HYDRAMASTER

Corporation
11015 47th Avenue W, Mukilteo, WA 98275

CleanMaster 402

Machine Serial Number_____

D-182-052

Revised March 20, 2005

Table of Contents

General Information

CleanMaster 402

Section 1-1

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

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

- The engine has to run at a consistent RPM.
- The vacuum has to pull air and dirty water back from cleaning site.
- The water pump provides stable pressure at proper water flow for cleaning.
- The chemical has to be injected into the water stream at the right concentration.
- The heating system must maintain proper heat.
- The vacuum tank must store dirty water until drained.

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

⚠ WARNING

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

⚠ CAUTION

This symbol is used to warn of possible equipment damage.

Hours	Telephone Numbers
Monday - Friday	(425) 775-7276 Parts
8:00 am to 5:00 pm	(425) 775-7275 Service
PACIFIC STANDARD TIME	(800) 426-4225 Parts / Service FAX

Precautions

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

⚠ CAUTION

ENGINE COOLING: Units employing internal combustion engines must not be enclosed within a van or trailer with doors and windows closed. Excessive temperatures within the engine will result in premature engine failure and a compromise of applicable warranty.

⚠ CAUTION

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

⚠ CAUTION

MOVING PARTS: Never touch any part of the machine that is in motion. Severe bodily injury may result.

⚠ WARNING

The machine cannot be run in the IDLE position for cleaning upholstery, carpet or floor extraction. This will void the warranty.

⚠ WARNING

ACID RINSE AGENTS: The increased demand for "clear water" rinsing results in the need for special care when using these acid based chemicals in your equipment. The negative side of these products is the corrosive effects the acid can have on metals, including swivels, pumps, heat exchangers, etc.

⚠ CAUTION

HydraMaster's *ClearWater Rinse* has been formulated to protect vital components. HydraMaster will not warranty parts that have been damaged from using unprotected acid products that have obviously caused failures.

HARD WATER PROTECTION: Failure to take appropriate measures to prevent scale build up can result in **system failure** and **loss of warranty** on affected parts. Test the water in your immediate and surrounding areas with hard water test strips. Assume all water obtained from wells is hard. If you are operating in a "Hard Water Area" (3.5 grains or more per gallon), use a water softening system.

⚠ CAUTION

FREEZE PROTECTION: There is often little warning before a cold spell. Therefore, not protecting this equipment from freezing will result in costly downtime. Placing an electric heater in the truck or parking the truck indoors will help to insure against freezing, but should not be the primary method of freeze protection.

⚠ CAUTION

EXHAUST SYSTEM: Do not allow flammable material (i.e. oil, fuel, plastic or wood products) to come in contact with the exhaust system.

⚠ CAUTION

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

⚠ WARNING

HEARING PROTECTION: The Occupational Safety and Health Administration (OSHA) recommends the use of hearing protection when a technician is exposed to an *average* of 85 decibels (this is an average of exposure over an 8 hour period). This equipment can produce 85 decibels to a distance of 10 feet. Please check with your local state agencies to see if OSHA standards apply to your application.

NO SMOKING: It is unsafe to smoke in or around the machine.

⚠ WARNING

CARBON MONOXIDE: This unit generates toxic fumes. DO NOT operate in confined spaces. This equipment is intended for warehouse settings. Area must be a minimum of 10,000 square feet to operate.

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

PORTABLE PROPANE TANK: Do not use a portable tank inside of the trailer. It is dangerous and illegal in most states.

⚠ WARNING

TRANSPORTATION OF FUEL CONTAINERS: Transportation in a vehicle of any vented fuel container that presently has or has ever contained a flammable liquid is strictly forbidden by HydraMaster Corporation and by federal and state regulation.

⚠ CAUTION

The owner of a propane carpet cleaning machine shall ensure that the technician has participated in a training corse on the safe handling of propane and the proper operation of the equipment.

⚠ CAUTION

The use of some chemicals through your mobile carpet cleaning plant can seriously damage the internal plumbing, high-pressure pump, chemical pump and heat exchangers. These harmful chemicals include concentrated acid (see the pH chart at the end of this section), solvents (including d-Limonene), and some paint, oil and grease removers with a high concentration of solvents.

System Operation

The CM402 heat exchanger system is a highly engineered cleaning plant designed by HydraMaster Corporation. The system utilizes a dynamic heating system com- prised of two separate exhaust heat exchangers for capturing "free heat."

The water flow is as follows:

Water is fed into the machine under tap pressure (pump-in pump) and it flows to the water box. The solution is then picked up by the high pressure pump and pressurized to the desired level. The water then splits flow, as demanded by the technician.

The majority of the water flows to the bypass valve assembly, then back to the water box. The water demanded by the technician flows from the water pump through the blower exhaust heat exchanger then through the engine exhaust heat exchanger and out to the cleaning tool.

When the cleaning solution reaches a preset high temperature, it is released from the system and directed to the recovery tank. Then cool water enters the system to regulate the temperature.

