLATION OF THIS MACHINE. THE DEALER IS ALSO RESPONSIBLE FOR INITIAL TRAINING OF YOUR OPERATORS AND MAINTENANCE PERSONNEL IN THE PROPER OPERATION AND MAINTENANCE OF THIS UNIT.

2. ACCEPTANCE OF SHIPMENT

Every part of your PROCHEM PERFORMER/PERFORMER 405 cleaning unit was carefully checked, tested, and inspected before it left our manufacturing plant. Upon receiving the unit, make the following acceptance check:

1. The unit should not show any outward signs of damage. If damaged, notify the common carrier immediately.
2. Check your equipment and packing list. The standard PROCHEM PERFORMER/PERFORMER 405 cleaning unit should arrive equipped with the following items (unless otherwise specified) and any optional accessories which were ordered:

3. EQUIPMENT LIST

- A) PROCHEM PERFORMER/PERFORMER 405 console.
- B) Operation and service manual with engine, water pump, and vacuum pump manuals.
- C) Installation bolting kit.
- D) Installation mounting plates.
- E) Fittings and hoses for fuel supply installation.
- F) Hose clamps for fuel & vacuum hoses.
- G) External fuel pump installation kit.
- H) Carpet wand.
- I) Waste tank w/float switch.
- J) Waste tank filter and strainer basket (PERFORMER 405 units have two filters).
- K) 150 ft. of 2" vacuum hose.
- L) 2 vacuum hose connectors.
- M) 150 ft. of 1/4" high pressure hose with quick connects.
- N) 50 ft. water supply hose with quick connect.

4. OPTIONAL EQUIPMENT

- O) Winterizing loop hose. Part #10-805380.
- P) Upholstery tool and stair tool.
- Q) Extra wands.
- R) Hose reel.

SECTION 2: INSTALLATION

3 INSTALLATION

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3 INSTALLATION



WARNING!

All units must be bolted to the floor of the vehicle by a PROCHEM DISTRIBUTOR.

1. LIFTING THE UNIT ONTO THE VEHICLE

Since the PROCHEM PERFORMER console weighs approximately 964 pounds (PERFORMER 405 weighs 1050 lbs.), we recommend using a fork lift to lift the unit onto the vehicle. Position the forks under the unit from the front and make **CERTAIN** that the forks are spread to the width of the base.

2. POSITIONING THE UNIT IN THE VEHICLE

Because vehicles vary in size and openings, individuals have their own preference as to where they want their units installed. We strongly recommend a side door installation for the PERFORMER/PERFORMER 405 and **DO NOT** recommend a rear door installation.

1. Enough space should be provided to assure adequate engine ventilation and room for service and maintenance.
2. The unit with waste tank and accessories must **NOT** exceed the vehicle's axle weight limit.
3. **DO NOT** position the console closer than 12" from the bottom of the driver and passenger seats.

NOTE: For individuals who wish to make an engineering layout prior to positioning the unit,

refer to Figure 2 for waste tank and console dimensions.

3. BOLTING DOWN THE UNIT AND WASTE TANK

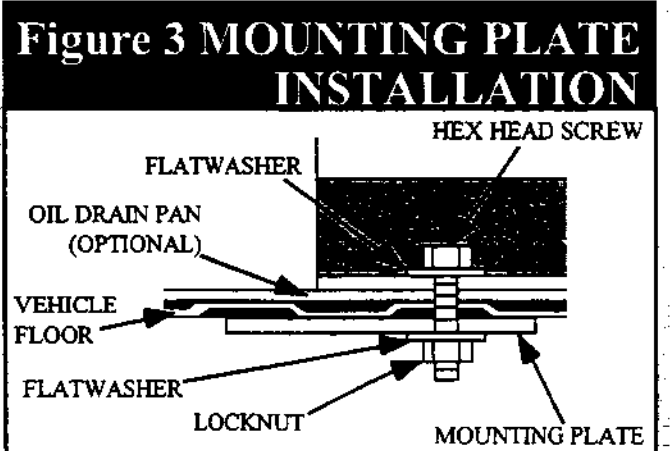
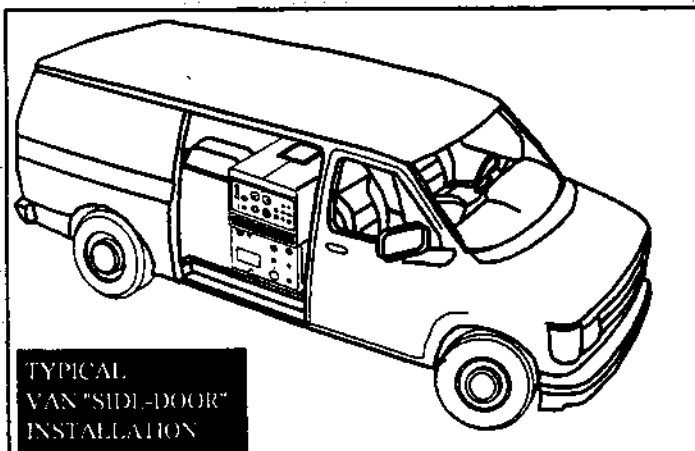
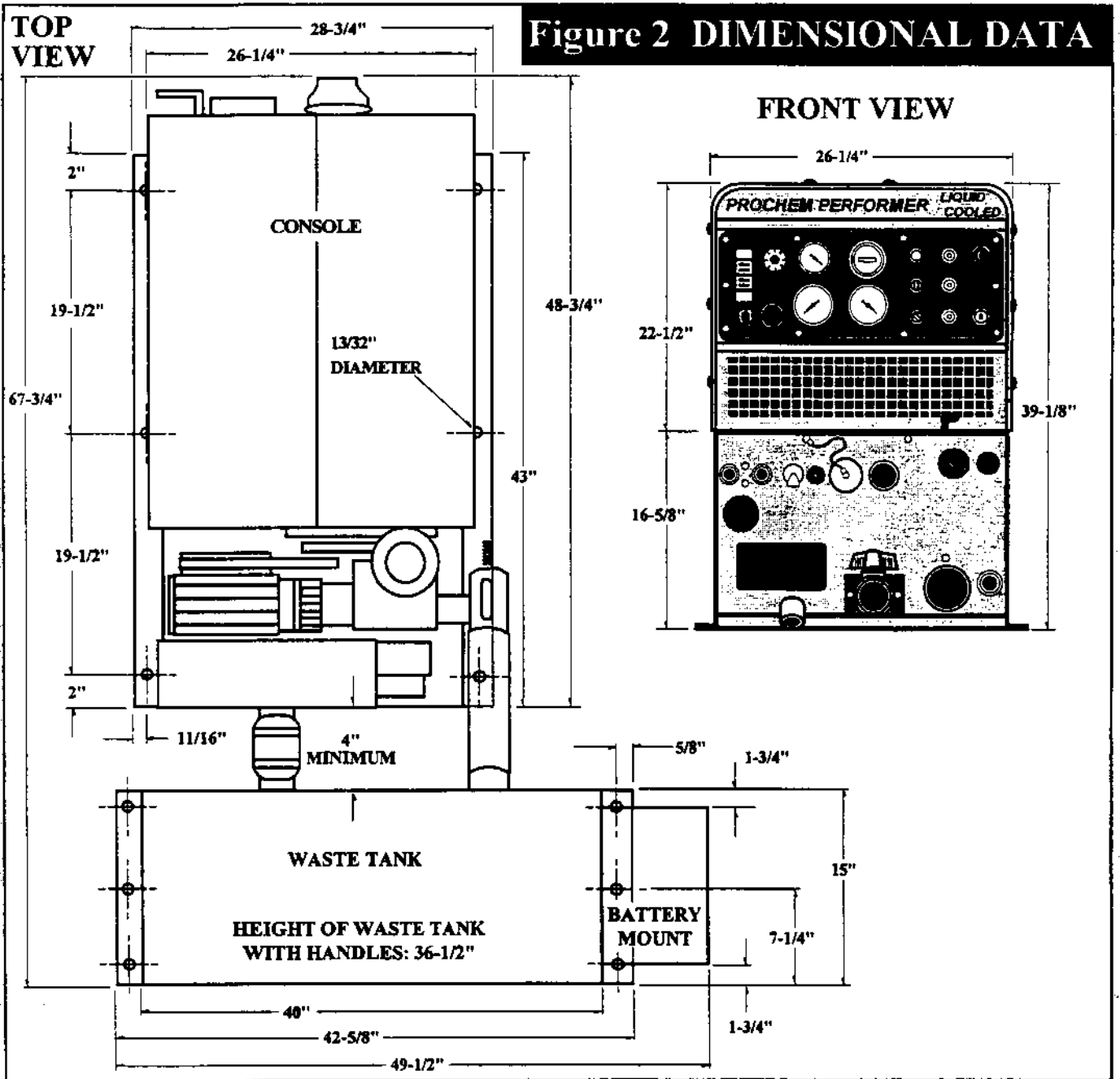
NOTE: When positioning the waste tank with respect to the console, hook up the vacuum hoses to the waste tank. This will ensure that the waste tank is positioned correctly. Once the unit and waste tank are positioned in the vehicle in the desired location, you may proceed.



CAUTION:

Before drilling any mounting holes in the vehicle floor, make certain that when drilling, you will not do any damage to the fuel tank, fuel lines, or any vital component which might affect the operation or safety of the vehicle.

1. Using the console and waste tank mounting holes as a template, drill six 13/32" diameter holes for mounting the console and six more 13/32" diameter holes for mounting the waste tank.
2. Using the installation hardware kit:
 - a) Insert six 3/8-16 x 2" hex head cap screws with flat washers through the mounting holes in the PROCHEM PERFORMER/PERFORMER 405 console, and six 3/8-16 x 2" hex head cap screws with flat washers through the mounting holes in the waste tank.
 - b) Install the mounting plates underneath the vehicle floor.
 - c) Screw the 3/8-16 hex head locknuts on the mounting screws and tighten them until the console and the waste tank are firmly secured to the vehicle floor.



4. INSTALLING FUEL LINE ON THE VEHICLE

READ THESE INSTRUCTIONS ENTIRELY BEFORE PROCEEDING.



WARNING!

Under **NO** circumstances should you splice any of the vehicle fuel lines. Severe injury or fatality may result.



CAUTION:

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

The following text applies to vehicles other than 1992 (or later) Fords or 1997 (or later) Chevrolets, GMCs, and Dodges. See Figure 7 for 1992 (or later) Ford fuel line installation. See Figure 8 for 1997 (or later) Chevrolet and GMC fuel line installation. See Figure 9 for 1997 (or later) Dodge fuel line installation.

1. Select a location on the vehicle floor to drill a hole for the bulkhead adapter. This location should be situated in a position that eliminates the possibility of fuel line contact by either the operator(s) or accessories during the working hours or maintenance periods. We supply steel braid fuel hose. Make certain that the hose will reach the location you choose.



CAUTION:

Before drilling the fuel line hole in the vehicle floor, make certain that when drilling you will not do any damage to the fuel tank(s), fuel lines, brake lines, heat shields,

or any other vital component which might affect the operation or safety of the vehicle.

2. Drill a 5/8" (.625) diameter hole through the vehicle floor.

3. Install the 1/8P bulkhead adapter by inserting the adapter and tightening the nut on the opposite side of the van floor (Figure 4).

4. Attach a 1/8P x 1/4T elbow to the bulkhead adapter on one end (Figure 4). Attach a 1/8P street elbow and a 1/8P x 5/16H barb fitting to the other end of the bulkhead adapter.

5. Connect one 45-1/2" stainless steel hose from the fuel inlet on the console to the bulkhead adapter.

6. Disconnect from the filler neck the 2 hoses which connect the filler neck and the fuel tank by loosening the hose clamps.

7. Remove the filler neck from the vehicle. Refer to the vehicle manual for instructions and cautions.

8. Select a suitable location for drilling the hole in the filler neck. The desired location for this hole may vary. It is important that you are able to re-install the filler neck without interference from the fittings which you are adding. Therefore, choose this location wisely before proceeding.

9. Drill a 1/2" diameter hole in the filler neck after you are certain that you have chosen the proper location (Figure 6).



NOTE:

When assembling pipe fittings, Teflon thread sealant must be used.

10. Attach a 1/8P x 1/4T elbow to one end of the short bulkhead adapter (Figure 5).

FUEL LINE INSTALLATION

FUEL LINE INSTALLATION KIT Part # 66-945153 (For vehicles other than 1992 or later Fords or 1997 or later Chevrolet, GMC, and Dodges)

IF THE VEHICLE IN WHICH YOU ARE INSTALLING YOUR UNIT IS OTHER THAN A 1992 (or later) FORD OR A 1997 (or later) CHEVROLET, GMC, OR DODGE VAN, IT WILL BE NECESSARY TO FOLLOW THE INSTRUCTIONS THAT COME IN THIS KIT:

WARNING!

DO NOT smoke around the vehicle. Work in a well-ventilated area away from sparks or flames.

Gasoline is extremely flammable and its vapors can explode if ignited.

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

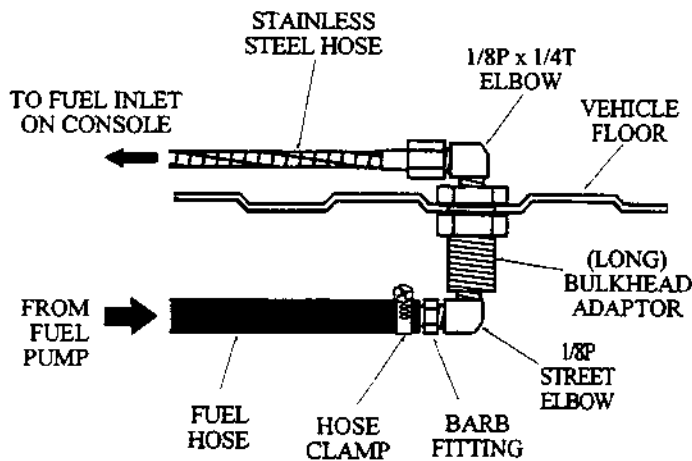


FIGURE 4

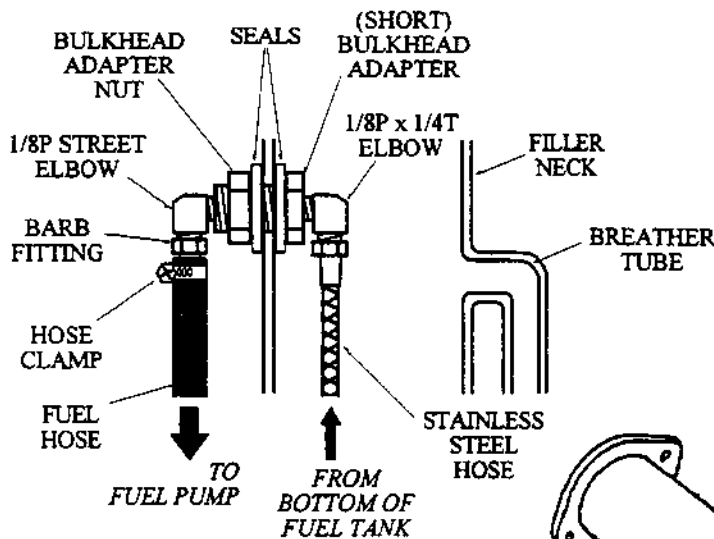


FIGURE 5

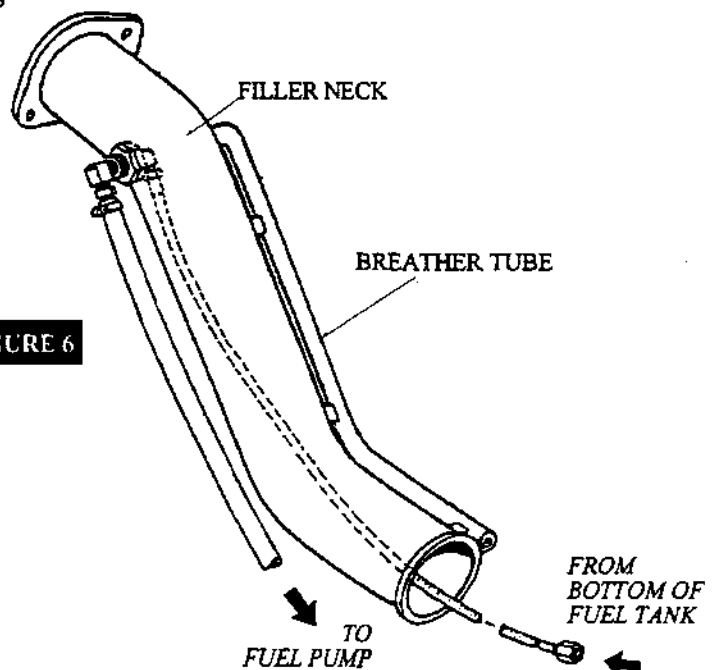


FIGURE 6

Figure 7 1992 (or later) FORD FUEL LINE MODIFICATION



WARNING!

DO NOT smoke around the vehicle. Work in a well-ventilated area away from sparks or flames.

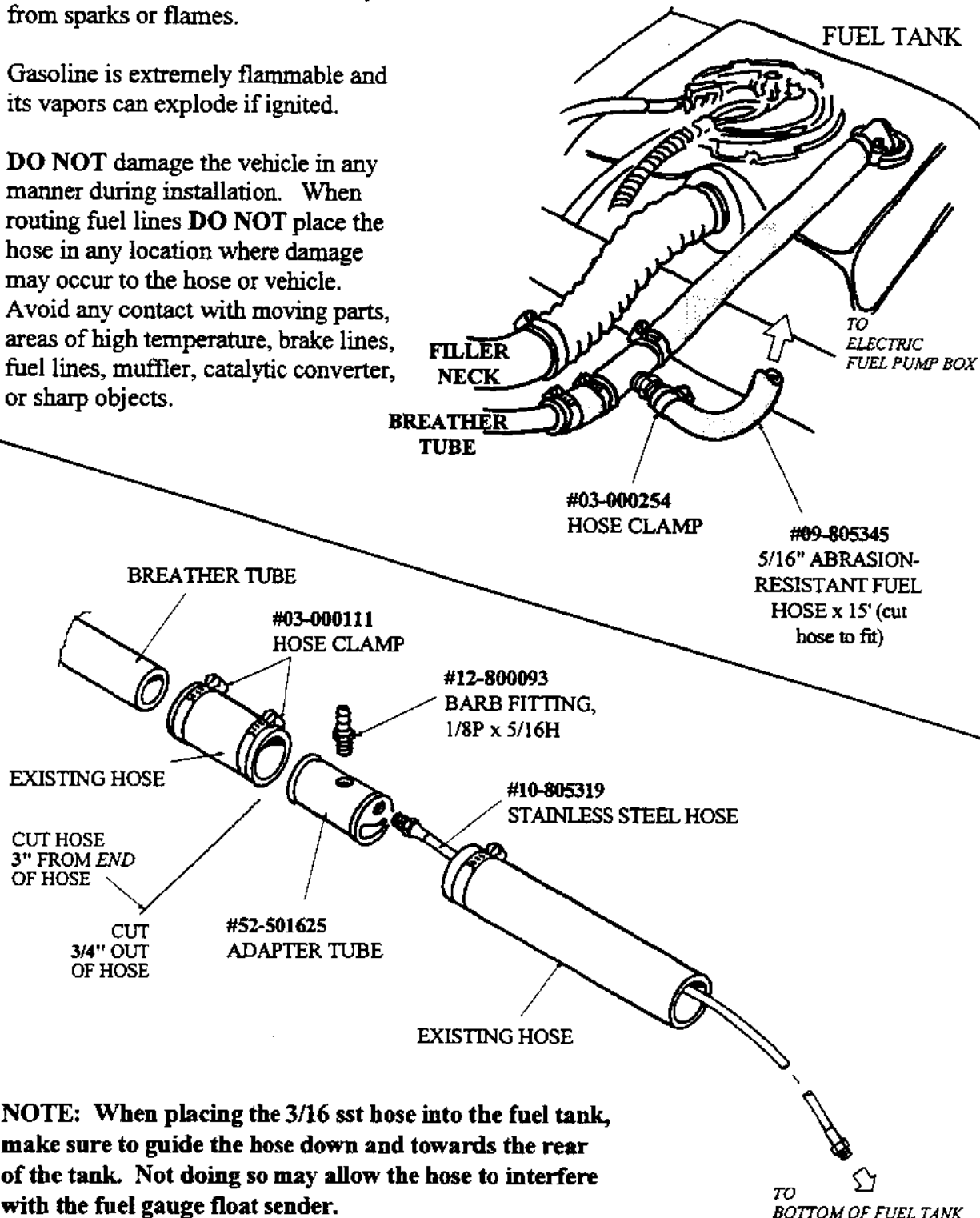
Gasoline is extremely flammable and its vapors can explode if ignited.

DO NOT damage the vehicle in any manner during installation. When routing fuel lines **DO NOT** place the hose in any location where damage may occur to the hose or vehicle.

Avoid any contact with moving parts, areas of high temperature, brake lines, fuel lines, muffler, catalytic converter, or sharp objects.

FUEL LINE INSTALLATION KIT Part #66-945171
(For 1992 or later Fords)

IF THE VEHICLE IN WHICH YOU ARE INSTALLING YOUR UNIT IS A 1992 (or later) FORD, IT WILL BE NECESSARY TO FOLLOW THE INSTRUCTIONS THAT COME IN THIS KIT:

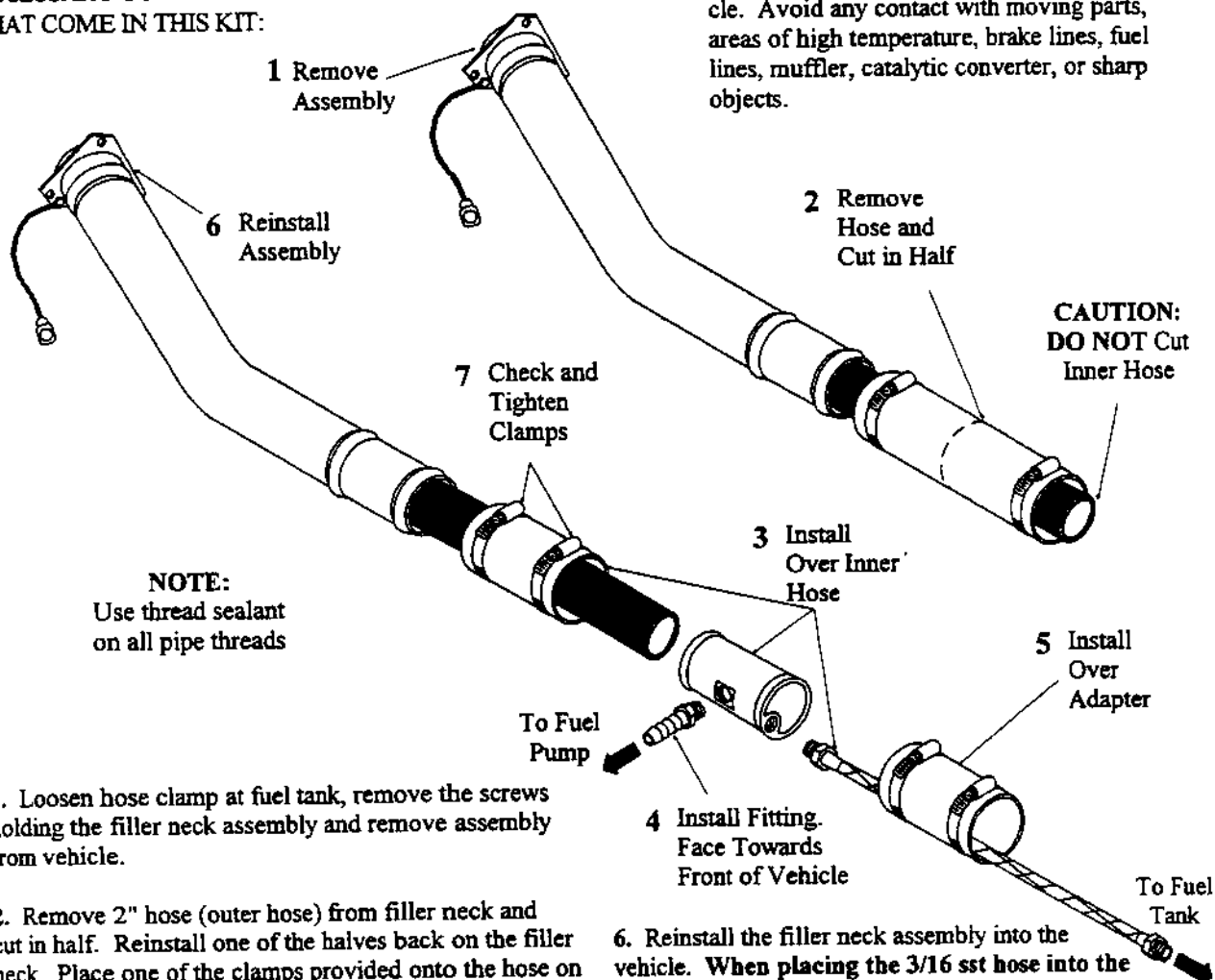


NOTE: When placing the 3/16 sst hose into the fuel tank, make sure to guide the hose down and towards the rear of the tank. Not doing so may allow the hose to interfere with the fuel gauge float sender.

Figure 8 1997 (or later) CHEVY and GMC FULL-SIZE VAN FUEL LINE MODIFICATION

FUEL LINE INSTALLATION KIT Part #66-945437
(For 1997 or later Chevrolet and GMC full-size vans with the center-mounted fuel tank)

IF THE VEHICLE IN WHICH YOU ARE INSTALLING YOUR UNIT IS A 1997 (or later) CHEVROLET OR GMC FULL-SIZE VAN WITH THE CENTER-MOUNTED FUEL TANK, IT WILL BE NECESSARY TO FOLLOW THE INSTRUCTIONS THAT COME IN THIS KIT:



NOTE:
Use thread sealant on all pipe threads

1. Loosen hose clamp at fuel tank, remove the screws holding the filler neck assembly and remove assembly from vehicle.

2. Remove 2" hose (outer hose) from filler neck and cut in half. Reinstall one of the halves back on the filler neck. Place one of the clamps provided onto the hose on the filler neck.

3. Install the 3/16 sst hose on fuel adapter. Install adapter over the small hose from filler neck and into the 2" hose, tighten hose clamp.

4. Be sure the adapter is positioned as shown. Install barb fitting onto the adapter, and be sure to use a thread sealant to prevent leakage.

5. Install the other half of the 2" hose over the fuel adapter. Use clamp to secure.

6. Reinstall the filler neck assembly into the vehicle. When placing the 3/16 sst hose into the fuel tank, make sure to guide the hose down and towards the rear of the tank. Not doing so may allow the hose to interfere with the fuel gauge float sender.

7. Fit 2" hose over tank fitting, tighten clamp and resecure filler neck assembly.

Parts for Fuel Modification Kit

03-000054.....CLAMP, HOSE #32
10-805319.....HOSE, 3/16 x 25"
12-800093.....FITTING, BARB 1/8P x 5/16H
52-501774.....ADAPTER, FUEL FILLER NECK



WARNING!

DO NOT smoke around the vehicle. Work in a well-ventilated area away from sparks or flames.

Gasoline is extremely flammable and its vapors can explode if ignited.

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

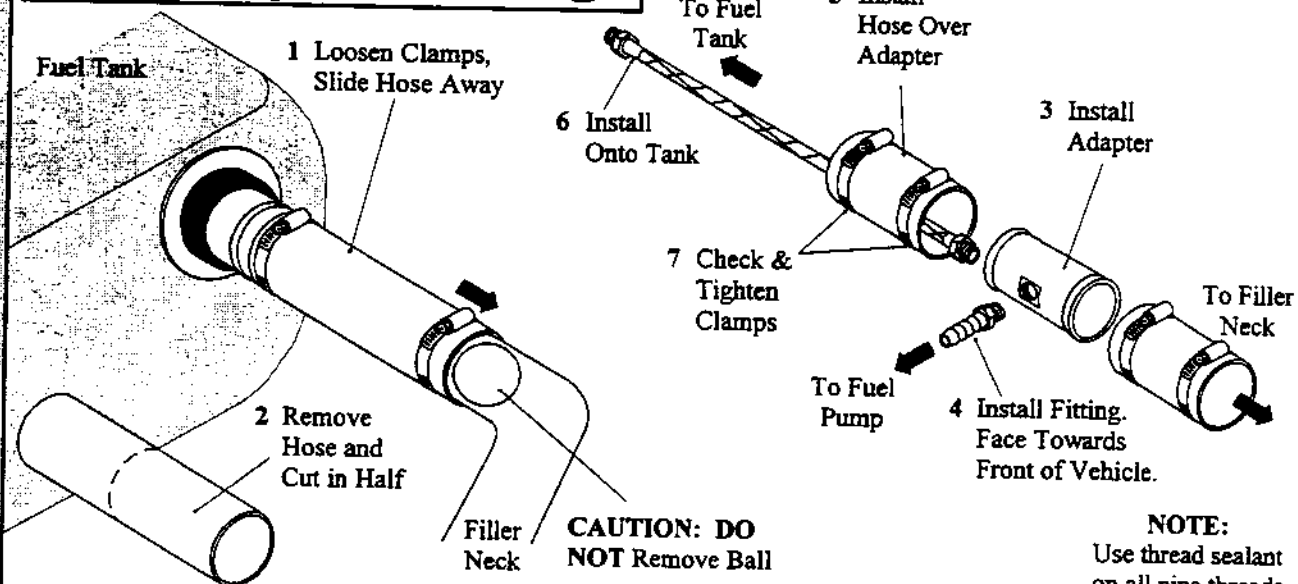
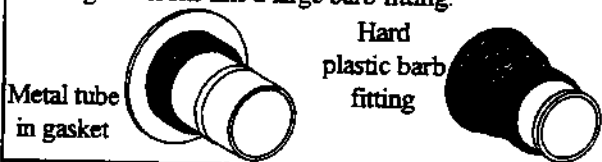
CAUTION:
DO NOT Cut Inner Hose

Figure 9 1997 (or later) DODGE FULL-SIZE VAN FUEL LINE MODIFICATION

FUEL LINE INSTALLATION KIT Part #66-945437
(For 1997 or later Dodge full-size vans)

IF THE VEHICLE IN WHICH YOU ARE INSTALLING YOUR UNIT IS A 1997 (or later) DODGE FULL-SIZE, IT WILL BE NECESSARY TO FOLLOW THE INSTRUCTIONS THAT COME IN THIS KIT:

Two styles of fittings on tank. One is a metal tube held in place by a gasket, the metal tube will slide in and out of the gasket. The other is a metal tube in a hard plastic housing that looks like a large barb fitting.



1. Loosen the hose clamps and slide the hose away from the tank. This will allow the filler neck to drop down and away.

2. Remove 2" hose from filler neck and cut in half. Reinstall one of the halves back on the filler neck. Place one of the clamps provided onto the hose on the filler neck. Don't tighten the clamps yet.

3. Install the 3/16 sst hose on fuel adapter. Install adapter into the 2" hose.

4. Be sure the adapter is positioned as shown. Install barb fitting onto the adapter, and be sure to use a thread sealant to prevent leakage.

5. Install the other half of the 2" hose over the fuel adapter. Use clamp provided to secure.

6. Route the 3/16 sst hose into the fuel tank and reposition the filler neck. When placing the 3/16 sst hose into the fuel tank, make sure to guide the hose down and towards the rear of the tank. Not doing so may allow the hose to interfere with the fuel gauge float sender.

7. Slide the 2" hose over tank fitting, tighten clamps to resecure filler neck assembly. NOTE: When working on vehicle with the metal tube in the gasket, be sure NOT to push the tube into the fuel tank while reconnecting the filler neck assembly.

Parts for Fuel Modification Kit

03-000054.....CLAMP, HOSE #32
10-805319.....HOSE, 3/16 x 25"
12-800093.....FITTING, BARB 1/8P x 5/16H
52-501774.....ADAPTER, FUEL FILLER NECK



WARNING!

DO NOT smoke around the vehicle. Work in a well-ventilated area away from sparks or flames.

Gasoline is extremely flammable and its vapors can explode if ignited.

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

NOTE:
Use thread sealant on all pipe threads

Slide one of the seals over the threads of the bulkhead adapter against the hexagon area. Next, attach the 25", 36" or 45" stainless steel hose to the 1/8P x 1/4T elbow. Choose a length that will reach through the filler neck to the bottom of the fuel tank. If the selected hose is too short or too long, the unit will run out of fuel before the vehicle fuel tank is empty.

11. Insert the stainless steel hose (bulkhead connector first) into the filler neck until the male threads on the bulkhead connector are protruding through the 1/2" hole.

Slide the other seal over the threads and tighten the hex head nut over the seal (Figure 5).

Attach the 1/8P street elbow and 1/8P x 5/16H barb fitting to the bulkhead connector, outside the filler neck.

Make certain the fuel hose and fittings remain positioned parallel to the filler neck (Figure 6).

12. Using a hose clamp, connect one end of the 5/16" fuel hose to the fitting on the outside of the filler neck (Figure 5).

13. Re-install the filler neck on the vehicle.

14. Insert the filler neck fuel hose into the fuel tank and make certain the end is at the bottom of the tank.

15. Re-connect the 2 hoses which connect the filler neck and the fuel tank. Make certain they are clamped correctly.

16. Route the 5/16" fuel hose underneath the van from the filler neck to the inlet side of the external electric fuel pump (Figure 10). Use the cable ties to secure the hose. Cut off any excess hose and attach to the barb fitting with hose clamp.

17. Attach the remaining hose to the outlet side of the external electric fuel pump with a hose

clamp.

18. Using the 5/16" hose and hose clamps connect the fuel pump box to the bulkhead adapter.



CAUTION:

When routing this hose underneath the vehicle, make certain that you **DO NOT** place the hose in any location where damage may occur to the hose or vehicle. **AVOID** any contact with moving parts, areas of high temperature, muffler, catalytic converter, or sharp objects.

5. INSTALLING THE FUEL TANK AND FUEL LINE (TRAILER)

For trailer installations we recommend the following.

1. Strict compliance with all Federal and State laws must be maintained.
2. Use a safe fuel tank which is manufactured specifically for gasoline, has a proper vented filling cap, and an outlet connection that is the same size as the inlet connection on the unit.
3. **DO NOT** mount the fuel tank inside an enclosed trailer or van.



WARNING!

Never carry any gasoline or flammable material in the vehicle. **NEVER** store any type of flammable material in the vehicle.

4. Mount the fuel tank where it will be protected from any vehicle collision.
5. When installing the fuel line from the tank to the unit, use the proper size fuel line.

Figure 10 EXTERNAL ELECTRIC FUEL PUMP MOUNTING INSTRUCTIONS

STUDY ALL FUEL LINE INSTALLATION INSTRUCTIONS COMPLETELY BEFORE PROCEEDING

WARNING!

DO NOT INSTALL THIS ASSEMBLY IN ANY MANNER OR POSITION WHICH, IN SO DOING, MAY CAUSE DAMAGE TO THE VEHICLE OR ANY COMPONENT WHICH MIGHT AFFECT THE OPERATION OR SAFETY OF THE VEHICLE.

1. DETERMINE THE POSITION WHERE THE BOX ASSEMBLY WILL BE MOUNTED.

WARNING! DO NOT MOUNT THIS ASSEMBLY NEAR THE CATALYTIC CONVERTER, EXHAUST, OR ANY AREAS OF HIGH TEMPERATURE.