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

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

Machine Specifications

Frame:	24"W x 33"L x 30"H Steel with Baked-on Epoxy Finish
Tank:	32″W x 48″L x 28″H Steel with Baked-on Epoxy Finish
Weight:	850 lbs.aprox.
Engine:	Kawasaki 19 HP OHV Pressurized Oil System Spin-on Filter, Oil Cooler and Oil PSI Protection Switch
Ignition:	Electronic, Keystart
Battery:	Group U1 Absorbed Glass Mat Interstate Model # MVP-U1 CCA - 450 / AH - 33
Vacuum Blower:	Dominator 4005, Tuthill/M-D Tri-Lobe,
Pump:	HydraPump II, 3.5 GPM Hot Seals, 2500 PSI
Chemical System:	Last-Step Chemical
Operating Pressure:	Up to 1,000 PSI
Heating System:	1 Stainless Steel Engine Exhaust Exchanger 1 Coil and Fin Blower Exhaust Heat Exchanger
Instruments:	Water Pressure Gauge, Liquid Filled, 0-1500 PSI Hour Meter, Machine Runtime Keyed Ignition, Start/Stop Chemical Flowmeter, Clear Acrylic, 0-10 GPH Vacuum Gauge Temperature Gauge

Recovery Tank:	45 Gallon Aluminum, Epoxy Finish
Fresh Water Tank:	50 Gallon Aluminum, Epoxy Finish
Cleaning Wand:	Stainless Steel 'S'-bend Replaceable Grip Rebuildable Solution Valve
High Pressure Hose:	¼" High Temperature Lined/Vinyl Covered Hose Rated to 2250 PSI
Vacuum Hose:	2" Reinforced, 1½" Reinforced.
Standard Equipment:	Machine Power Console Full Instrumentation Tuthill/M-D Tri-Lobe Vacuum Blower CM402 Water Heating Package Holding Tank Carpet Cleaning Wand Chemical Jug 100 ft, 2" Vacuum Hose 10 ft, 1-½" Wand Whip Line 100 ft, Super Flex Solution Line Battery Box Van Decal Package Van Installation Kit Operation Manual

Spare Parts Recommendation

Downtime in the unit can be very expensive, because your truckmounted unit is capable of generating several hundred dollars per day. In order to minimize such downtime, it is strongly recommended by the manufacturer that you purchase and keep in your truck the parts listed below.

Parts Orders

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

HydraMaster Parts Dept. Phone ..... (425) 775-7276
HydraMaster Parts Dept. Toll Free Fax 1-800-426-4225

Spare Parts List (078-340)

PART NO	DESCRIPTION	QTY
010-054	Belt, A38 Pump	1
046-010	Diaphragm, Chemical Pump	1
049-008	Filter, S/S Vacuum Pump, 2½"	1
049-026	Filter, Kawasaki Oil	2
049-016	Filter, ¼" Replacement Y	1
049-023	Screen, Garden Hose	1
049-027	Filter, Kawasaki Air	1
049-118	Filter, ¼" s/s	1
049-030	Filter Bag, 92+ Truck Mount	2
052-050	Quick Connect, 440 Male	3
052-051	Quick Connect, 440 Female	2
052-052	Quick Connect, 660 Male	1
052-053	Quick Connect, 660 Female	1

Spare Parts List (078-340)

PART NO	DESCRIPTION	QTY
056-001	Fuse, 10 amp	2
056-008	Fuse, 15 amp	2
056-010	Fuse, 25 amp	1
074-007	Gauge, Hi PSI (0-1500)	1
074-032	Meter, Chemical Flow	1
078-101	Kit, Seal & Spring Hi PSI	1
078-140	Kit, Comet Seal	1
106-021	Plug, Kawasaki Spark	2
106-045	Plug, HD4 Coupling - 1" OD x 3⁄16" LG, EPDM	8
157-080	Switch, s/s Float	1
157-040	Rocker	
157-022	Switch, Relay	2
169-017	Valve, 3-way Chemical	1
169-022	Valve, 1½" Full Port	1
169-155	Check Valve, Last-Step Chemical	2
169-160	Valve, 2-way Chemical Metering	1
180-004	Orifice, Primary	1
180-006	Orifice, Secondary	1

NOTE:

Engine Oil: ***30 weight*** motor oil with a minimum standard of SE, SF, SG.

Blower OIl: 40 weight ***non detergent***

Pump Oil: 40 weight ***non-detergent***

Responsibilities

The **Purchaser's** responsibilities are:

To purchase heavy duty 42 - 60 amp hour battery and have the battery 'slow' charge if new. *If the battery is not fully charged, damage can occur to the engine charging regulator.*

Reading of owner's manual: It is the purchaser's responsibility to read the unit operation manual and to familiarize himself with the information contained therein.

*Special attention should be paid to all **Cautions** and **Warnings**.* ⚠ **CAUTION**

The **Sales Representative's responsibilities are:**

ACCEPTANCE OF SHIPMENT:

1. If the unit shows any outward signs of damage, do not sign the delivery receipt until you have closely inspected the unit and noted any damage on the delivery receipt.

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

CORRECT INSTALLATION INCLUDES:

- Trailer of proper load carrying capacity.
- Placing the unit and recovery tank in your trailerand securing them with bolts or tie down cleats. (If unit is not properly secured damage may occur)
- Connecting the battery.
- Checking the pump, vacuum blower and engine oil levels prior to staring the unit.
- Starting the unit to check the engine and see that all systems function normally.
- Checking all hoses, wands, etc. for correct operation.

TRAINING:

- A thorough review of the operation manual with purchaser.

Instruction and familiarization in:

- How to correctly start up and shut down the unit.
- How to correctly clean with the unit.
- Where and how often to check and change component oil levels.
- How the unit's systems work.
- How to troubleshoot the unit.
- How to do basic repairs.
- Safety precautions and their importance.
- Freezing damage and how to avoid it.
- Hard water damage and how to avoid it.
- A thorough review of the unit warranty and warranty procedures.
- A thorough review of hard water precautions and warnings.
- How to determine hard water areas.
- Use of water softening systems.

Local Water Precautions

The quality of water varies greatly. Many areas have an excess of minerals in the water which results in what is commonly called "hard water." These minerals tend to adhere to the insides of heater coils and other parts of the machines causing damage and a loss of cleaning effectiveness. This influences the reliability and efficiency of equipment in direct proportion to the level of hardness.