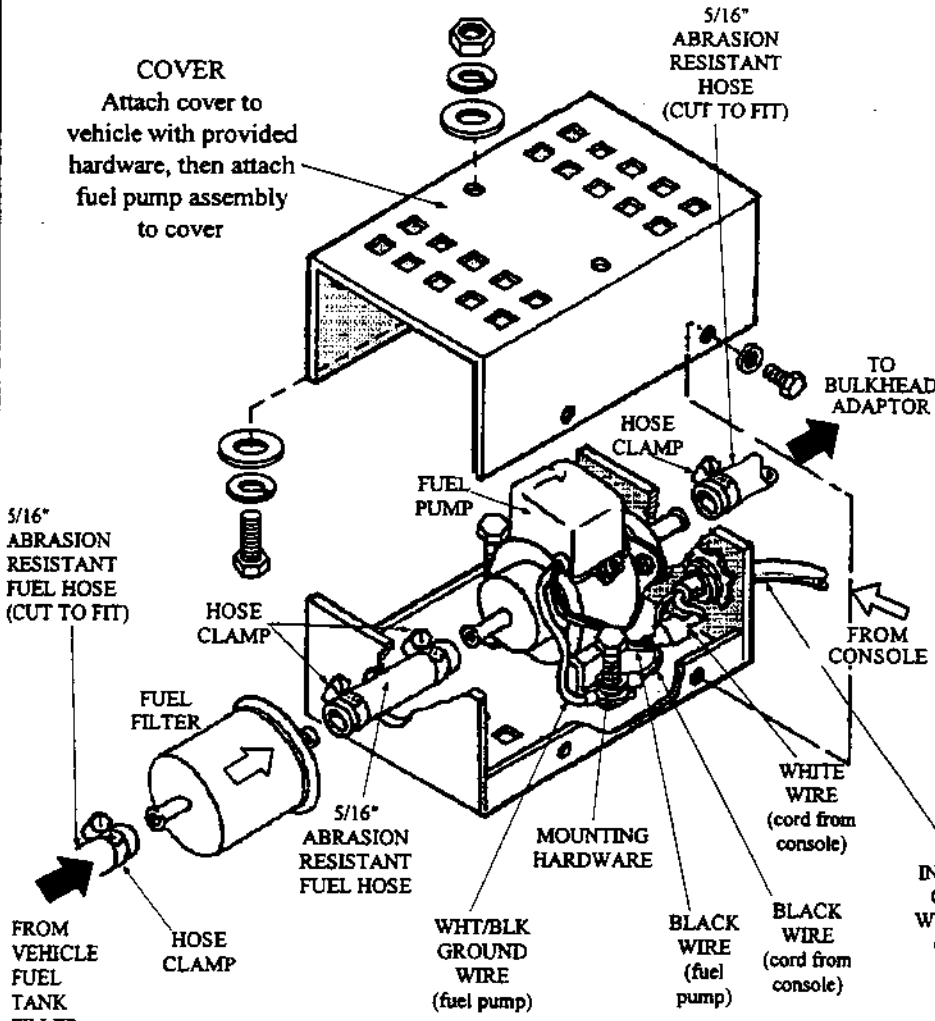
2. USING THE COVER AS A TEMPLATE, DRILL TWO 5/16" DIA. HOLES IN THE VEHICLE FRAME

3. MOUNT THE COVER TO THE VEHICLE FLOOR.

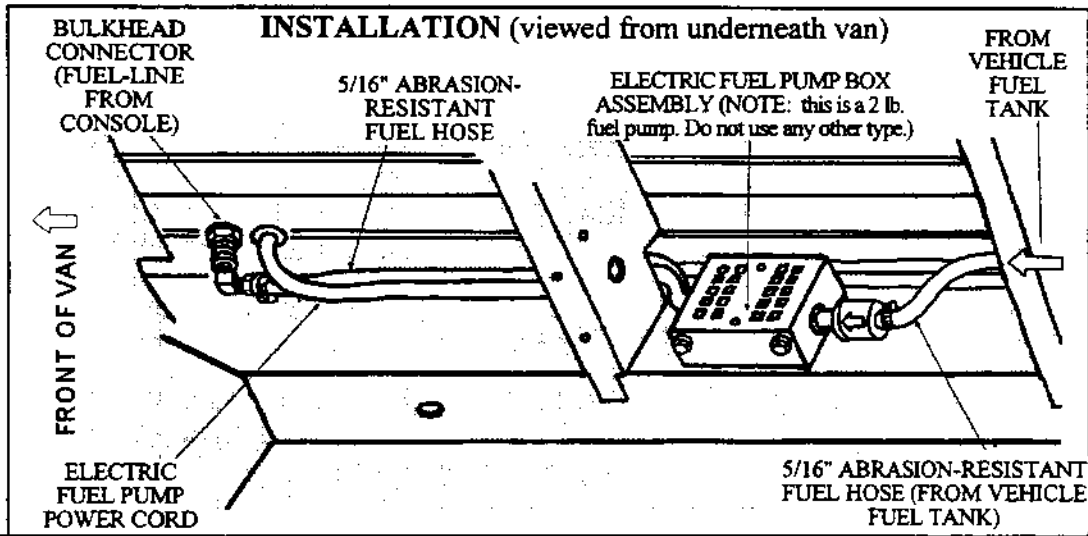
4. CONNECT THE HOSES AND CORD AS SHOWN. TIGHTEN HOSE CLAMPS

CAUTION: WHEN ROUTING THE HOSE AND CORD UNDERNEATH THE VEHICLE, MAKE CERTAIN THAT YOU DO NOT PLACE THEM IN ANY LOCATION WHERE DAMAGE MAY OCCUR TO THE HOSE, CORD, OR VEHICLE. AVOID ANY CONTACT WITH MOVING PARTS, AREAS OF HIGH TEMPERATURE OR SHARP OBJECTS.

5. INSTALL THE FUEL PUMP ASSEMBLY ON TO THE COVER WITH THE PROVIDED HARDWARE.



INSERT FUEL PUMP POWER CORD, CONNECT POWER CORD WHITE WIRE TO FUEL PUMP BLACK WIRE, GROUND POWER CORD BLACK WIRE, AND TIGHTEN CORD HOLDER SCREWS.



6. WASTE TANK TO CONSOLE CONNECTION

NOTE: Before connecting any hoses to the waste tanks, make certain the hose clamps are on each hose.

1. See Figure 11. Connect the 6-1/2" long section of 2-1/2" I.D. internal vac hose to the 2-1/2" dia. vac inlet tube on the console and the 2-1/2" dia. inlet tube on the waste tank. Tighten the hose clamps. **NOTE:** On the PERFORMER 405, the hose and tubing will be 3" diameter.
2. Connect the section of 2-7/8" I.D. internal vac hose to the 2-7/8" dia. vac outlet tube on the waste tank and to the vacuum pump relief valve on the console. It may be necessary to cut this hose to fit. Tighten the hose clamps. **NOTE:** On the PERFORMER 405, the hose and tubing will be 3-1/2" diameter.
3. Connect the 2" I.D. waste removal hose to the 2" dia. tube at the bottom of the waste tank. Tighten the hose clamps.
4. Connect the 5/16" I.D. water box hose to the barb fitting (pointed downward) on the waste tank, which is mounted on the outside of the waste tank. Tighten the hose clamps.
5. Connect the console engine shut-off cord to the waste tank level sensor cord.
6. Connect the 3/16 stainless steel hose from the bypass valve to the connector on the waste tank.

7. BATTERY CONNECTION



WARNING!

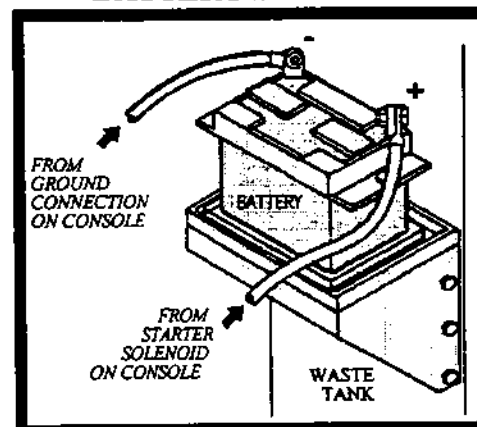
Dangerous Acid, Explosive Gases!
Batteries contain sulfuric acid. To prevent

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

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

1. Attach the red positive (+) battery cable from the console starter solenoid to the positive (+) terminal on the battery and tighten the holding nut.
2. Next, attach the black negative (-) battery cable from the console ground to the negative (-) terminal on the battery and tighten the holding nut.

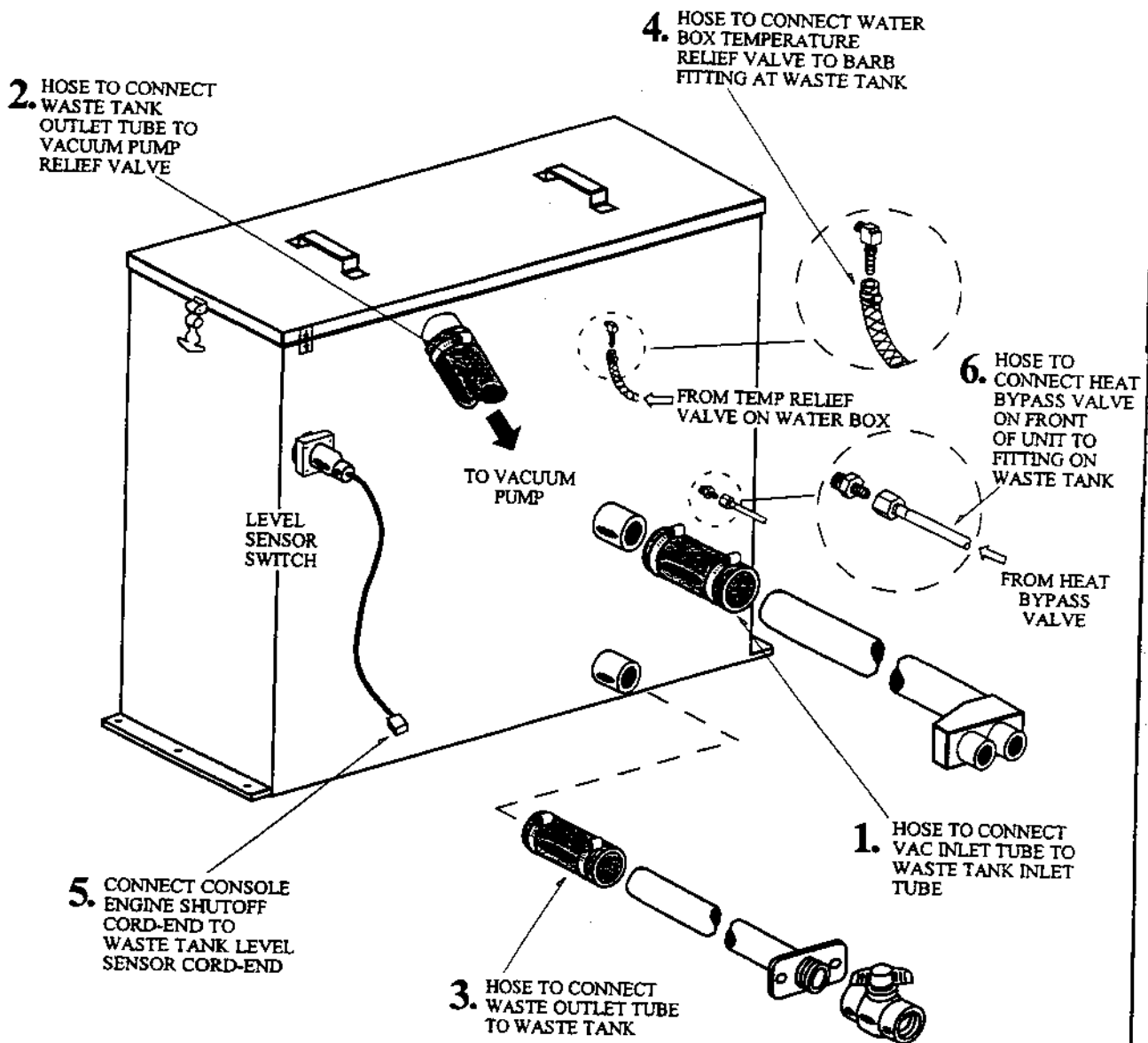
BATTERY HOOK-UP



8. FIRE EXTINGUISHER

We recommend that a fire extinguisher, preferably rated for A, B, & C type fires, be installed inside the vehicle.

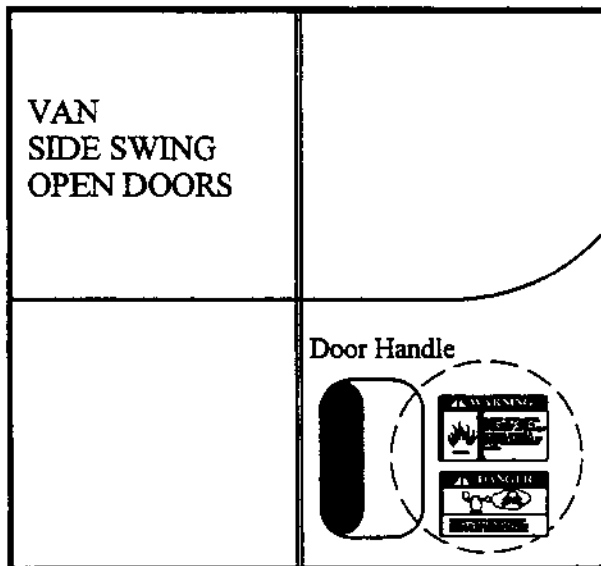
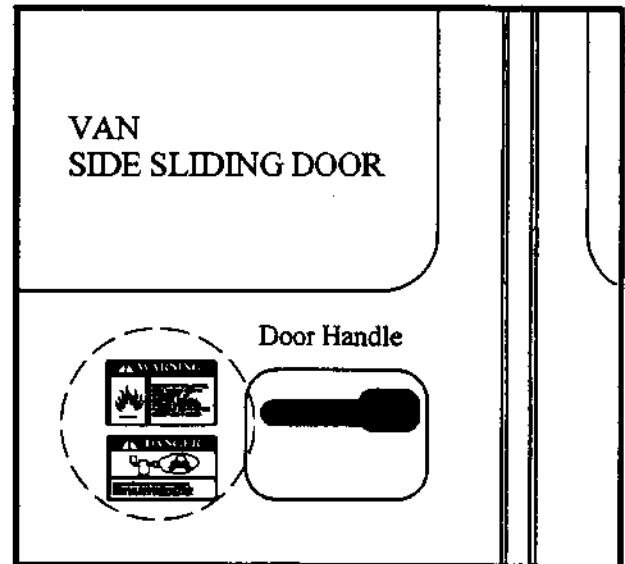
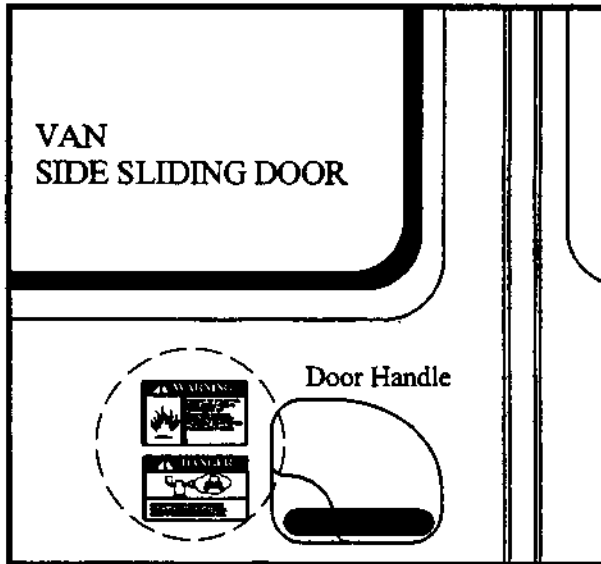
Figure 11 WASTE TANK TO CONSOLE CONNECTION



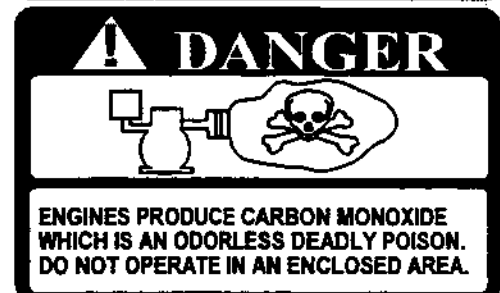
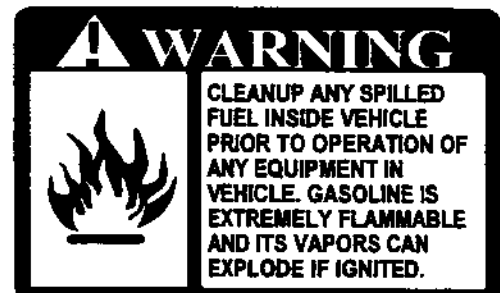
SPECIAL INSTRUCTIONS:

1. Cut hoses to fit, if necessary.
2. When cutting hoses, make certain that the cutting blade is facing away from your hands, fingers, or any other part of your body to avoid injury.
3. Do not install hoses with excessive bends or kinks.
4. Place clamps on hoses before installing.
5. Tighten all hose clamps *firmly*.

Figure 12 PLACEMENT OF EXTERNAL WARNING DECALS



Decal, Fuel Clean-up
Part# 48-941317



Decal, Carbon Monoxide
Part# 48-941316

The decals should be placed in a prominent spot on the vehicle where access is given to operate the unit. The illustrations above suggest the location and placement of the decals.

When placing the decals, be sure the area is clean of any dirt and possible wax build-up. Place the decal by starting at one edge and smoothing the decal over to the other edge. This will help eliminate air bubbles and allow the decal to adhere better. After a time the decals may become damaged or worn. If they become unreadable, they should be replaced. The part numbers are shown above to help in ordering new decals.

SECTION 3: OPERATION

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5 OPERATION

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4 SYSTEMS

This chapter of the operator's manual divides the unit up into systems and explains how each system works. Before proceeding into the operation and maintenance sections of this manual, we recommend acquiring a basic knowledge of how this unit functions. Read the next section of this manual carefully and completely.

1. WATER PUMPING SYSTEM

See Figures 13 and 14. Cold water enters the console through the water inlet connection located on the lower front panel. The water flows to the water box through a float valve, which shuts off water flow when the water box is full.

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

The pressure regulator manifold includes a nitrogen-charged accumulator which helps reduce pressure pulsations. In addition, the manifold also contains a low-pressure switch and a high-pressure switch. These switches will shut the unit down if the water pressure drops below 50 PSI or exceeds 1200 PSI.

If the tool valve is closed, water flows from the pressure regulator through the vacuum exhaust radiator-type heat exchangers, where heat is transferred from the vacuum pump exhaust to the water.

The heated water then returns to the water box. If the temperature in the water box exceeds

180°F, a temperature relief valve will open and bleed a small amount of hot water into the waste tank, allowing cool water to flow into the water box.

When the tool valve is open, water flow is from the pressure regulator, through the heli-coil heat exchanger, to the engine exhaust heat exchanger, where it is super-heated by engine exhaust.

A bypass manifold, located next to the water box, constantly bleeds a small amount of hot water from the engine exhaust heat exchanger outlet to the water box.

Next, the hot water flows through the check valve manifold which contains a check valve and Y-strainer. This is where chemical injection occurs.

The hot solution then flows through the solution outlet manifold to the cleaning tool.

Temperature is adjusted primarily using the thermostatic temperature control. This control opens a solenoid valve if the water exceeds the temperature setting. When open, this valve allows hot water to be drawn into the waste tank. The temperature sensor for this control is located in the thermostat manifold en route to the solution outlet.

In addition, a heat bypass valve on the lower front panel lowers the solution temperature manually with a knob adjustment. When open, this valve allows hot water to be drawn into the waste tank.

An additional temperature sensor on the engine exhaust heat exchanger outlet will shut down the engine if the water temperature exceeds 285°F. If this occurs, consult the "Troubleshooting" section of this manual to determine the cause of overheating before restarting your unit.

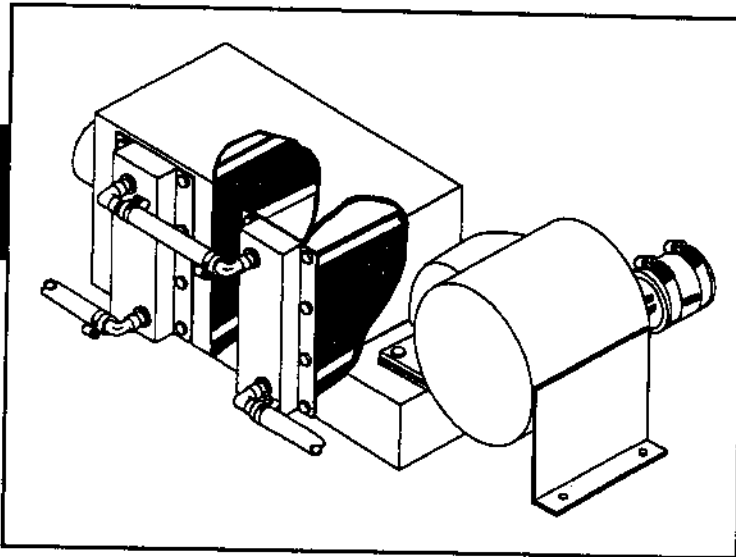
2. HEAT TRANSFER SYSTEM

See Figures 13 and 14. Water is heated through a three stage heat exchange system which utilizes vacuum exhaust, engine coolant, and engine exhaust.

Stage one utilizes vacuum exhaust heat blowing over two radiator-type heat exchangers in series prior to discharging the exhaust into the atmosphere. When the tool valve is closed, the water bypasses from the pressure regulator manifold to the water box through the vacuum exhaust heat exchangers. Water then

flows from the water box to the water pump, where it is pressurized. It then travels to the pressure regulator manifold.

When the tool valve is open, the water flows through the stage two heli-coil heat exchanger system which uses heated engine coolant pumped over copper coils. The pressurized water flows through the copper coils and collects heat from the engine's cooling system. The water then flows to the stage three heat exchange system.



**VACUUM EXHAUST
HEAT EXCHANGER**

**CATALYTIC
ENGINE EXHAUST
HEAT EXCHANGER**

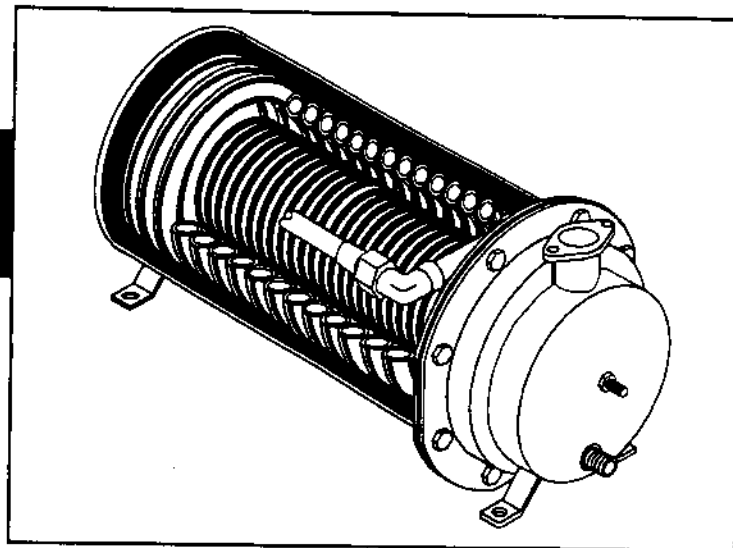


Figure 13 HEAT TRANSFER & WATER PUMPING SYSTEM

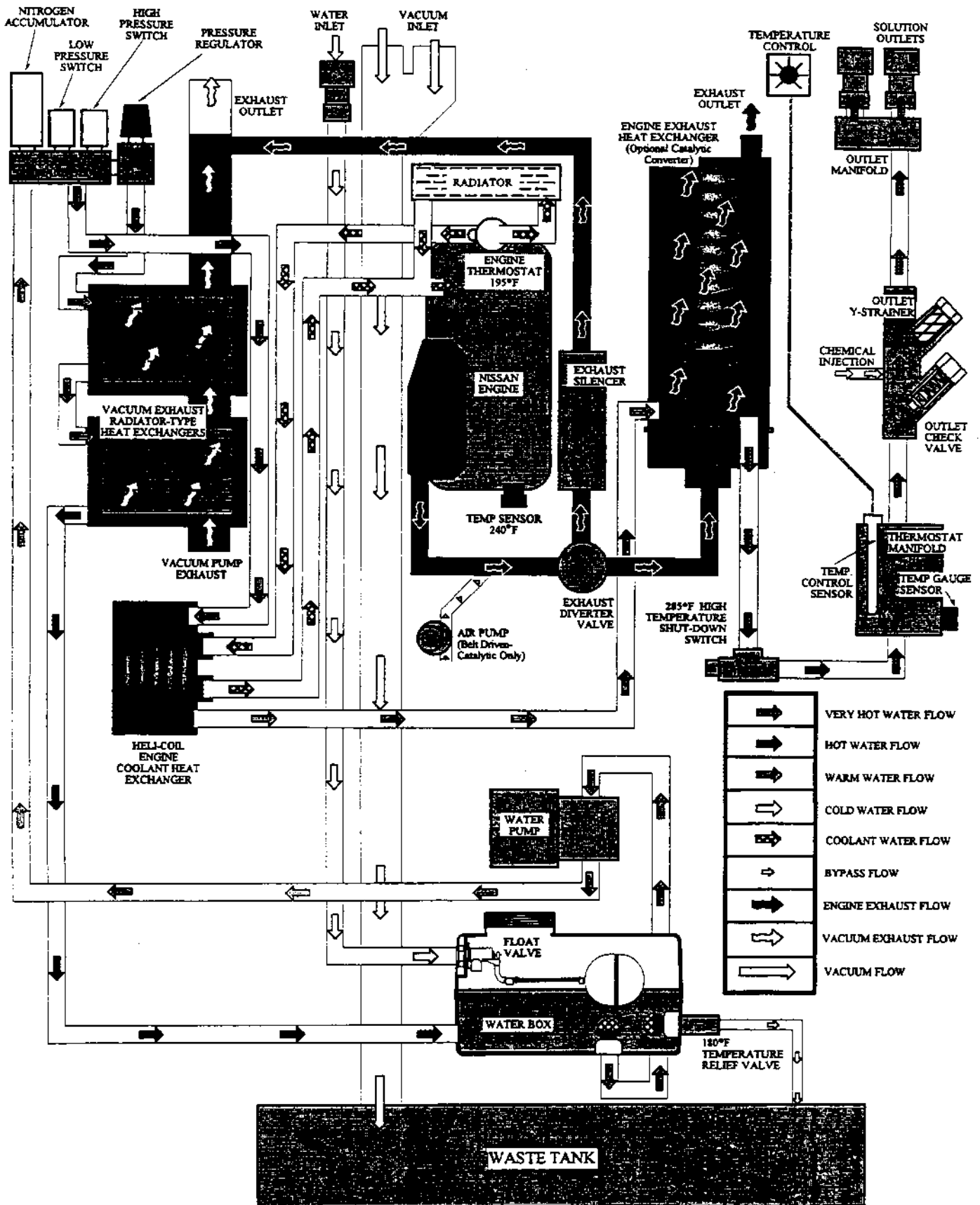
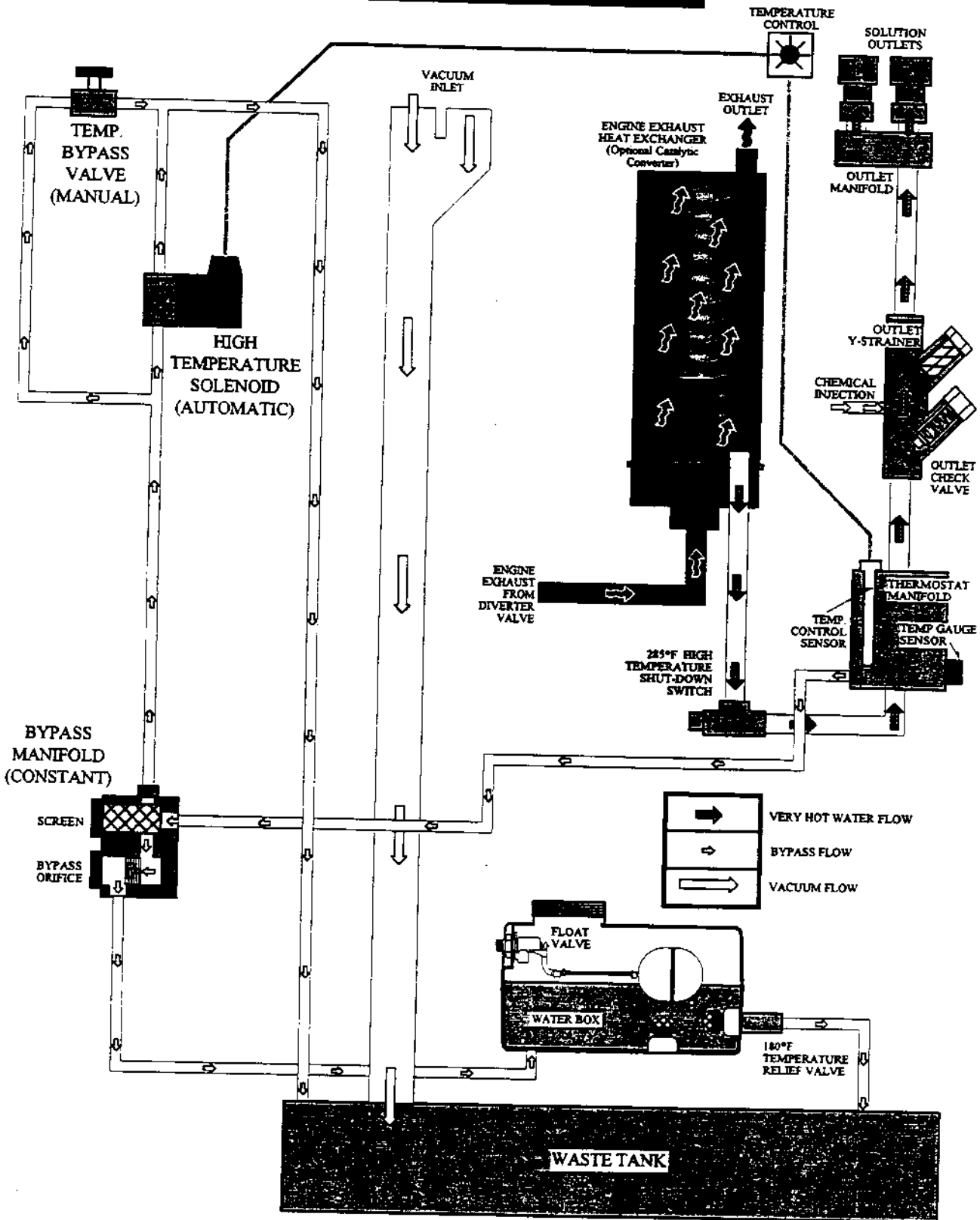


Figure 14 MANUAL & AUTOMATIC HOT WATER BYPASS SYSTEMS



The stage three heat exchanger is an engine exhaust chamber containing a stainless steel heating coil and catalytic converter (optional). Water flows through the coil and is heated by the engine exhaust as it leaves the engine. The catalytic heat exchanger uses a catalytic core.

The catalytic converter, combined with the injection of air pumped into the exhaust manifold, re-burns the exhaust waste gases. This results in super-heated water flowing through the outlet manifold to the cleaning tools.

An exhaust diverter valve is located on the engine exhaust system. This allows you to direct the exhaust either to the heat exchanger

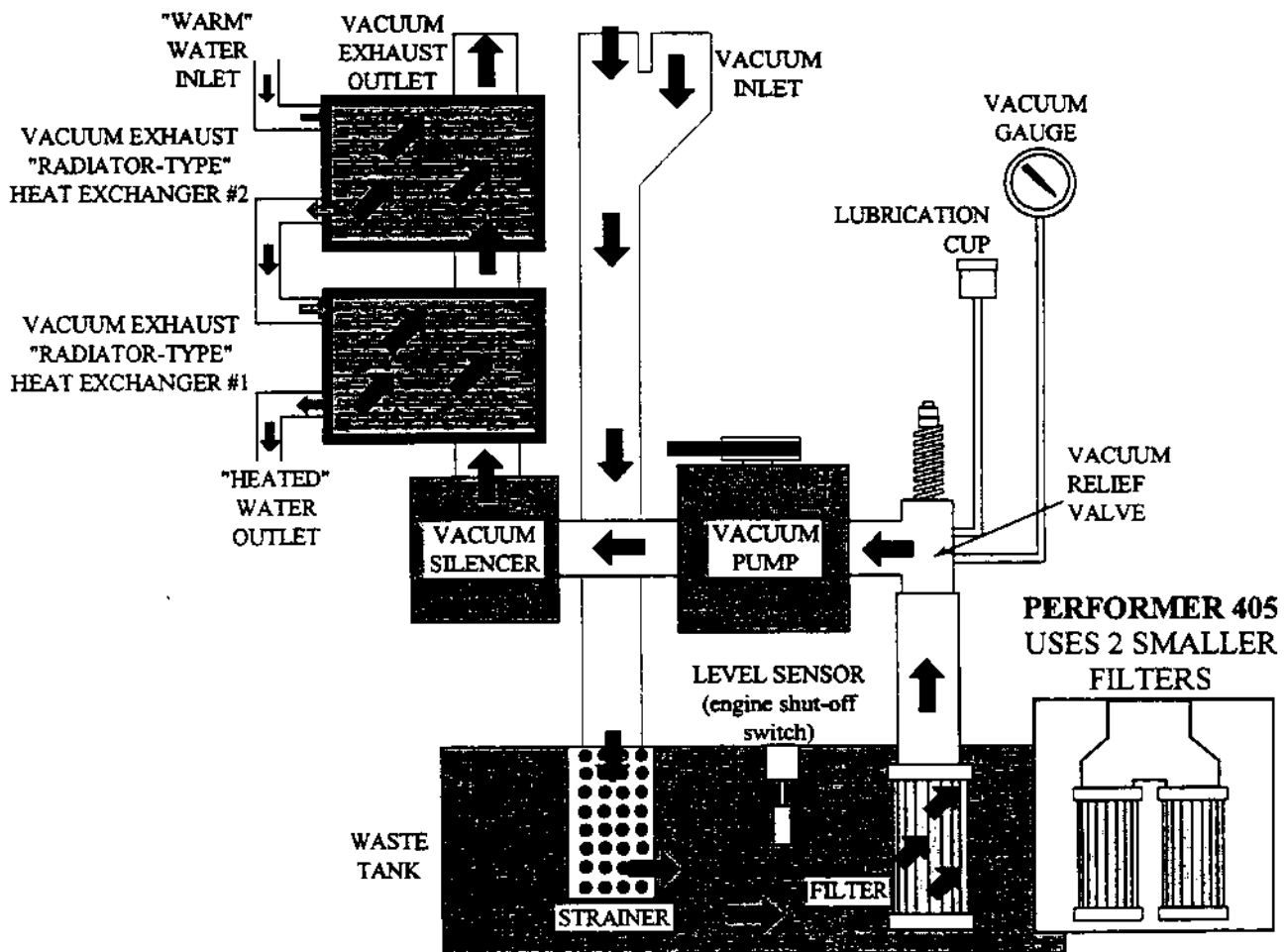
for high temperature cleaning or to the exhaust muffler for low temperature cleaning or extraction, such as for flood restoration.

When the diverter valve is in the MUFFLER position, a microswitch automatically shuts off the water pump. An override switch on the control panel will enable you to turn the water pump ON, for low temperature cleaning.

3. VACUUM SYSTEM

See Figure 15. Vacuum flow is initiated by the vacuum pump, with air and water being drawn into the vacuum inlet at the front of the console.

Figure 15 VACUUM SYSTEM



The mixture then flows through a strainer basket into the waste tank. Air exits the waste tank through a 100-mesh filter (the PERFORMER 405 uses two filters), and then flows into the vacuum pump. A vacuum pump relief valve has been provided for vacuum pump protection.

The air is discharged from the vacuum pump through the stage one heat exchanger where the heated vacuum exhaust blows across two radiator-type heat exchangers before discharging into the atmosphere.

A level sensor switch located near the top of the waste tank will shut the unit down before the waste tank reaches its full capacity. This protects the vacuum pump from water damage.



CAUTION:

Use of a DEFOAMER will help prevent damage to the unit by a build-up of foam in the waste tank, which may be caused by some chemicals (foam build-up will not activate float switches).

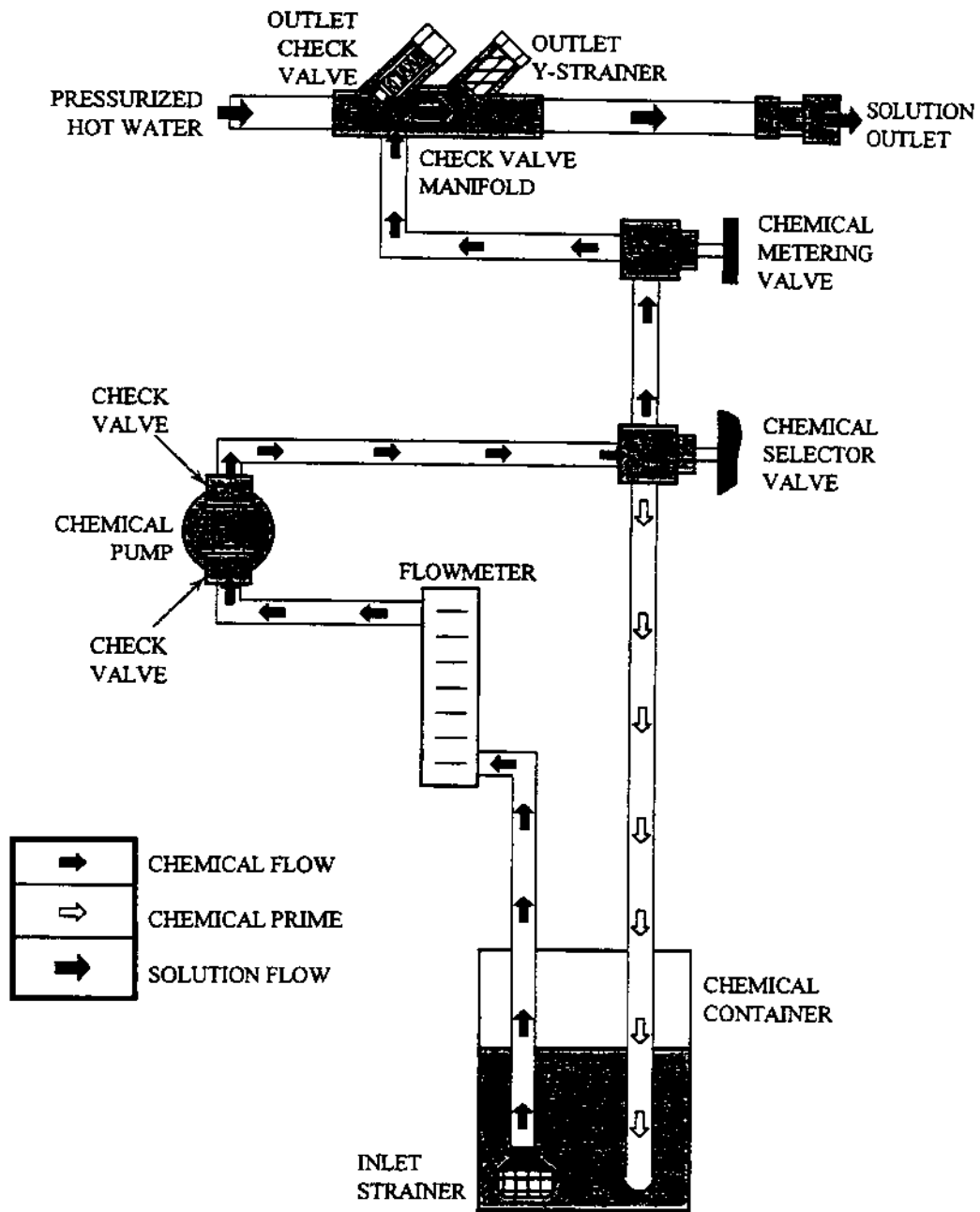
4. CHEMICAL PUMPING SYSTEM

See Figure 16. The chemical is drawn from the chemical container through a strainer into the flow meter. The flow meter indicates the rate of chemical flow.