HARD WATER ADVISORY

HydraMaster recognizes that any hard water deposits which might occur within the water system of our truckmounts is a serious problem. The precision technology of truckmount heat exchanger systems is intolerant of any foreign material. Hard water deposits will ultimately decrease the performance of the system and are expected to seriously lower the reliability of the machine.

To validate a machine's warranty, HydraMaster requires that all machines operating in designated "Hard Water Areas" (3.5 grains or more per gallon) be fitted with a water softening system or a properly installed magnetic-type de-scaler must be used and maintained. Periodic de-scaling or acid-rinsing alone is not adequate in these areas.

HydraMaster does not recommend any particular type or brand, however the relative effectiveness of some types of magnetic de-scalers or softeners may require additional periodic use of de-scaling agents.

HydraMaster also recommends, in the strongest possible terms, that machines in all areas be fitted with a water softening system for improved operation and reliability.

HydraMaster has included five hard water test strips with your machine. These can be used to test the water in your immediate and surrounding areas as they can vary greatly. Assume all water obtained from wells is hard.

Failure to take appropriate measures to prevent scale build up can result in **system failure** and **loss of warranty** on affected parts.

HARD WATER AREA MAP

The following map defines areas in the United States which compromise fluid related components such as hoses, fittings, heaters, pumps, valves and water cooled engines. For other countries, hard water area maps can be obtained from geological societies.

WATER SOFTENER

Cleaning efficiency and equipment life is increased, chemical use decreased, and the appearance of cleaned carpets enhanced when water softeners are incorporated in hard water areas. The manufacturer strongly urges the use of water softener units in areas exceeding 3½ grains per gallon. Failure to use a water softener in these areas will invalidate the machine's warranty. Using a hard water area map as a reference, determine the quality of water in your area and take action immediately, if necessary.

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

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

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

WASTE WATER DISPOSAL ADVISORY ⚠ WARNING

There are laws in most communities prohibiting the dumping of recovered "gray" water from carpet cleaning in any place but a sanitary treatment system. This cleaning rinse water, recovered into your unit's vacuum tank, contains materials such as detergents. These must be processed before being safe for streams, rivers and reservoirs.

⚠ WARNING

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

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

One disposal method which usually complies with the law is to accumulate the waste water and haul it to an appropriate dump site. Another solution to the disposal problem is to equip yourself with an Automatic Pump-Out System. These systems are designed to remove waste water from the extractor's recovery system and actively pump the water through hoses to a suitable disposal drain. Properly designed, they will continuously monitor the level of waste water and pump it out simultaneously to the cleaning operation. The hidden benefit of this process is that the technician does not have to stop his cleaning to empty the recovery tank.

HydraMaster makes an A.P.O. System available which can be ordered with new equipment or installed later.

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

High Altitude Operation Preparation

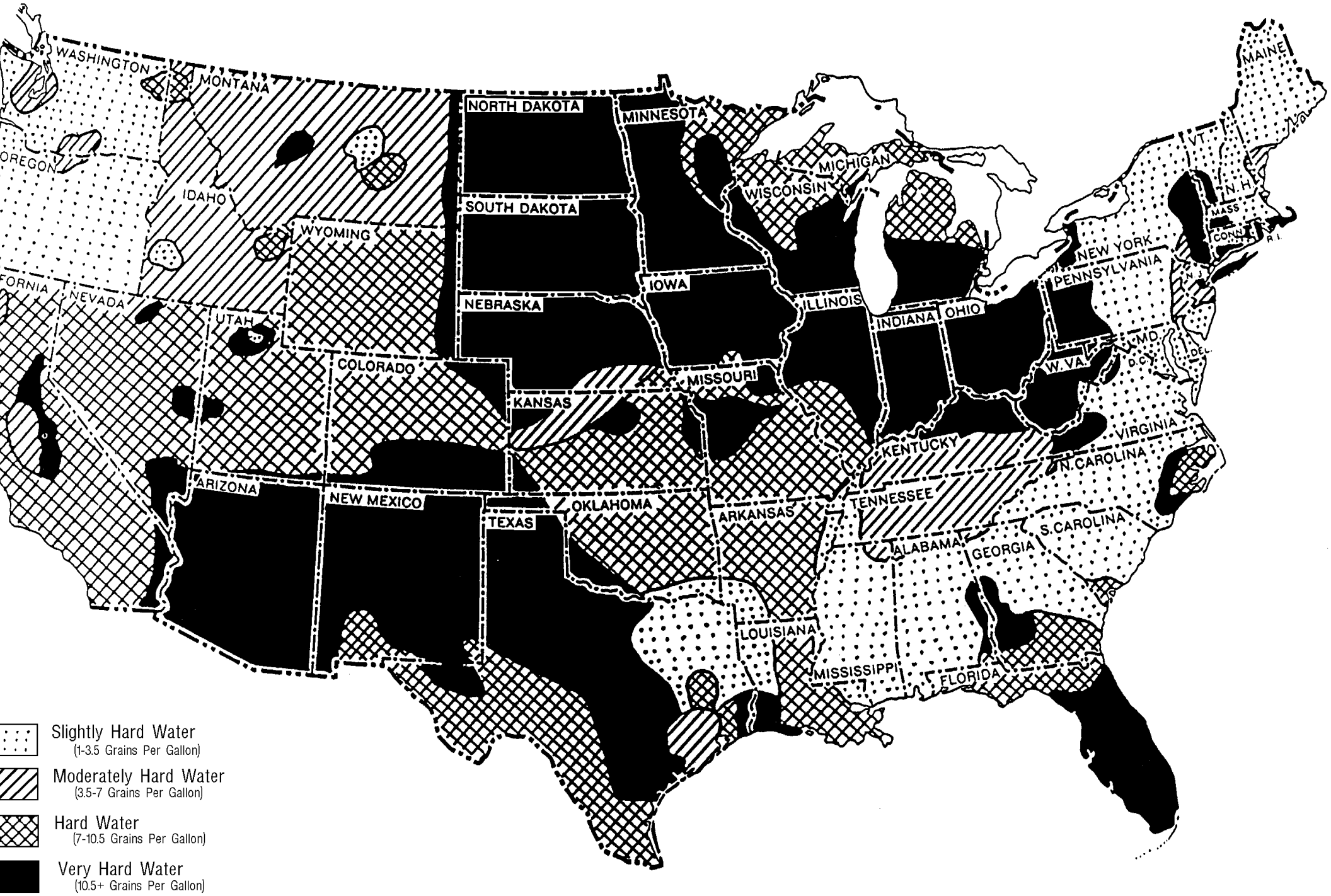
To have your machine run at it's peak performance; yourdistributor may have to make adjustments depending on the elevation. Elevation plays a key role in how the machine will operate.

The factory setting of the machine is set for elevations from 0—3,000 feet. Any time the machine is operated above 3,000 feet there are two areas on the machine the *may* need adjustment.

The first area is the fuel mixture screw. The higher the elevation, the less air is provided to the fuel mixture. This will make the engine run 'rich', and, in turn will result in the loss of power, excessive heat in the exhaust, and carbon buildup in the exhaust and heat exchanger system. The fuel mixture varies per engine and elevation. Consult HydraMaster to obtain proper setting.

The second area that may need adjustment is the heat control system. The heat control system is also optimized to 0-3,000 feet. At higher altitudes the boiling point of water is lowered. In turn, this can cause the water box to boil and the high pressure pump to cavitate. The heat control system settings will have to be adjusted to compensate for the elevation. These settings will vary according to elevation. Contact HydraMaster to obtain the recommended settings.

er Map



rce: Water Treatment Fundamentals, Water Quality Association, 1996.

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Cleaning and Chemicals

CleanMaster 402

Section 2-1

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

⚠ CAUTION

The use of some chemicals through your mobile carpet cleaning plant can seriously damage the internal plumbing, high-pressure pump, chemical pump and heat exchangers. These harmful chemicals include concentrated acid (see the pH chart at the end of this section), solvents (including d-Limonene), and some paint, oil and grease removers with a high concentration of solvents.

PRECAUTIONS

There are no short cuts to good carpet cleaning. It requires time, cleaning knowledge and the use of good chemicals. Therefore, the manufacturer recommends the use of spotting agents and traffic lane cleaners, as required, prior to the actual cleaning of carpeting.

The use of some chemicals through your mobile carpet cleaning plant can seriously damage the internal plumbing, high pressure pump and heater. These harmful chemicals include concentrated acid (see the pH chart at the end of this section), solvents, and some paint, oil, and grease removers with a high concentration of solvents.

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

The increased demand for "clear water" rinsing results in the need for special care when using these acid based chemicals in your equipment. The negative side of these products is the corrosive effects the acid can have on metals, including swivels, pumps, heat exchangers, etc.

HydraMaster's ***ClearWater Rinse*** has been formulated to protect vital components. HydraMaster will not warranty parts that have been damaged from using unprotected acid products that have obviously caused failures.

CLEANING STROKE PROCEDURE

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

Procedure:
Always move the cleaning tool in smooth, forward and backward strokes. Apply slight pressure to the forward stroke while the solution is injected into the carpet. When extracting (drying), apply firm pressure on the forward stroke to ensure a positive "lock" for the vacuum and minimize the "hopping" effect resulting on carpet that is not smooth. During the forward and reverse strokes, movement to the right or left should only be accomplished at the extreme rear of the stroke. Overlapping is also important to ensure even application of solution and prevent saturation when cleaning wand is stopped twice at the same point at the rear of the cleaning stroke. This is illustrated at the end of this section.