The chemical then flows through a check valve into a pulse-powered chemical pump. Next, the chemical pump injects the chemical through a check valve to the 3-way selector valve on the control panel. This valve may turn the chemical flow ON, OFF, or PRIME the chemical pump.

The chemical then flows through a metering valve to the solution outlet. This valve controls the rate of flow of chemical injection into the cleaning solution, which is indicated on the flow meter.

Figure 16 CHEMICAL SYSTEM



5 OPERATION

This chapter of the operator's manual explains how to prepare, start, operate, shut down, and maintain the PROCHEM PERFORMER/PERFORMER 405 cleaning unit. Operation of the PERFORMER/PERFORMER 405 is simple. However, only trained personnel should proceed.



WARNING!

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

1. CHECK FOR ADEQUATE FUEL

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

2. REMOVE TOOLS FROM VEHICLE

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

3. WATER SUPPLY CONNECTION

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

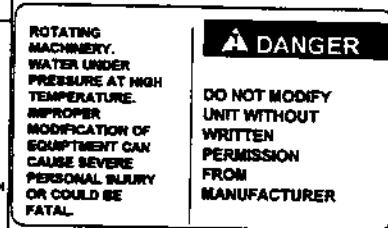
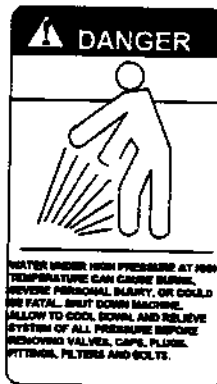
1. Connect the **water supply hose** to the **water inlet quick-connect** at the front of the unit. Connect the hose to the water supply faucet.

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

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

4. HIGH PRESSURE HOSE

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



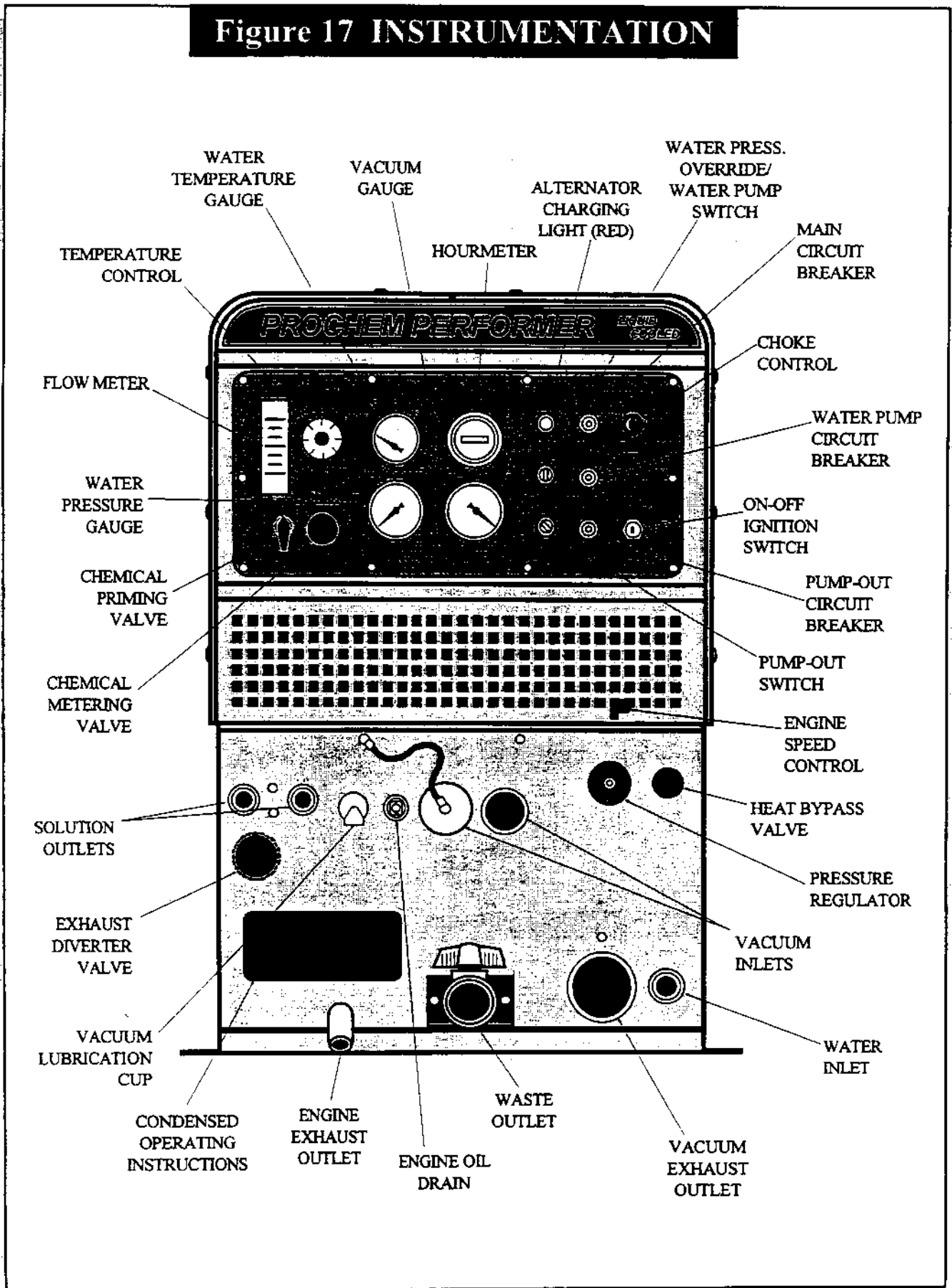
5. VACUUM HOSE

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

6. JET SIZING

PROCHEM recommends **floor tool tip sizing** not exceed a total of "06". Using larger jet sizes on your PERFORMER/PERFORMER 405 may reduce cleaning temperatures.

Figure 17 INSTRUMENTATION



Example: Quad-jet wand uses four 95015 jets. (95° spray angle w/ 015 orifice)

$$015 \times 4 = 06$$

When using two floor tools while cleaning with your unit, PROCHEM recommends that each tool tip size does not exceed a total of ".04".

Example: Quad-jet wand uses four 9501 jets.

$$01 \times 4 = 04 \dots\dots 04 \times 2 \text{ tools} = 08$$

Upholstery tool jet size: 80015

Stair tool jet size: 9502

7. STARTING THE UNIT

1. Set the exhaust diverter valve to the **HEAT EXCHANGER** position. The diverter valve microswitch will automatically turn ON the water pump.

2. Set the **temperature control** on the control panel to the desired cleaning temperature. The **thermostatic temperature control** will allow you to increase or decrease the solution temperature automatically. Simply turn the **control knob** to the desired temperature setting.

3. Close the **heat bypass valve** by turning the knob clockwise. **DO NOT** over-tighten.

The **heat bypass valve** allows you to decrease the solution temperature manually. Opening the valve (counter-clockwise) decreases the temperature by allowing hot water to bypass to the waste tank.



CAUTION:

DO NOT operate this unit without constant water flowing into the console.

The water **low-pressure switch** will automatically shut the unit down if the water pressure in the system drops below 50 PSI.

The water **high-pressure switch** will automatically shut the unit down if the water pressure in the system exceeds 1200 PSI.

Before proceeding, be certain that the control panel indicators are at the following settings:

Engine – IDLE (Throttle Control Out)
Engine Choke – PULL OUT

NOTE: It will not be necessary to pull the choke out if the engine is already warmed up.

4. Turn the **ignition switch** to the **START** position while holding the **water pump switch** to the left (override position). The engine will start. Continue to hold the **water pump switch** in the override position until pressure is indicated on the pressure gauge.

NOTE: If your unit fails to build water pressure after 15 seconds, check for adequate water supply. If necessary, see "Loss of Water Pump Pressure" in the "Troubleshooting" section of this manual.

5. After starting the engine, push the **choke in**. After the engine has warmed up, push the **throttle** all the way in and lock it in the full throttle position.

Allow adequate time for the unit to warm up before beginning the cleaning operation, approximately 5-15 minutes.

8. PRIMING THE CHEMICAL PUMP

NOTE: PROCHEM recommends that the chemical pump be primed whenever the water pump is ON. This will eliminate possible pressure fluctuations and water pump pulsations related to a dry chemical pump.

1. Place the **chemical inlet tube** and the **chemical prime tube** into the chemical container.

NOTE: When placing the **chemical inlet tube** into the **chemical container**, make certain that it stays fully submerged since the chemical pump will not function if air is allowed to enter the inlet line. **DO NOT** operate the chemical pump without the inlet strainer properly installed.

2. Turn the **chemical selector valve** on the control panel to the **PRIME** position. The chemical will then flow from the chemical container through the chemical prime tube.

If the chemical does not flow, then:

a) Put the **chemical prime tube** into the **vacuum inlet** on the unit and seal off the vacuum inlet. The vacuum will quickly pull chemical from the chemical container. When the chemical starts to flow, turn the **chemical selector valve** to **OFF**, place the **chemical prime tube** back into the container, and turn the **chemical selector valve** back to **PRIME** to continue the procedure.

b) Once continuous chemical flow without air bubbles has been achieved, turn the **chemical selector valve** from **PRIME** to **METER**. With the **cleaning tool** open, observe the **flow meter** and adjust the **chemical metering valve** until the desired rate of chemical flow is obtained (the **chemical metering valve** is located on the control panel below the flow meter).

9. WASTE PUMP

1. If your unit is equipped with an **automatic waste pump**, connect one end of a garden hose to the **pump-out connection** on the console and the other end to an **appropriate**

waste disposal.

2. Turn the **pump-out switch** on the control panel to the **ON** position. The waste pump will operate automatically throughout the cleaning operation.

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

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



WARNING!

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

10. OPERATION

Once you have completed steps 1 through 9, proceed with the cleaning operation. Your unit should be in the full throttle position when cleaning or extracting. A **float switch** located inside the waste tank will automatically shut down the unit when it reaches its full capacity. When this occurs, empty the waste tank before continuing.

EXHAUST DIVERTER VALVE

The **exhaust diverter valve** allows you to direct exhaust through either:

a) the **engine exhaust HEAT EXCHANGER** for high temperature cleaning, or

b) through the **exhaust MUFFLER** for extraction, such as flood restoration.

When the **exhaust diverter valve** is in the **MUFFLER** position, a microswitch automa-

tically shuts off the water pump. This protects the water pump from excessive heat during flood restoration work.

An **override switch** on the control panel will enable you to turn the water pump ON, when in the MUFFLER position. Make certain that this switch is in the OFF position during flood restoration.

11. CLEANING

Observe the following guidelines, while cleaning:

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



WARNING!

NEVER dispose of waste in storm drains, waterways, or onto the ground. Always dispose of waste in accordance with Local, State, and Federal laws.

12. UPHOLSTERY CLEANING

Upholstery Tool, Part #60-950422
Multi-Head Tool, Part #60-950464

1. Since the upholstery and multi-head tools have a lower flow rate and smaller orifices, operate the unit with the **diverter valve** in the MUFFLER position and the **water pump switch ON**. This will prevent excessive heat in the water pumping system and limit bypass flow into the waste tank while cleaning upholstery.
2. To further reduce heat, slightly open the **heat bypass valve** located on the lower front panel. **NOTE:** If the unit is so equipped, turn the **automatic waste pump-out switch ON**. This will compensate for the extra bypass flow to the waste tank.
3. Use one (1) "80015" spray tip in either tool.
4. Pressure adjustment below 300 PSI should be made at the tool itself, by using the adjusting knob located on the valve.

13. STAIR TOOL CLEANING

Stair Tool, Long, Part #60-950421
Stair Tool, Short, Part #60-950450

1. Turn the **diverter valve** to the HEAT EXCHANGER position. Set the **temperature control** to the desired temperature setting.

2. To further reduce heat, slightly open the **heat bypass valve** located on the lower front panel. **NOTE:** If the unit is so equipped, turn the **automatic waste pump-out switch ON**. This will compensate for the extra bypass flow into the waste tank.
3. Use one (1) "9502" spray tip in your stair tool.

14. FLOOD RESTORATION



CAUTION:

Set the temperature control on the control panel to 150°F and open the heat bypass valve by turning the knob counter-clockwise. This will prevent excessive heat in the water pumping system.

During flood restoration, turn the diverter valve to the **MUFFLER** position and extract. The water pumping system is now **OFF**. Make certain that the water pump override switch is **OFF** to prevent all water being exhausted out of the water box and running the pump dry.

15. SHUTDOWN AND DAILY MAINTENANCE

1. Run fresh water through the **chemical injection system** to flush out chemicals.
2. We recommend removing as much moisture from your **vacuum hoses** as is reasonable. This will prevent spillage of solution in your vehicle when replacing hoses.
3. Position the **throttle control** to the first notch (low speed).
4. Disconnect the **vacuum hoses** from the unit.
5. Open the **heat bypass valve** two (2) turns and allow the unit to cool down to 180°F or less, and then close the **heat bypass valve** completely. **DO NOT** over-tighten the valve.
6. Pull the **throttle** all the way out to idle and allow the unit to run for **1 minute** in order to remove all moisture from the **vacuum pump**.

NOTE: If finishing for the day: Push the throttle all the way in, plug the **vacuum inlets** and spray WD-40 (or equivalent) into the **vacuum lubrication cup** (located at front of console) for **5 seconds**. This will lubricate the **vacuum pump**. Pull the **throttle** back to idle and continue to step #7.
7. Turn the **ignition switch** to the **OFF** position.
8. Turn the **water supply faucet** off. Bleed the pressure out of the **water supply hose** by loosening the hose at the water supply. Unhook the **water supply hose** and store in vehicle.
9. Relieve pressure from the **cleaning tools and pressure hoses** by activating the valve on the tools. Disconnect the **tools and pressure hoses** from the unit and store all items.
10. Drain the **waste tank** and dispose of waste in a proper manner.



WARNING!

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

11. Remove the **strainer basket** from the waste tank, clean out any accumulated debris, and re-install. Inspect the **vacuum inlet filter** inside the **waste tank**. If there is any lint or debris, remove and clean filter.

NOTE: When removing the **vacuum inlet filter**, grip the plastic hexagonal section of filter. Grasping filter by the screen may collapse or ruin the filter. Re-install the filter hand-tight. **NEVER operate this unit with this filter removed, damaged or improperly installed.**

NOTE: When replacing this filter, we recommend using the stainless steel PROCHEM filter (Part #14-806518 for PERFORMER, #14-806509 for PERFORMER 405) only. This will prevent rust and corrosion from entering the vacuum system.

12. At the end of your work day, rinse out the waste tank with fresh water. DUO Deodorizer may be added to the waste tank to inhibit the growth of bacteria.

13. Clean the unit, tools, hoses, van interior, etc., as needed. Inspect ALL equipment for any damage, wear, leaks, etc.

16. FREEZING PROTECTION



CAUTION:

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

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

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

If a heated building is not available, we recommend that you winterize the unit with

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

ADDING ANTI-FREEZE TO YOUR UNIT:

1. Shut off the water supply. Disconnect the **water inlet hose** from the front of your console.
2. Connect all **high pressure hoses and tools** that may have water in them.
3. Start the unit with the **exhaust diverter valve** in the **HEAT EXCHANGER** position, and open the tool valve until the low-pressure switch shuts the unit down.
4. Fill the water box with approximately two gallons of 100% glycol base anti-freeze.
5. Turn the **diverter valve** to the **MUFFLER** position. Close the **heat bypass valve** by turning the knob all the way clockwise.
6. Turn the **water pressure override switch** to the **override** position and start the unit. Turn the **water pump switch ON**.
7. Open the tool valve until anti-freeze begins to come out of the tool. Recover **ALL** anti-freeze that comes out of the tools into an approved container. We strongly recommend that you re-cycle and re-use the anti-freeze.

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

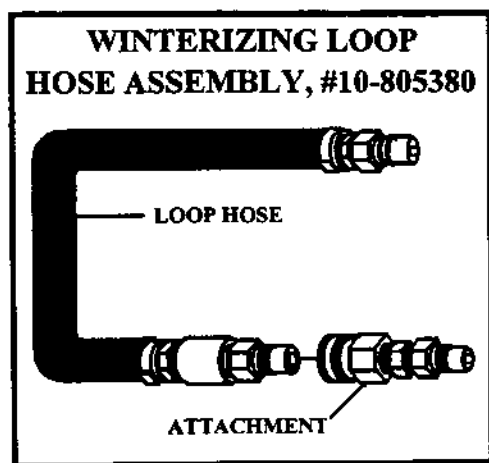
8. Turn the **water pump switch OFF**. Attach the **winterizing loop hose** with attachment, Part #10-805380, to the solution outlet connection and the water inlet connection. Turn the **water pump switch ON**.

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

9. Prime the **chemical system** with a 50/50 anti-freeze/water mix. Insert the chemical inlet and prime tubes into the anti-freeze container. Turn the **chemical valve** to PRIME until antifreeze begins to flow out of the prime hose.

Now turn the **chemical valve** to the ON (CHEMICAL) position, making certain that the flow meter indicates flow. Make certain that all anti-freeze drains out of the chemical hose into an approved container.

After 20 seconds, turn the **chemical valve** to the OFF position.



10. Open the **heat bypass valve** by turning the knob counter-clockwise. After 10 seconds, close the **heat bypass valve**.

Turn the **temperature control** on the control panel to 50°F for 10 seconds.

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

REMOVING ANTI-FREEZE FROM THE UNIT:

1. Connect one end of the **winterizing loop hose** to the solution outlet connection. Place the other end of the loop hose, without the attachment, into an approved container.

2. Start the unit. Allow the anti-freeze to flow into the container until the low-pressure switch shuts the unit down.

3. Fill the water box with fresh water and repeat step #2.

4. Connect the **water inlet hose** to the water inlet connection on the console. Turn the water supply on.

5. Connect all **solution hoses** and any tools which require purging of anti-freeze to the solution outlet connection(s).

6. Open the tool valves and drain the anti-freeze into an approved container until the flow is clear and all anti-freeze is purged from the tools and hoses.

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

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

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

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



WARNING!

When disposing of used anti-freeze, observe local laws and regulations. Where permitted, we recommend disposal in sanitary sewer systems. Do not drain onto the ground or into storm drainage systems.