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

OVER-WETTING

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

THESE ARE SEVERAL AREAS THAT WILL CAUSE OVER-WETTING

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

Figure 2-1: pH Chart

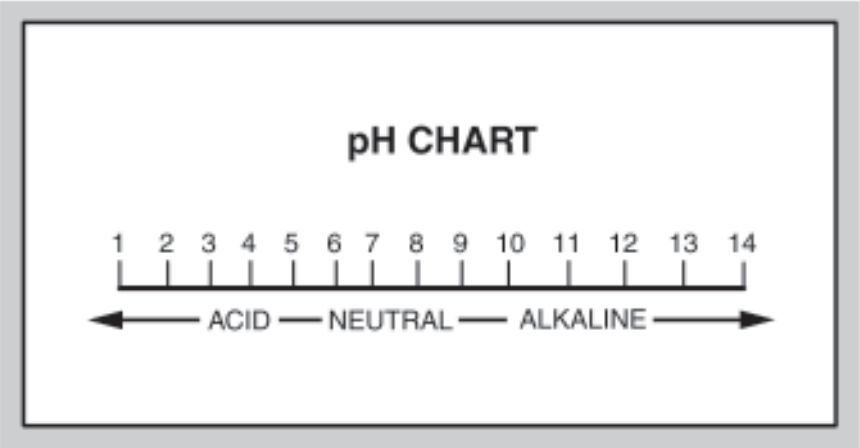
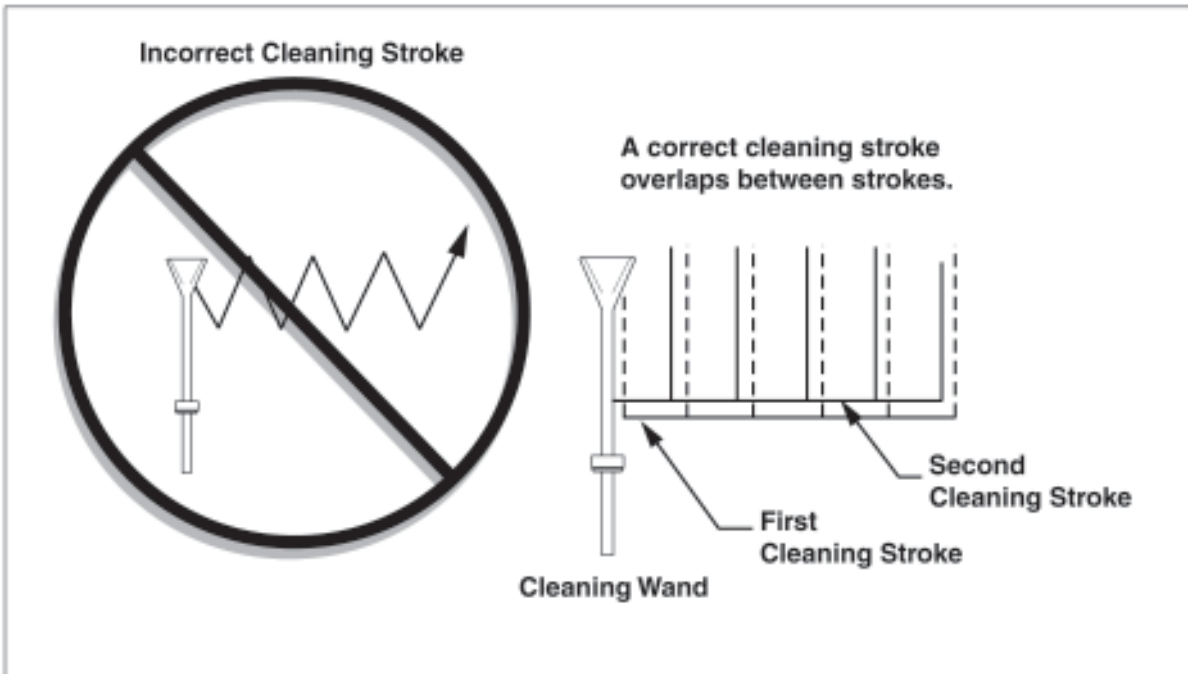


Figure 2-2: Cleaning Stroke Procedure



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Operating Instructions

CleanMaster 402

Section 3-1

START UP

1. Perform daily and periodic maintenance as specified in this Owner's Manual.
2. Connect all required hoses, including a garden hose for water supply.
3. Connect the cleaning tool to the length of hose required to perform the cleaning.

⚠ CAUTION

Water box must be full prior to ignition.

⚠ WARNING

The machine cannot be *run* in the "IDLE" position for cleaning upholstery, carpet or floor extraction. This will void the warranty.

NOTE: In order to achieve consistent adjustable temperatures, an operating pressure of 200 PSI must be maintained.

NOTE: Under exceptionally long periods of 'No Flow' conditions, the "Over Temp" light may come on momentarily. This indicates that the high temp solenoid is activated to control water temperature.

SET UP

Indoor Application:

1. Remove the unit from the storage area.
2. Obtain a full propane cylinder from the outside storage area. Before entering the building, check the propane cylinder for an over-full condition. If the cylinder is over-full see the section entitled "Propane Handling."

⚠ WARNING

An overfilled vapor tank, if put into operation, may allow liquid propane to enter the propane system and cause damage or explosion.

3. Place the machine in a well ventilated area and install the propane cylinder into the machine.
4. Make the propane connections. Open the propane tank valve and check for leaks. Close the propane tank valve for transport.

⚠ WARNING

If you smell gas:

a) Extinguish any open flames, pilot lights, and all smoking materials
b) Do not touch electrical switches.
c) Shut off the gas supply at the tank valve.
d) Open doors and other ventilating openings.
e) Leave the area until odor clears.
f) Have the gas system checked and leakage source corrected before using again.

5. Move the machine to the area to be cleaned, place the machine in the largest available open area.
6. Make the hose connections to the machine, vacuum, solution, incoming water, and automatic pump out.

Carpet or Hard Surface Cleaning

1. Turn the propane tank valve counterclockwise 3 full turns
2. Start the engine with throttle switch in "**IDLE**" position.
   Allow machine to run in idle for **2 - 3 minutes to warm up.**
2. Connect hoses.
3. If used, turn PUMP IN switch to **"ON"** (switch light will be illuminated).
4. Connect wand or tool.
5. Set THROTTLE to **"HIGH"**.
6. Set temperature to desired level.
7. If used, turn PUMP OUT switch to **"ON"** (switch light will be illuminated)
8. Set cleaning pressure to desired level.

Suggested Settings

Carpet Cleaning: 300 – 400 psi;

Hard Surface: 1000 psi or as indicated on the tool.

9. Turn the chemical selector valve to the "PRIME" position to purge any air from the system.
   a. If the chemical does not begin to flow through the flowmeter within 60 seconds, remove the chemical PRIME line (the one without the filter) from the chemical container and insert it into the vacuum hose connection at the front of the machine.

   b. When the chemical begins to flow through the flowmeter, with the flow indicator reading maximum flow and the PRIME line pulsing, turn the chemical selector valve to "**ON**", and place the chemical PRIME line back into the chemical container.

   c. Then, while spraying solution from the cleaning tool, adjust the chemical flow by turning the chemical adjustment knob as necessary.

10. Commence cleaning.

Upholstery Cleaning

1. Start the engine with throttle switch in "**IDLE**" position.
   Allow machine to run in idle for **2 - 3 minutes to warm up.**
2. Connect hoses.
3. If used, turn PUMP IN switch to **"ON"** (switch light will be illuminated).