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MAINTENANCE CHART

daily maintenance	Engine	daily	Check engine oil level.*** Fill to proper level.
	Engine	daily	Check coolant level in overflow bottle.
	Vacuum Pump	daily	Spray WD-40 in lubrication cup at front of console for 5 sec.
	Water Pump	daily	Check oil level.** Fill to proper level.
	Vacuum Inlet Filter (in waste tank)	daily*	Clean filter, inspect, replace if damaged.
	Vacuum Hoses	daily	Wash out with clean water.
	(Optional) Automatic Waste Pump	daily*	Inspect and remove any debris or sediment.

Vacuum Pump	weekly*	Check oil level. Fill to proper level.
Water Pump Inlet Filter (in water box)	weekly*	Check for debris and clean.
Battery	weekly*	Check for proper fluid level. Fill with distilled water only.
Bypass Manifold Orifice & Strainer	weekly*	Inspect and remove any debris or blockage.
Solution Outlet Y-Strainer	monthly*	Inspect and remove any debris or blockage.
High Pressure Hoses	25*	Inspect for damage or impending damage.
Pressure Regulator	100	Lubricate o-rings.
Engine	100	Change engine oil.***
Engine	100	Change oil filter.***
Battery	100*	Clean battery terminals.
Engine	100	Check fan belt tightness.
Engine	200	Service air cleaner element.*
Engine	200	Check radiator hoses and clamp tightness.
Engine	200	Check spark plugs for carbon deposits and proper gap.
Heat Bypass and Chemical Valves	200*	Inspect and/or adjust packing nuts.
Temperature Solenoid	200*	Remove any hard water deposits.
Vacuum Exhaust Heat Exchanger	200	Inspect core and remove debris.
Water Pump	500	Change oil.**
Vacuum Pump	500	Lubricate bearing on pulley end with grease.
Pulley Set Screws & Hub Cap Screws	500	Check for proper torque values. Re-torque, if required.****
Drive Pulleys	500	Inspect, clean, and check for pulley groove wear.****
Drive Pulleys	500	Check pulley alignment.****
Drive Belts	500	Inspect and clean.****
Drive Belts	500	Check belt tension.****
Engine	1000	Replace spark plugs.
Engine	1000	Flush radiator and change engine coolant.
Engine	1000	Drain and refill engine governor oil.
Chemical Pump & Check Valves	1000	Replace diaphragm and check valves.
Check Valve (Solution Outlet)	1000	Inspect, clean, and repair, if needed.
Vacuum Pump	1500	Drain, flush, and replace oil.*****
Engine	yearly*	Replace in-line fuel filter on engine.
Engine	yearly*	Replace air cleaner element.
Nitrogen Accumulator	yearly*	Check and have re-charged with nitrogen, if required.
Engine	2 years	Replace radiator hoses and hose clamps.
Engine	3 years	Replace ignition wires.

* Or as often as required.

** Change water pump crankcase oil after the first 50 hours of operation.

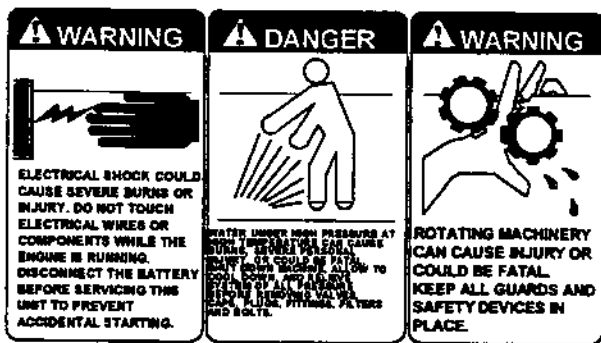
*** Change engine crankcase oil and filter after the first 50 hours of operation.

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

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

6 MAINTENANCE

This chapter of the operator's manual contains the maintenance information for this unit. Initiation of a planned preventative maintenance program will assure that your PROCHEM PERFORMER/PERFORMER 405 has optimum performance, a long operating life, and a minimal amount of "down" time.



WARNING!

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

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

1. ENGINE

1. Check the engine oil level **daily**, when in use. Make certain that proper oil level is maintained. **NEVER** overfill.

2. Change the break-in oil after the first **50 hours** of operation. Thereafter, change oil

every **100 hours** of operation. **USE ONLY NISSAN BRAND OIL FILTERS.** USING ANY OTHER TYPE OIL FILTER WILL VOID YOUR ENGINE WARRANTY.

Oil Recommendation. Use high-quality detergent oil of at least API (American Petroleum Institute) service class SF or SG. Select the viscosity based on the air temperature at the time of operation as shown in the following table:

RECOMMENDED SAE VISCOSITY GRADE

							20W-20, 20W-40, 20W-50
							10W-30, 10W-40, 10W-50, 15W-40, 15W-50
							10W
							5W-30
							5W-20
F°	-22	-4	14	32	59	104	
C°	-30	-20	-10	0	15	40	
	Temperature Range Expected Before Next Oil Change						

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

3. Re-torque the manifold and exhaust tube nuts, cylinder head bolts, and carburetor attaching nuts after the **first 200 hours** of use.

4. Check the oil level in the engine governor every **250 hours**. When empty, the governor requires approximately 1-1/2 fluid ounces of 30 weight non-detergent oil (see Figure 18).

Drain and refill the engine governor every **1000 hours**.

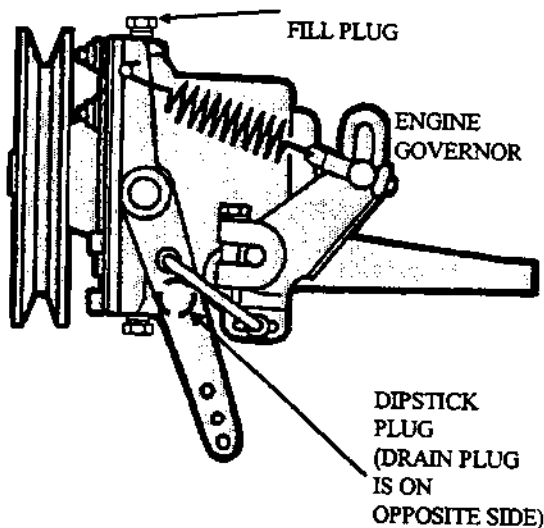
5. Check the spark plugs every **200 hours**. Clean if necessary. Replace the spark plugs every **1000 hours**. **NOTE:** Never sandblast spark plugs. Spark plugs should be cleaned by scraping or wire brushing.

6. Clean the air cleaner element every **200 hours**. Replace the element every **2400 hours**.

Figure 18 ENGINE GOVERNOR

CHECK ENGINE GOVERNOR OIL LEVEL EVERY 250 HOURS

WHEN FILLING, REMOVE THE GOVERNOR FILL PLUG AND, USING A SYRINGE OR OTHER MEASURABLE FILLING DEVICE, ADD 30-WEIGHT NON-DETERGENT OIL. REPLACE THE FILL PLUG. WHEN EMPTY, THE GOVERNOR REQUIRES 1-1/2 FLUID OZ.



7. Check the engine idle RPM every 200 hours and adjust, if necessary. **NEVER** adjust engine RPM without a tachometer. Refer to Nissan Engine Operation and Service Manual.

8. Check the coolant level in the radiator overflow container **daily**. If no coolant is seen, remove the cap and add coolant. Change the coolant with a 70:30 coolant to water ratio every 1000 hours.

9. Replace the in-line gas filter **yearly**.

NOTE: For additional engine service information, obtain a "Nissan A-12 Service and Repair Manual" from any authorized Nissan Service Center. If service or repair is required, contact an authorized Nissan Service Center. You will need to provide the serial number of the engine.

2. VACUUM PUMP

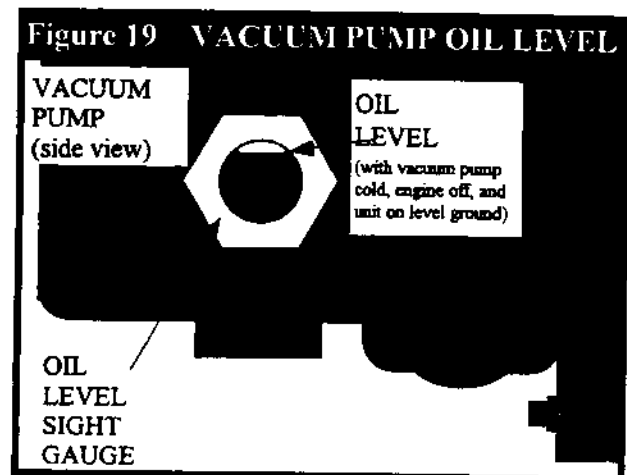
Refer to the Vacuum Pump Operation and Service Manual for specific instructions.

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

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

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

1. Check the oil level **weekly** to assure the proper level. **PROPER LEVEL** cannot be overemphasized. Too little oil will ruin bearings and gears. Too much oil will cause overheating. Use Figure 19 as a guide when adding oil.



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

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

3. Drain, flush and replace oil **every 1500 hours or yearly, whichever comes first**. Change oil more frequently if inspection so indicates. With AEON PD synthetic lubricant, perform the oil change maintenance **every 4500 hours or every 2 years, whichever comes first**.

VACUUM PUMP LUBRICANT

Blower Discharge Temperature	Oil Grade U.S.A.*	Oil viscosity, Centistokes @ 40° C
-40° to 32°F (-40° to 0°C)	SAE 10W	45
32° to 100°F (0° to 38°C)	SAE 20	100
100° to 275° F (38° to 135°C)	SAE 40	200
over 275° F (135° C)	SAE 50	250

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

For Grease Lubricated Bearings
Service every 500 hours of operation

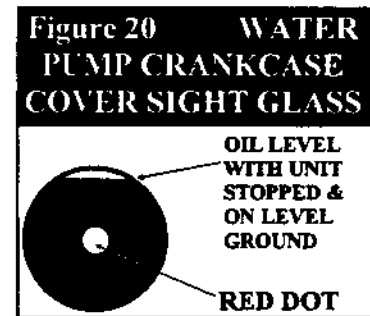
Blower Discharge Temperature	Type Grease
-40° to 275° F (-40° to 120° C)	No. 2 Non-Corrosive Bearing Grease

4. The bearings on the pulley end of the vacuum pump requires grease lubrication **every 500 hours**. Pack the bearings until grease comes out of the vent holes. Use extreme pressure bearing grease of the specification NLGI Grade 2 EP.

3. WATER PUMP

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

1. Check the crankcase oil level **daily** to assure the proper level. Use Figure 20 as a guide when checking the oil level. If the level has dropped, check for the source of leakage and repair.



2. Change the crankcase oil with Cat Pump Crankcase Oil, Part #05-008016, after the **first 50 hours** of operation. Drain and refill the crankcase oil with Cat Pump Crankcase Oil **every 500 hours** thereafter.

3. Other Cat approved oil equivalents are: Mobil DTE 16, Amoco Rykow 68, and Shell Tellus T68.

4. VACUUM INLET FILTER (IN WASTE TANK)

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

2. Inspect the vacuum inlet filter inside the waste tank. If there is any lint or debris, remove and clean filter. Re-install the filter **hand-tight**.



CAUTION:

When removing the vacuum inlet filter, grip the plastic hexagonal section of filter. Grasping filter by the screen may collapse or ruin the filter.

NOTE: When replacing this filter, we recommend using a stainless steel PROCHEM filter (#14-806518 for PERFORMER. The PERFORMER 405 requires two filters, #14-806509) only.

5. DRIVE BELTS, PULLEYS, & HUBS

1. Check pulley set screws and/or hub cap screws after the **first 25 hours** and then again at **100 hours**. Re-torque these screws with a torque wrench, using the values on the following chart. Check pulley set screws and/or hub cap screws **every 500 hours** thereafter.



CAUTION:

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

TORQUE VALUES		
Component	inch/lbs	foot/lbs
Engine hub	720	60
Vacuum pump hub	192	16

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

groove drives, belt ride should be uniform, not more than 1/16" above or below top of pulley groove.

Check groove wear area for wear. Side wall of groove should be straight, not dished out. Bottom of groove should show no signs of belt contact.

Inspect belts for contaminants, such as oil or grease. Wipe belts clean with detergent and water. Inspect pulley grooves for buildup of such material and remove, if necessary.

Check wear surfaces of belt for excessive wear. If they have a slick, glazed look, belts are slipping. Check belt tension. Never replace one belt in a used set, as used belts will elongate. Replace entire set if replacement is necessary.

Place a straight-edge across the top of belt. There should be no more than 1/2" deflection in the center of the belt, halfway between the pulleys. If there is too much slack, tighten belt, making sure that it stays properly aligned.

See the "General Service Adjustments" section in this manual for details.

Check alignment with straight-edge, string, or machinist level. Correct alignment to as near perfect as possible.

6. FLOAT VALVE (WATER BOX)

Check the float valve at least once a month for proper operation. If overfilling is a problem, check the plunger for a proper seat. Replace tip on plunger if needed or damaged. Water level in the water box should be about 5-1/2" to 6".

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

7. INLET FILTER (TO WATER PUMP)

The filter inside and on the bottom of the water box is rubber with a stainless steel screen. This should be inspected and cleaned on a **weekly** basis. Replace, if damaged.

NOTE: Vacuum all excess water and debris from water box prior to removing strainer.

8. WASTE TANK STRAINER BASKET

The strainer basket located inside the waste tank should be removed and cleaned whenever it is full of debris. This should be done on at least a **daily** basis.

9. BYPASS MANIFOLD (STRAINER AND JET BLOCK)

Check the strainer and the jet **weekly**. Remove any debris or blockage.

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

10. Y-STRAINER (OUTLET)

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

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

11. CHECK VALVE (OUTLET)

Inspect the check valve when rebuilding the

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

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

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

12. CHEMICAL PUMP

Rebuild the chemical pump **every 1000 hours**. This involves changing the diaphragm and check valves.

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

13. CHEMICAL AND HEAT BYPASS VALVES

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

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

14. NITROGEN ACCUMULATOR

Check the nitrogen pre-charge at **least once a year**. Recharge the accumulator and replace the bladder, when needed. This should be performed by an Authorized Service Center.

**WARNING!**

Recharge accumulator with nitrogen **ONLY**.
DO NOT charge accumulator over 250 PSI.

15. PRESSURE REGULATOR

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

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

16. VACUUM HOSES

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

17. CATALYTIC AIR PUMP

Check and/or replace the air pump every 1500 hours. When replacing, it will also be necessary to replace the air pump pulley.

18. TEMPERATURE SOLENOID

Remove hard water deposits from the temperature solenoid every 200 hours or as often as required.

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

19. BATTERY**WARNING!**

Dangerous Acid, Explosive Gases!

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

Keep batteries out of the reach of children. Remove all jewelry when servicing batteries. Before disconnecting the negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or gasoline vapors are present. When disconnecting the battery, ALWAYS disconnect the negative (-) terminal FIRST.

1. Check the fluid level in the battery every 25 hours or once a week. If low, fill to the recommended level with distilled water ONLY.

NOTE: DO NOT overfill the battery. Poor performance or early failure due to loss of electrolyte will result.

2. Keep the cables, terminals, and external surfaces of the battery clean. A buildup of corrosive acid or grime on the external surfaces can cause the battery to self-discharge. Self-discharge occurs rapidly when moisture is present.

The battery terminals should be cleaned every 100 hours to prevent corrosion build-up. Wash the cables, terminals and external surfaces with a mild baking soda and water solution. Rinse thoroughly with clear water.

**CAUTION:**

DO NOT allow the baking soda to enter the battery cells as this will destroy the electrolyte.

20. ENGINE EXHAUST HEAT EXCHANGER

If the engine and/or air pump are not properly maintained, the exhaust gases may deposit carbon on the outside of the heat exchanger coil and affect the cleaning solution temperature and damage the catalytic converter. If this condition exists, remove the heat exchanger from the unit and clean the carbon off the coil. This may be done by taking it to a radiator dealer and having it boiled out. **The catalytic converter must be completely removed before cleaning carbon deposits or damage may result.**

Proper maintenance of the unit, such as regular tune-ups, proper fuel, and a properly operating air pump will help prevent carbon build-up on the coil and increase the life of the unit.

Using A212 ULTRA CLEAN INDUSTRIAL CLEANER or A217-1 ULTRAPAC RENOVATE will also greatly enhance the removal of carbon deposits. Soak the coil and casing **ONLY, NEVER** soak the catalytic converter core.

21. VACUUM EXHAUST HEAT EXCHANGER

Removing and cleaning the vacuum exhaust pre-heater cores is recommended as needed or if the unit was operated with the vacuum inlet filter damaged, removed, or improperly installed. Pull out the core and remove all debris, being **careful not to drive debris deeper into the core.** We recommend removing the debris with water by either submerging the core and moving it back and forth until the debris loosens and falls off or by spraying the debris out of the core. Allow the core to dry before reinstalling.

22. HIGH PRESSURE HOSES

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



WARNING!

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

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

23. OPTIONAL WASTE PUMP-OUT

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

Remove the waste pump unit from the waste tank and clean inside the screen at least **once a week, or more frequently if required.**

24. TEMPERATURE PROBE PACKING

Examine the temperature packing assembly for leaks every **200 hours.** Tighten the packing nut fitting just enough to stop leaks. **DO NOT over-tighten.**

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

7 SERVICE GENERAL ADJUSTMENTS



WARNING!

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

1. ENGINE SPEED

1. The PERFORMER/PERFORMER 405 uses a governor to set and maintain engine speed. The engine speed is adjusted by shifting the throttle adjustment lever located on the front panel. The throttle adjustment lever has three positions. The first position is idle, 900 RPM. At this position the throttle adjustment lever is pulled out and is not locked in at the console. The throttle adjustment lever has two notches at its base. Push in the throttle adjustment lever to the first notch and lock in position for low speed, about 1900 RPM. Push in and lock the throttle adjustment lever at the second notch for high speed, 2400 RPM.

2. The throttle adjustment lever is attached to a governor. The governor has internal weights that apply pressure to a shaft gear with an extending arm. Attached to the arm is the carburetor linkage, adjusting engine speed. **NOTE:** Units are pre-set at the factory.

3. Engine RPM should drop approximately 150-200 RPM on high and low speed when the vacuum inlets are covered.

LINKAGE ADJUSTMENT (Engine Off)

Unsnap the tip of the linkage from the throttle arm ball, Figure 22. Pull the throttle adjustment lever all the way out to the idle position.

While holding the throttle arm down with your finger, position the linkage underneath the ball as shown in Figure 23. The ball should barely touch the top of the adjustment arm.

If adjustment is required, loosen the locking nut, adjust the linkage to the proper length, and re-tighten the locking nut.

THROTTLE ARM ADJUSTMENT (Engine Off)

Push the throttle adjustment lever and lock at the second notch position (high speed). The lever should lock firmly. See Figure 21.

Check the governor limit screw. If the governor limit screw is not positioned firmly against the arm, tighten the governor limit screw and locking nut until firm. Do not over-tighten.