Upholstery Cleaning Continued:

4. Connect wand or tool.
5. Set THROTTLE to **"HIGH"**.
6. Set temperature to desired level.
7. If used, turn PUMP OUT switch to **"ON"** (switch light will be illuminated)
8. Set cleaning pressure to desired level.
9. Turn the chemical selector valve to the "PRIME" position to purge any air from the system.
   a. If the chemical does not begin to flow through the flowmeter within 60 seconds, remove the chemical PRIME line (the one without the filter) from the chemical container and insert it into the vacuum hose connection at the front of the machine.
   b. When the chemical begins to flow through the flowmeter, with the flow indicator reading maximum flow and the PRIME line pulsing, turn the chemical selector valve to "**ON**", and place the chemical PRIME line back into the chemical container.
   c. Then, while spraying solution from the cleaning tool, adjust the chemical flow by turning the chemical adjustment knob as necessary.
10. Commence cleaning.

Flood Extraction

1. Start the engine with the THROTTLE switch in **"IDLE"** position. Allow the machine to run in idle for **2 - 3 minutes to warm up.**
2. Connect hoses.
3. Connect wand or tool.
4. Set the THROTTLE to **"HIGH"**.
5. If used, turn PUMP OUT switch to **"ON"** (switch light will be illuminated).
6. Commence water extraction.

Flood Damage Work for the Standard CM 402

When using equipment for flood damage, you *must* have a fresh water source hooked up at all times to allow a cold water source into the machine. This will prevent overheating during long periods of vacuum recovery.

Shut Down

1. Flush clear water through the chemical system for 10 seconds. Turn off the chemical flowmeter.
2. Cool the machine by lowering the adjustable thermostat to the "**LOW** spraying the cleaning wand into the vacuum hose for three to five minutes.

The chemical will be flushed from the unit, hoses and cleaning tool.

NOTE: If the machine is not properly cooled, the water box can overflow.

3. Remove the vacuum hose.
4. At this time, the blower should be lubricated with an oil-based lubricant. See **Lubrication** in the Blower Operation and Maintenance Manual included in Section 8 of this document.

NOTE: If freeze guarding is necessary, perform the freeze guard procedure at this time. (see Section 4 for **Freeze Guarding**)

5. Lower the engine RPMs to idle.
6. Turn the key off.
7. Drain the water box.
8. Drain the vacuum tank. The vacuum filter should be cleaned prior to mobilization of the van.

NOTE: In accordance with the EPA, state and local laws, **do not dispose of waste water into gutters, storm drains, streams, reservoirs, etc.**

9. Perform daily maintenance as prescribed in this manual.

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Propane

CleanMaster 402
Section 4-1

HydraMaster, being a leader in the floor care industry, has taken every precaution possible in the design of this equipment to ensure the safety of the technician. Safety is our primary concern. Therefore, the fuel of choice for this equipment is Liquefied Petroleum Gas (LPG, or more commonly referred to as propane). Propane is one of the cleanest burning commercial fuels available. The compounds produced by the combustion of propane are carbon dioxide, carbon monoxide, and oxides of nitrogen. Even though these can be toxic compounds in high concentrations, in this equipment everything possible has been done to ensure that these compounds do not reach harmful levels.

Propane has many advantages over other liquid fuels. For instance:

This fuel is readily available. Propane can be purchased in virtually any town in America.

Propane cylinders are commercially available and offer a safe and convenient way to transport this fuel.

Propane has been used successfully for many years by the floor care industry for indoor applications.

There are well established safety standards for the indoor use of propane fuel.

Propane is a very clean burning fuel, so it does not leave carbon deposits on interior engine components. This results in better engine life.

Propane boils at -40 degrees F so it can not spill. It is enhanced with a strong odor that is perceptible well below the flammable level so leaks can easily be detected.

FUEL SYSTEM FLOW

The fuel system flow is as follows:

1. When the tank valve is opened, pressurized propane vapor travels through a quick connect to a shut-off valve.
3. When the engine is started, this valve opens and allows propane vapor to reach the pressure regulator.
4. The pressure regulator reduces the propane pressure and regulates the flow of vapor to the engine.
5. The vapor then travels through the main metering valve on the hose.
6. The vapor then reaches the venturi and is injected into the engine.

REFUELING PROPANE TANKS

⚠ CAUTION

Use only the propane tank specified or supplied with the equipment. Do not substitute any other tank.

⚠ CAUTION

Never fill the propane tank for this equipment more than 80% of capacity. This is a vapor tank, filling it beyond 80% may cause liquid propane to enter the equipment and cause damage.

HydraMaster has designed this equipment to use a vertically-mounted 43 pound DOT tank. This is a vapor tank and must be kept with the properly indicated side up.

The NFPA discusses the proper refueling of propane cylinders in chapter 4 of standard #58. Briefly stated it warns against the overfilling of vapor tanks, that filling should be accomplished by "qualified personnel" only and that it is the responsibility of that qualified person to inform you in writing of any tanks that do not comply with sections 2-2 and 2-3 of NFPA 58.

The NFPA defines "qualified personnel" by this statement, "in the interest of safety all persons employed in handling LP-Gases shall be trained in proper handling and operating procedures, which the employer shall document. Effective Jan 1, 1993, all employees shall carry written certification of their job qualifications issued by the training agent or a written document issued by the authority having jurisdiction identifying the functions each person is authorized to perform." (NFPA 58 1-6)

In the event that a propane tank becomes overfilled, venting of the tank is permitted only under the following conditions, "outdoors, container venting shall be done under conditions that will result in rapid dispersion of the product being released. Consideration shall be given to such factors as distance to buildings, terrain, wind direction and velocity, and use of a vent stack so that a flammable mixture will not reach a point of ignition." (NFPA 58, 4-3.2.1) Propane can be released by opening the small relief valve located next to the main tank valve. Allow the tank to vent until fuel vapor is no longer visible.

⚠ WARNING

Escaping propane vapor can freeze skin tissue causing frost bite.

STORAGE OF CM402

⚠ CAUTION

Do not store the CM 402 unit indoors with the propane cylinder installed. Remove the cylinder and store outdoors as indicated below.

The CM 402 may be stored safely in any enclosed area provided it does not block access to any building fire safety equipment, or block any area intended for the safe egress of people.

⚠ WARNING

Do not store the unit in an area that may experience freezing temperatures unless the "freeze guard" procedure has been done prior to placing the unit in storage.

STORAGE OF PROPANE CYLINDERS

Propane cylinders shall not be stored inside buildings frequented by the public.

Storage outdoors shall be in compliance with NFPA 58 5-4. In brief this states that portable containers shall be a minimum of 5 feet from doorways, windows, property lines, busy thoroughfares and sidewalks. The containers must be protected by industrial fencing or in a ventilated metal locker or rack that prevents tampering with valves and pilferage of the cylinders. The location must also be protected from vehicular impact.

Storage locations are also required to have a fire extinguisher installed, with a minimum capacity of 18 lb. dry chemical with a B:C rating.

TRANSPORTATION OF PROPANE CYLINDERS

Vehicular Transport:

Containers must be determined to be leak-free before loading into a vehicle.

Cylinders must be DOT approved.

The vehicle in which propane cylinders are transported must comply with the following:

> "The cargo space of the vehicle shall be isolated from the driver's compartment, the engine, and its exhaust system. Open-bodied vehicles shall be considered to be in compliance with this provision. Closed-bodied vehicles having separate cargo, driver's, and engine compartments shall also be considered to be in compliance with this provision.
>
> "*Exception: Closed-bodied vehicles such as passenger cars, vans, and station wagons shall not be used for transporting more than 215 lb (98 kg) water capacity [nominal 90 lb (41 kg) LP-Gas capacity] but not more than 108 lb (49 kg) water capacity [nominal 45 lb (20 kg) LP-Gas capacity] per container (see 6-2.2.6 and 6-2.2.7), unless the driver's and engine compartments are separated from the cargo space by a vapor tight partition which contains no means of access to the cargo space.*" (NFPA 58 6-2.2.5)

Transport Inside Buildings:

> "Transportation (movements) of containers within a building shall comply with the following:
>
> (b) Valve outlets on containers having water capacities greater than 2 ½ lb...shall be tightly plugged.
>
> (c) Only emergency stairways not generally used by the public shall be used, and reasonable precautions shall be taken to prevent the containers from falling down the stairs.

(d) Freight or passenger elevators shall be permitted to be used when occupied only by those engaged in moving the container." (NFPA 58 3-4.2.7)

"**Buildings Undergoing Minor Renovation When Frequented by the Public.** Containers shall be permitted to be used and transported for repair or minor renovation in buildings frequented by the public as follows:

(a) During the hours of the day the public normally is in the building the following shall apply:

(1) The maximum water capacity of individual containers shall be 50 lb..., and the number of containers in the building shall not exceed the number of workers assigned to using the LP-Gas.

(2) Containers having a water capacity greater than 2.7 lb [and filled with no more than 16.8 oz LP-Gas (*empty*)] shall not be left unattended.

(b) During the hours of the day when the building is not open to the public, containers shall be permitted to be used and transported in the building for repair or minor renovation...provided, however, that containers with a greater water capacity than 2.7 lb [and filled with no more than 16.8 oz LP-Gas (*empty*)] shall not be left unattended." (NFPA 58 3-4.4)

PROPANE CAUTIONS

⚠ WARNING

Prior to machine start up, check the fuel tank, hoses and fuel lines for leaks.

⚠ WARNING

Always operate the machine in a well ventilated area.

⚠ WARNING

When the equipment is not in use remove the propane tank and store outside in an appropriate outdoor area. Do not store propane tanks indoors.

⚠ WARNING

Remove the propane tank from the equipment before refueling.

⚠ CAUTION

Do not fill propane container(s) to more than 80% capacity.

⚠ CAUTION

Propane cylinders must be stored in accordance with the National Fire Protection Association standard 58 chapter 5.

⚠ CAUTION

Transportation of portable propane cylinders must be in accordance with National Fire Protection Association standard 58 chapters 3 and 6.

⚠ WARNING

Carpet cleaning equipment should only be used by fully trained machine technicians.

⚠ CAUTION

Freezing this equipment can be costly. Take all necessary precautions to protect this equipment from freezing temperatures.

⚠ WARNING

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

⚠ WARNING

It is unsafe to smoke in the vicinity of this equipment.

⚠ WARNING

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

⚠ WARNING

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

WARNING

Escaping propane vapor can freeze skin tissue causing frost bite.

WARNING

Propane vapor is heavier than air and will collect in the lowest confined space in the event of a leak.

WARNING

Propane smell... If you smell gas:

a) Extinguish any open flames, pilot lights, and all smoking materials.

b) Do not touch electrical switches.

c) Shut off the gas supply at the tank valve.

d) Open doors and other ventilating openings.

e) Leave the area until odor clears.

f) Have the gas system checked and leakage source corrected before using again.

WARNING

All propane fuel system connections shall be checked periodically for leaks with soapy water or equivalent.

WARNING

Never use a match or flame to check for leaks.

WARNING

Propane container valves shall be closed when equipment is not in use and while transporting.

WARNING

Propane containers may only be filled by qualified persons.

⚠ WARNING

Always follow the engine manufacturers recommendations for proper engine maintenance and operation.

CAUTION

The owner of a propane carpet cleaning machine shall ensure that the technician has participated in a training course on the safe handling of propane and the proper operation of the equipment.