IDLE SPEED ADJUSTMENT (Engine Running)

Pull the throttle adjustment lever all the way out to the idle position. Using a tachometer, turn the idle adjustment screw, Figure 21, until 900 RPM is indicated.

HIGH SPEED ADJUSTMENT (Engine Running with the Water Pump On)

Push the throttle adjustment lever in and lock at the second notch position (high speed). Using a tachometer, adjust the spring tension nut, Figure 21, until 2400 RPM is indicated.



CAUTION:

DO NOT attempt to adjust without a tachometer and **NEVER** adjust the engine above 2400 RPM or operate the unit over 2600 RPM. Permanent damage may occur.

NISSAN ENGINE SPEED CONTROL ADJUSTMENT

Figure 21

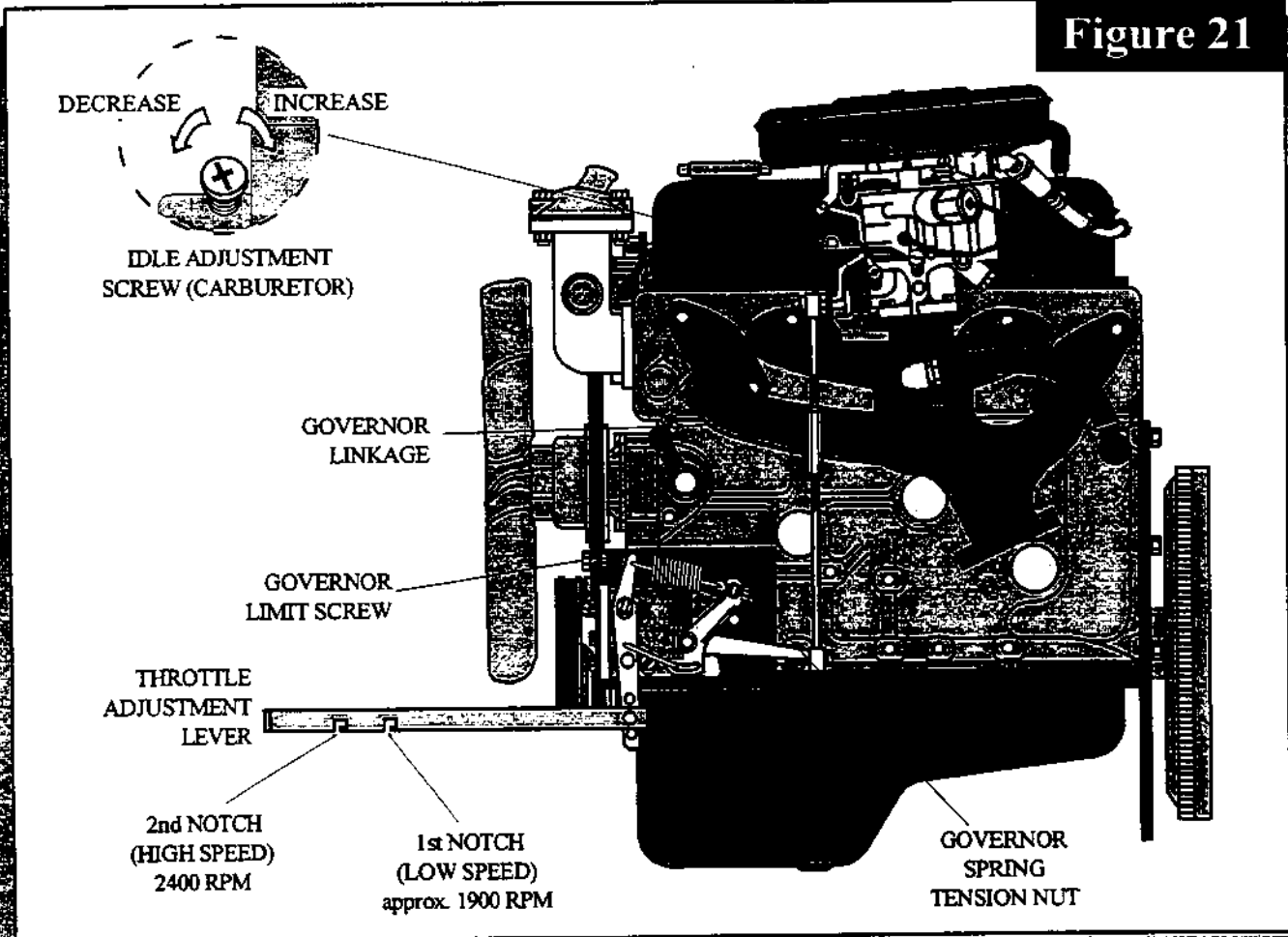


Figure 22

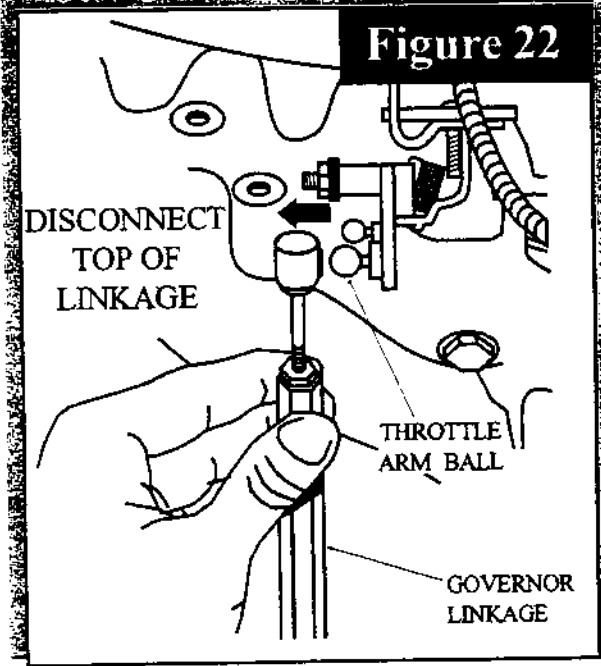
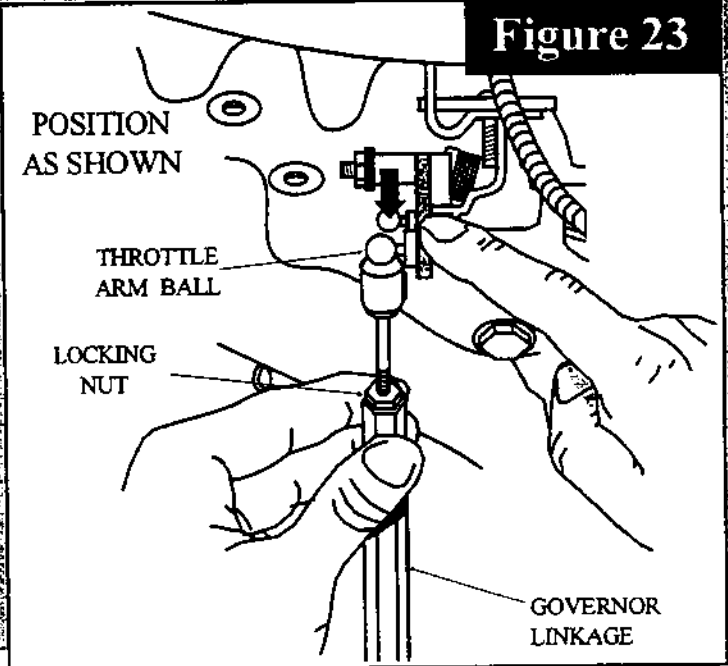


Figure 23



2. VACUUM RELIEF VALVE

While the unit is running at full RPM, block the air flow at the vacuum inlet connection and read the vacuum gauge. If adjustment is required, shut the unit down and adjust the vacuum relief valve locking nut tension. Start your unit and read the vacuum gauge. Repeat this process until the relief valve opens at 14" Hg (13" Hg for the PERFORMER 405).

3. VACUUM PUMP DRIVE BELTS

To tighten the vacuum pump belts:

1. Loosen the two nuts which hold the air pump mount in place (for units equipped with the catalytic engine exhaust heat exchanger and air pump).
2. Loosen the four nuts which hold the vacuum pump mount in place.
3. Turn the adjusting bolts until the proper belt tension is achieved (1/2" deflection in the center of the belt, halfway between the pulleys).

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

4. After adjusting, re-tighten the four nuts which hold the vacuum pump mount in position. Check belt alignment with straight-edge.
5. Readjust and check air pump belt. **DO NOT** over-tighten belt. Re-tighten the two nuts which hold the air pump mount in place. Check belt alignment with straight-edge.

4. WATER PUMP DRIVE BELT

To tighten the water pump belt:

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

5. FLOAT VALVE (WATER BOX)

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

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

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



CAUTION:

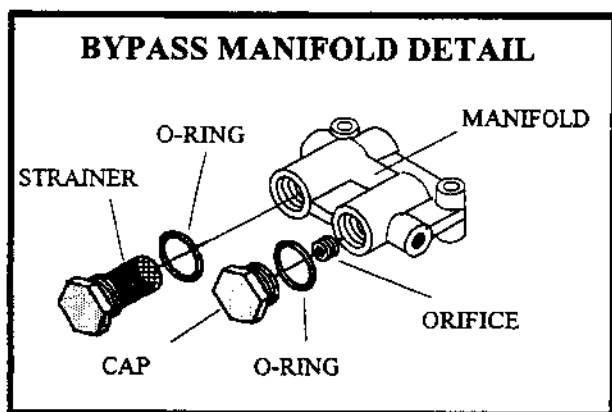
When replacing float ball, **DO NOT** over-tighten, as the rod can puncture the ball. Make sure to tighten the nuts on the rod.

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

6. BYPASS MANIFOLD

Clean the bypass strainer and orifice weekly, using the following guidelines:

1. Remove the strainer. Clean and re-install. **DO NOT** over-tighten strainer.
2. Remove the cap. Remove the orifice, using a 3/16" Allen wrench (the 3/16" Allen wrench is provided with Part #66-945280, the bypass maintenance kit).



3. Re-install the cap and run the unit with the water pump ON for 15 seconds to flush out the bypass manifold.

4. Remove the cap and re-install the cleaned orifice, using the 3/16" Allen wrench. Tighten orifice just enough to seat. **DO NOT** over-tighten. Re-install cap. **DO NOT** over-tighten cap.

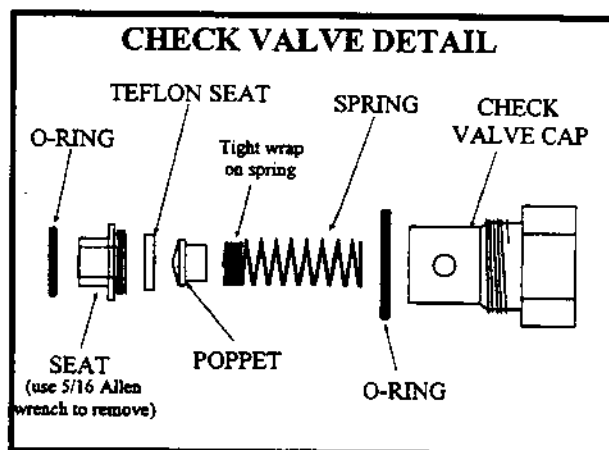
NOTE: If o-ring seals leak, replace them. If strainer is damaged, replace strainer.

7. CHECK VALVE (SOLUTION OUTLET)

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

1. Remove the check valve. Be sure the small o-ring for the seat comes out with the check valve.
2. Remove the seat, using a 5/16" Allen wrench.

3. Check the Teflon seat for debris or wear. Clean or replace Teflon seat if needed.
4. Clean the poppet and spring, inspect for wear or damage, and replace as needed.
5. Re-assemble the check valve. Start the seat by hand, tighten using a 5/16" Allen wrench. **DO NOT** over-tighten seat.



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

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

8. CHEMICAL PUMP

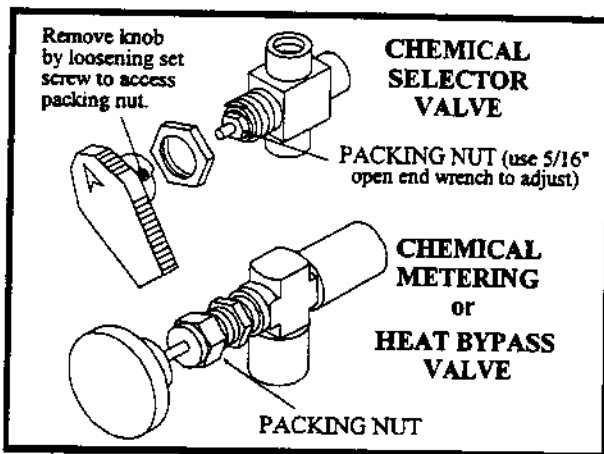
The only repairs which the chemical pump may require is the replacement of the diaphragm or check valves. To replace the diaphragm, unscrew the cover from the body. When replacing the diaphragm, lubricate the outer edges of the diaphragm with o-ring lubricant Part #05-008035 and reassemble. To replace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

DO NOT attempt to re-use o-rings once the check valves have been removed. See the

"Illustrated Parts Listing" for a parts breakdown on the chemical pump.

9. PACKING NUT ADJUSTMENT FOR CHEMICAL METERING AND CHEMICAL SELECTOR VALVES

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



10. PRESSURE REGULATOR

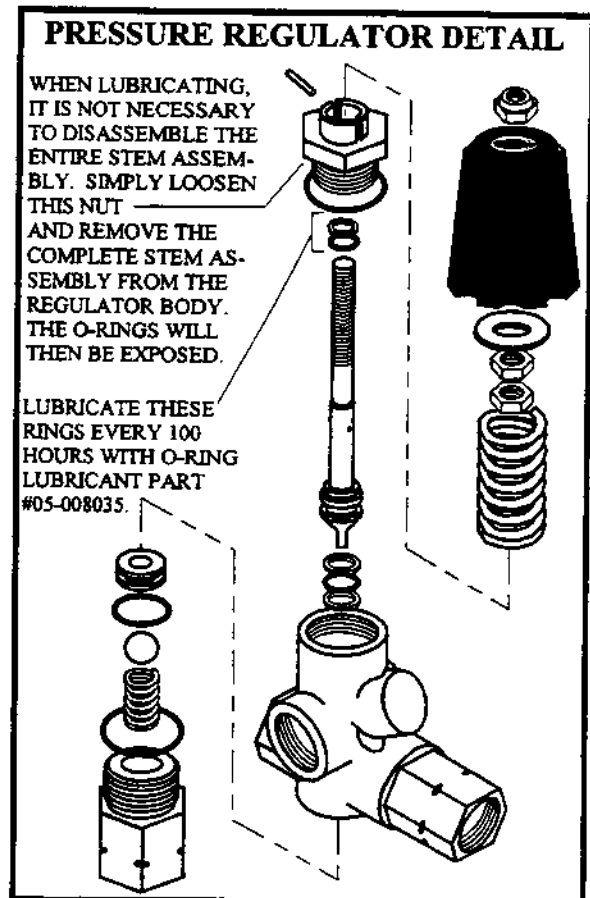
The pressure regulator serves only to hold locked up water pressure at a preset point and to bypass this water back to the water box.

To adjust:

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

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

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



11. ADDING/DRAINING ENGINE COOLANT

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

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

draincock on the heli-coil and remove the lower heli-coil plug, until drained.

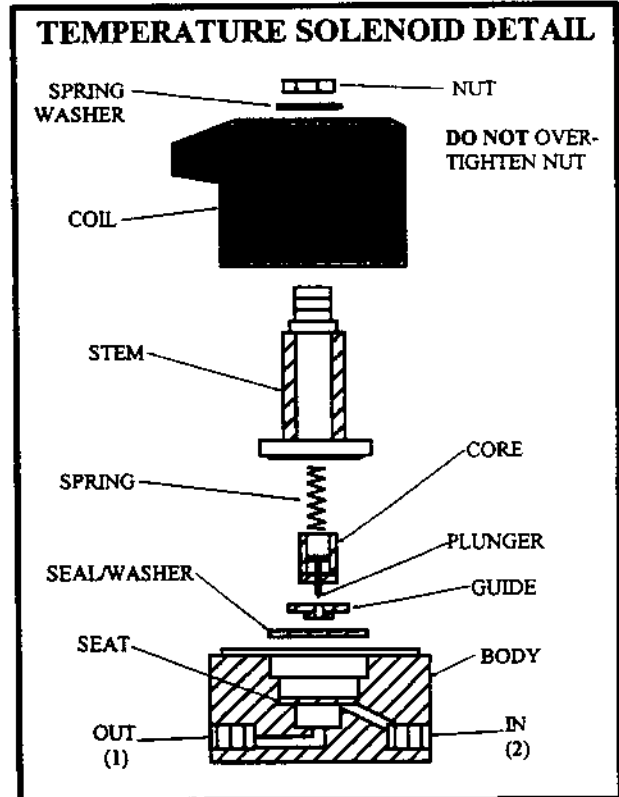
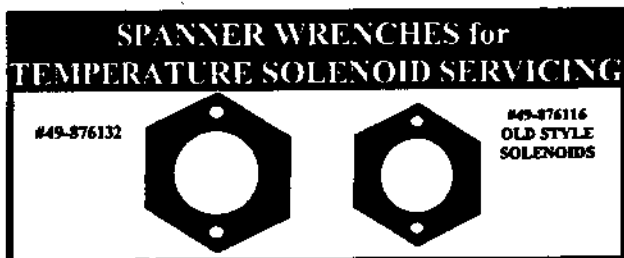
2. To add coolant, first install the heli-coil plug and fill the radiator. Next, bleed the air out of the system by turning the heli-coil heat exchanger draincock counter-clockwise. The heli-coil heat exchanger draincock is located on the heat exchanger casting on the right side of the console. After bleeding the air out of the heli-coil heat exchanger draincock, close the heli-coil heat exchanger draincock by turning it clockwise. Fill the engine radiator once again. Then add to the overflow container (fill **ONLY** halfway between the "add" and "fill" marks). After running the unit, add more coolant, if necessary, into the overflow container only.

12. TEMPERATURE SOLENOID

The temperature solenoid may become seized due to hard water deposits. Make certain that the core moves freely in the stem. Also, the plunger must move freely within the guide. Clean with #0000 steel wool.

Check the seat to make sure that it is not distorted. Clean the seat, using a 3/64" drill bit. **ROTATE THE DRILL BIT WITH YOUR FINGERS ONLY.**

NOTE: DO NOT over-tighten nut when reassembling temperature solenoid. Over-tightening the nut will damage the coil.



13. TEMPERATURE CAPILLARY & PACKING ASSEMBLY

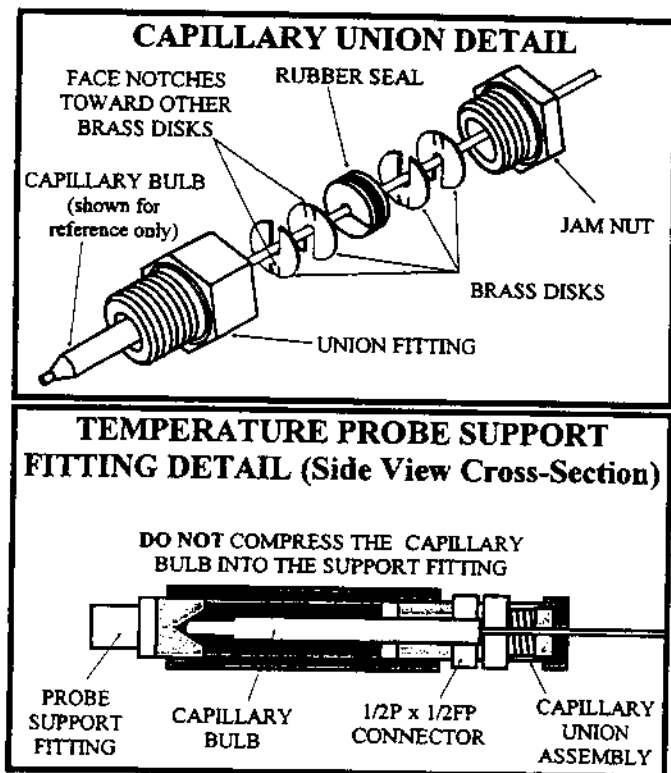
INSTALLATION INSTRUCTIONS

1. Using thread sealant, thread the tapered end of the union fitting into the thermostat manifold and tighten.
2. Slide the jam nut over the capillary bulb with the threaded end toward the end of the capillary bulb.
3. Insert the capillary bulb through the union fitting and into the thermostat manifold.
4. Place the rubber seal onto the capillary tube with the split facing 90° from the top (see the capillary union detail).
5. Fit the four brass disks onto the capillary tube, with two of the brass disks on each side

of the rubber seal. Face the notch on one brass disk toward the nearby brass disk to lock the brass disks together. Then face the notches on the brass disks 90° from the split in the rubber seal.

NOTE: Lubricating the facing sides of the brass disks will hold them together on the capillary tube during installation.

6. Insert the rubber seal and brass disks into the union fitting, hand tight.
7. Position the capillary bulb in the temperature manifold as shown in the illustration. When positioning the capillary bulb, do not allow the bulb to compress against the support fitting.
8. Tighten the jam nut lightly, about 1-1/2 turns.
9. Examine the capillary union assembly for leaks and tighten the union fitting just enough to stop leaks. **DO NOT** over-tighten.



8 TROUBLESHOOTING



WARNING!

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

This chapter of the operator's manual explains how to look for and repair malfunctions which may occur.

Intelligent, accurate troubleshooting is based on a complete and thorough understanding of the WATER, VACUUM, CHEMICAL, HEAT TRANSFER, SAFETY and WIRING systems on this unit.

If there is a malfunction occurring in a system which you do not fully understand, turn back to the "Operation" section of this manual and review "Systems".

In addition, prior to proceeding, you can save time by checking that:

1. The water supply is ON.
2. The engine speed at full throttle is 2400 RPM, with the diverter valve in the HEAT EXCHANGER position.
3. Check that water pump volume is correct. Check the pump volume with the cleaning tool closed. Measure the water flow returning to the water box from the pressure regulator. The flow rate should be 3.4 GPM. An additional .25 GPM of water should be flowing through the bypass manifold orifice, which is adjacent to the water box. If you block the heat bypass flow, the flow rate will be 3.65 GPM.

SPECIFIC PROBLEMS

1. LOSS OF WATER PUMP PRESSURE

With the cleaning tool open, the water pressure gauge reads below the normal operating pressure. **NOTE:** If the water pump pressure drops below 50 PSI or exceeds 1200 PSI, the unit will automatically shut down.

PROBABLE CAUSES	CORRECTIVE ACTION
Water supply is turned off or the float valve is stuck or improperly adjusted. NOTE: This may also cause the water pressure switch to shut the unit down.	Turn the water supply on or up. Check for kinks in the water supply hose. Examine the float valve and adjust or replace.
Water pump inlet supply line is plugged or drawing air. NOTE: This may also cause the water pressure switch to shut the unit down.	Examine the water inlet filter inside the water box. Remove accumulated debris and replace if required. Check for suction leaks and loose clamps or fittings. Tighten any loose fittings or clamps. Replace any ruptured hose(s).
Improper engine speed.	Using a tachometer, check the engine speed. Full throttle engine speed is 2400 RPM. Idle speed is 900 RPM. Re-adjust in accordance with the instructions on pages 49-50 of this manual.
Pressure regulator o-rings are dry.	Lubricate o-rings, using o-ring lubricant Part #05-008035.
Pressure regulator has worn o-rings.	Check o-rings. If necessary, replace.
Pressure regulator is dirty, stuck open, or improperly adjusted.	Clean or repair pressure regulator. Adjust to working pressure. Lubricate o-rings, using o-ring lubricant Part #05-008035.
Low pump volume. (Measure the amount of water being returned to the water box from the pressure regulator. It should fill a gallon container about every 17 seconds.)	Examine the check valves, plunger cups, and cylinder head on the water pump. Repair, whenever required (refer to the water pump service manual.)
Defective water pressure gauge.	Replace gauge.
Orifice (spray nozzle) in the cleaning tool is worn, defective, or the wrong size.	Replace nozzle or change nozzle size.
Bypass manifold orifice not installed or installed improperly (threads damaged in manifold).	Check bypass manifold and orifice for proper installation and repair, if necessary.
Debris clogging water lines or water inlet disconnect.	Clean or replace as needed.
Belt loose or broken.	Re-tension or replace as needed.

2. LOSS OF SOLUTION VOLUME AT CLEANING TOOL ORIFICE

Water pressure gauge reads normal.

Plugged orifice and/or screen in the cleaning tool.	Unplug or replace orifice and/or screen.
Internal block between the pressure regulator manifold and the outlet Y- strainer, or the Y-strainer screen is clogged.	Inspect all lines, remove accumulated debris which is blocking proper flow. Replace any defective hoses. Remove, inspect, and clean the Y-strainer screen. De-scale unit and install a water softener, if necessary.
Outlet check valve is plugged.	Examine the check valve, remove any debris.
Defective quick-connect on one of more of the high pressure hoses.	Replace defective quick-connect(s) on high pressure hose(s).
Cleaning tool valve is malfunctioning.	Repair or replace valve.
Hose inner lining is constricted.	Remove restriction or replace hose.
Engine exhaust heat exchanger is scaled on inside of coil.	De-scale coil, and install the water softener, if necessary, to protect the equipment. If water contains 3-1/2 grains or more of water hardness, a water softener is needed.

3. LOSS OF VACUUM

While cleaning, the vacuum is not up to par. Engine RPM is normal.

Vacuum gauge is giving an improper reading.	Examine the tubing between the vacuum relief valve and the vacuum gauge and remove any blockage.
Vacuum hose(s) is damaged, causing a suction leak.	Inspect the vacuum hose(s). Repair any damage or replace.
Waste tank gasket not sealing properly, not positioned properly.	Inspect the gasket. Repair seal or replace. Re-position lid.
Plugged vacuum hose or vacuum plumbing between vacuum inlet and strainer basket.	Unplug vacuum hose or inlet plumbing.
Waste tank filter or strainer basket is plugged.	Clean or replace filter. Clean strainer basket.
Loose vacuum pump drive belts.	Tighten the drive belts.
Waste tank drain valve is damaged or left open, causing a vacuum leak.	Drain the waste tank. Close drain valve, if open. Remove the dump valve and, after inspecting, replace the defective components.

3. LOSS OF VACUUM *(continued from previous page)*

While cleaning, the vacuum is not up to par. Engine RPM is normal.

PROBABLE CAUSES	CORRECTIVE ACTION
Vacuum relief valve requires adjustment or has a vacuum leak due to damaged diaphragm.	Re-adjust the vacuum relief valve. If the vacuum does not increase, remove and inspect the relief valve diaphragm. If damaged, replace.
Vacuum exhaust heat exchangers are plugged with lint.	Remove and clean.
Vacuum pump is worn out.	Replace the vacuum pump.

4. LOSS OF CHEMICAL

With the cleaning tool valve open, no chemical.

PROBABLE CAUSES	CORRECTIVE ACTION
Chemical pump is improperly primed.	Refer to chemical pump priming instructions.
The strainer at the inlet end of the chemical inlet line is clogged.	Unclog the strainer. If damaged, replace.
Suction leak in the inlet line leading into the chemical pump.	Inspect inlet lines and flow meter for damage and replace, if required.
Chemical pump check valve(s) is clogged.	Remove any debris from the chemical check valve(s). Replace chemical check valve(s) or seals, if necessary.
Chemical prime/on-off valve or chemical metering valve is defective.	Replace valve(s).
Chemical pump diaphragm is ruptured.	Disassemble the chemical pump and replace the damaged diaphragm.
Defective cylinder in the water pump.	Measure the pump volume. If the pump volume is less than normal, refer to "Loss of Pump Volume" in the "Troubleshooting" section in this manual.

5. CHEMICAL FLOW METER INDICATES FLOW WITH THE TOOL VALVE CLOSED

PROBABLE CAUSES	CORRECTIVE ACTION
External leak in chemical piping.	Tighten fittings. Re-apply thread sealant where required. If any fittings are damaged, replace.

5. CHEMICAL FLOW METER INDICATES FLOW WITH THE TOOL VALVE CLOSED (continued from previous page)

Outlet check valve is full of debris or damaged, not allowing it to close properly.

Close the chemical valve on the instrument panel. If the flow meter does not indicate flow, remove debris or replace check valve, if necessary.

Chemical pump diaphragm is ruptured.

Close the chemical valve on the instrument panel. If the flow meter still indicates flow, replace the chemical pump diaphragm.

Internal leak in chemical prime valve causing continual flow through prime tube returning to container.

Tighten valve packing nut (see "General Service Adjustments" section in this manual). Replace valve, if necessary.

6. WATER PUMP DOES NOT ENGAGE WHEN THE DIVERTER VALVE IS IN THE "HEAT EXCHANGER" POSITION

Water pump circuit breaker has been tripped.

If the blue light is OFF, check the water pump circuit breaker on the control panel. Press the circuit breaker reset button.

Defective electrical connection in the console wiring or defective switch.

If the blue light is OFF and the water pump circuit breaker is not tripped, examine switch, electrical connections, and wiring. Repair any defective connections. If there is power going to the switch but not going out, replace the defective switch.

Water pump has not been activated.

Adjust activator arm to assure contact and activation of the microswitch. If the microswitch is defective or damaged, replace.

Defective water pump clutch. NOTE: The clutch may be MANUALLY set by inserting two ¼-20x1/2" bolts. Line up the holes on the clutch and insert the bolts. To disengage the pump, remove the bolts.

If the blue light is ON, check the white wire which leads from the switch to the clutch. If there is power in the switch, but no power at the clutch, replace the defective wire. If there is power at the clutch, replace the defective switch.

Loose or broken water pump belt.

Tighten or replace belt.

7. ENGINE WILL NOT START*The engine does not turn over.*

PROBABLE CAUSES	CORRECTIVE ACTION
Main circuit breaker on the control panel has been tripped.	After inspecting the unit to determine the cause of the tripped circuit breaker, press the reset button.
Loose or corroded battery.	Clean, tighten, or replace the battery terminals.
Dead battery.	Recharge or replace battery.
Defective ignition switch.	Test ignition switch for power going into the switch. If there is power going in but NO power going out, replace the switch.
Defective starter motor.	Test the starter motor. If necessary, replace.
Engine problem.	Refer to the Nissan Engine Operation and Maintenance Manual.
Vacuum pump is seized.	Refer to Sutorbilt Service & Repair manual.

8. STARTER TURNS OVER ENGINE, BUT ENGINE WILL NOT START

PROBABLE CAUSES	CORRECTIVE ACTION
Waste tank is full.	Empty the waste tank.
Water pressure has not reached 50 PSI, triggering the pressure switch to prevent starting.	Turn water pump switch to the override position. If the unit shuts back down, refer to the "Loss of Water Pump Pressure" in the "Troubleshooting" section of this manual.
Engine temperature has exceeded 240°F, triggering the high temperature switch to shut the unit down.	Determine the cause of overheating before restarting the unit. See "Excessive Heating" in the "Troubleshooting" section of this manual.
Defective fuel pump.	Replace the fuel pump.
Loose or broken wires leading to waste tank float switch.	Repair or replace any broken electrical connections.
Defective float switch in the waste tank.	Disconnect the float switch plugs and bypass the switch. If the unit starts, repair or replace the defective float switch.
Oil pressure switch (located on engine), anti-diesel solenoid (located on engine), high temperature switch (located on engine).	Test these components. If any are defective, replace. Consult the Nissan Engine Operation and Maintenance Manual.

8. STARTER TURNS OVER ENGINE, BUT ENGINE WILL NOT START *(continued from previous page)*

Defective 285°F high temperature shutdown switch (located at rear of exhaust heat exchanger).

Test. If necessary, replace.

Engine is malfunctioning.

Refer to Nissan Engine Operation and Maintenance Manual.

9. ENGINE STOPS RUNNING

While doing normal cleaning, the engine stops running.

Engine is out of gasoline.

Add gasoline to the fuel tank.

Waste tank is full.

Empty waste tank.

Water pressure has dropped below 50 PSI, triggering the pressure switch to shut the unit down.

Check water supply to your unit. Check water pump inlet screen in water box. Check supply hose for kinks.

Water pressure has exceeded 1200 PSI, triggering the pressure switch to shut the unit down.

Check pressure regulator for proper setting.

Main circuit breaker on the control panel has been tripped.

After inspecting the unit to determine the cause of the tripped circuit breaker, press the reset button.

Solution temperature has exceeded 285°F, causing the unit to shut down.

Refer to "Excessive Heating" in the "Troubleshooting" section of this manual.

Engine coolant temperature has exceeded 240°F, triggering the high temperature switch to shut the unit down.

Determine the cause of overheating before restarting the unit. Refer to the Nissan Engine Operation and Maintenance Manual.

Defective fuel pump.

Replace fuel pump.

Defective float switch inside the waste tank.

Disconnect the float switch plugs and bypass the float switch. If the unit starts, repair or replace the defective float switch.

Defective 240°F engine coolant high-temperature shutdown switch.

Test switch. If necessary, replace.

Oil pressure gauge on engine has shut down, due to insufficient oil pressure.

Refer to the Nissan Engine Operation and Maintenance Manual. **DO NOT** restart the engine until the cause is determined and corrected.

285°F solution temperature switch is defective.

Test switch. If necessary, replace.

9. ENGINE STOPS RUNNING (continued from previous page)

While doing normal cleaning, the engine stops running.

No ignition in the engine or engine is malfunctioning.

Refer to the Nissan Engine Operation and Maintenance Manual.

10. EXCESSIVE HEATING

Check instrumentation settings:
Diverter valve is in the HEAT EXCHANGER position.
Temperature bypass valve is closed.
Temperature control is set at a high temperature.

Turn diverter valve to the MUFFLER position. (If cleaning, make certain that the water pump switch is in the ON position). Open the heat bypass valve. Set temperature control to a lower setting.

Strainer or orifice in bypass manifold is plugged.

Clean strainer screen and orifice. Replace, if necessary.

Defective solenoid – remains in closed position.

Inspect solenoid for proper operation. Clean, or replace, if needed.

Bypass valve is completely closed and unit is left running for a long period of time without using water.

Open bypass valve and allow system to cool down.

Defective temperature control or temperature control microswitch.

Inspect temperature control for proper operation. Repair, or replace, if necessary.

Flow restriction caused by hard water scaling.

Descale unit, repair or replace damaged plumbing components as necessary. Install water softener.

11. HEAT EXCHANGER LEAKS

Engine and vacuum exhaust heat exchanger are damaged from frozen water.

Inspect heat exchangers for leaks. On pre-heaters visually inspect for damage. Pressure check both styles after removing them from the unit. (Maximum test pressure engine exhaust H.E. 1200 PSI, vacuum pre-heaters 300 PSI.)

NOTE: The engine exhaust heat exchanger will produce water condensation discharge at times during normal operation. **DO NOT** confuse this with a water leak.

12. LOSS OF TEMPERATURE

The heat output of the unit is *LESS* than normal.

PROBABLE CAUSES		CORRECTIVE ACTION	
Check instrumentation settings: Diverter valve is in the MUFFLER position. Temperature bypass valve is open. Temperature control is set at a low temperature.		Turn diverter valve to the HEAT EXCHANGER position. Close the heat bypass valve. Set the temperature control to a higher setting.	
Defective solenoid – remains in open position.		Inspect solenoid for proper operation. Clean, or replace, if needed.	
Defective temperature control or temperature control microswitch.		Inspect temperature control for proper operation. Repair, or replace, if needed.	
Temperature relief valve on water box is stuck open.		Clean temperature relief valve and test. Replace, if necessary.	
Engine RPM is low.		Reset engine RPM. Refer to pages 49-50 in this manual.	
Defective temperature gauge.		Test gauge and sensor. Replace failed component.	
Defective air pump (catalytic converter not burning).		Replace air pump.	
Engine exhaust heat exchanger is carbon-coated on outside of coil (defective air pump).		Soak coil section at a machine shop. Boil tank or soak in an industrial cleaner. Check air pump, replace if needed. DO NOT soak catalytic core.	
Engine exhaust heat exchanger is scaled on inside of coil.		De-scale coil. Install water softener if needed.	
Excessive bypass due to loose or damaged orifice.		Inspect bypass orifice. Repair or replace as needed.	

13. AUTOMATIC WASTE PUMP IS MALFUNCTIONING OR NOT OPERATING NORMALLY

(for units equipped with an automatic waste pump)

PROBABLE CAUSES		CORRECTIVE ACTION	
Debris interfering in the normal operation of pump, pump check valve, or float switch.		Remove pump-out from waste tank, thoroughly check all components. Inspect for proper operation.	
Pump-out circuit breaker on the control panel has been tripped.		After inspecting the waste pump to determine the cause of the tripped circuit breaker, press the reset button. (Check for debris in the impeller inside the pump head.)	
Defective waste pump float switch.		Replace float switch.	

13. AUTOMATIC WASTE PUMP IS MALFUNCTIONING OR NOT OPERATING NORMALLY (continued from previous page)

(for units equipped with an automatic waste pump)

Worn out waste pump.

Check for voltage at the pump. If there is voltage and the pump does not run, replace the pump.

NOTE: When replacing either the pump or float switch, use new electrical connectors and heat shrink. Inspect connection for water tight seal.

Water has penetrated the electrical connectors.

Reseal or replace electrical connectors.

Broken wiring leading to the waste pump.

Check for voltage at the pump. If no voltage, find the broken connection and repair.

Weak battery. Battery charge too low to maintain pump-out operation.

Charge or replace battery if needed. Check charging system.

Pump wired incorrectly. Pump impeller rotates backwards.

Verify rotation using arrow marking on bottom of pump housing. Inspect wiring using a voltage meter.