⚠ CAUTION

This unit weighs over 350 pounds. Care must be used when transporting this equipment. **Do not** try to lift the equipment!

ADVANTAGES OF TWO-STAGE REGULATION

Reduced Freeze-Up Problems–According to national code, a two-stage regulator must be used on RV's. A two-stage regulator greatly reduces the possibility of freeze-ups.

Improved Regulation–The second stage regulator receives a relatively uniform pressure from the first stage regulator. This helps the second stage regulator to maintain appliance pressure at a nearly constant 11" W.C.

BASIC FACTS ABOUT LP-GAS*

Pounds per gallon	4.24
Specific gravity of gas	1.50
Specific gravity of liquid	.504
Cu. ft. gas per gallon liquid	36.38
Cu. ft. gas per pound	8.66
BTU per gallon	91,502
BTU per pound	21,548
Dew point in degrees F	-44
Vapor pressure at 0º F	31
Vapor pressure at 70º F	127
Vapor pressure at 100º F	196
Vapor pressure at 110º F	230

In cold climates, in order to keep vaporization of LP-gas at the highest level, keep the fuel levels above 50%.

AVERAGE LP-GAS CAPACITIES IN CYLINDERS

# CAPACITY	GALLON CAPACITY	BTU CAPACITY
5	1.18	107,903
10	2.36	215,807
11	2.59	237,387
20	4.72	431,613
30	7.08	647,420
40	9.43	863,226

The above capacities allow for the 20% vapor space on each cylinder.

CONVERSIONS

Gallons to Liters (1 gallon = 3.785 liters)

Fº to Cº (Fº = 9/5 Cº + 32º)

11" Water Column = 6-1/4 ozs. per sq. in pressure

27.7" Water Column = 1 pound per sq. in. pressure

*Data from NFPA (National Fire Prevention Association) Pamphlet #58-1998

NOTE: This pamphlet is not meant to be a complete guide to the use of propane cylinders and appliances.

Call or write Manchester Tank for additional copies of this brochure– available at no charge. Or, download from our website at www.mantank.com

Part #S 33108; Rev. 1/98

SOME BASIC PRACTICES TO ENSURE SAFETY AND TROUBLE-FREE USE

Practice safety at all times. If you have questions about the operation of your appliance or LP-gas systems, contact your local LP-gas dealer.

1. Never allow your LP-gas container to be filled above the maximum safe level as indicated by a scale or the fixed liquid level gauge (outage). Do not use the visible gauge for filling.
2. Do not use a wrench or pliers to close the service valve or fixed liquid level gauge. These valves are designed to be closed leak-tight by hand or screwdriver as appropriate. If wrenches are necessary to stop a leak, the valve needs repair or replacement.
3. When tightening the POL Nut (left hand thread) on the service valve, draw it up snug with a proper wrench. This is a machined male brass fitting which seats securely against a female seat in the POL valve–no pipe dope is necessary. Acme/Type 1 valves have right handed threads which are secure when hand tight, and on the Quick Disconnect/Type 2 Valves, the male connection is inserted into the female connection on the cylinder valve. (No wrenches required for both the Acme and the Quick Disconnect.)
4. When using container, slowly open service valve all the way. Listen to the regulator. A continuous hiss may indicate a leak or an open valve on an appliance.
5. Check all tank and the line connections periodically to be sure they are tight. When testing for leaks, use approved leak detector solution–not matches.
6. Make certain your container is properly fastened in place.
7. Turn container with open part of container guard towards trailer (travel trailer installation). This protects valves and regulator against flying rocks and mud. Transport container in the proper position in which it is used, with the valves closed and POL Plugs inserted for POL Valves, or Dust Caps for Acme Valves. Secure the tank against falling or rolling.
8. Check for leaks after connecting. Apply approved leak detector solution to connection, turn off all burners and pilots, and open service valve. Leaks will be detected by the growth of the bubbles. If bubbles grow, tighten or repair the connection as needed. Repeat leak test until problem is corrected.
9. LP-gas is non-corrosive, you need not worry about the inside of your container. However, the outside should be kept free from rust by a periodic coat of paint in a light reflective color. It is very important to inspect and maintain the bottom and footring on the container.
10. Do not store LP-gas containers indoors or in enclosed areas. Do not expose LP-gas container to heat. Always store with service valve closed and plugged as required.
11. Do not attempt to repair any containers, container valves, regulators or appliances by yourself. Use only trained, certified LP-gas service personnel to perform repairs.

HELPFUL HINTS on LP-GAS and LP-GAS CONTAINERS

Millions enjoy using the world's most versatile fuel, but we should always remember to follow all the important safety warnings and product instructions.

This pamphlet is designed by Manchester Tank to answer some questions you may have. If you need additional information or clarification, please feel free to call us.

Customer safety is and will always remain our number one priority at Manchester Tank.

LP-GAS (liquid petroleum gas, or propane)

is a true gas compressed into liquid form for easy transportation and storage. It is also known as propane or bottled gas. LP-Gas is safe and economical, and because of its portability, provides modern living convenience no matter where you travel.

LP Gas is flammable, is always contained under pressure, and the liquid *can* freeze skin. Therefore, in the interest of safety, it is important to understand the basic facts about LP-gas and LP-gas containers.

Federal DOT (Department of Transportation) regulations require periodic inspections and requalifications of cylinders.

DO NOT USE damaged or rusted tanks.

MANCHESTER TANK

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Brentwood, TN 37027

www.mantank.com

PROPANE
EXCEPTIONAL ENERGY™

CAUTION
USE LP-GAS CONTAINERS IN PROPER POSITION

Most LP-gas appliances for cooking, heating, lighting, water heating and refrigeration are designed to operate on LP-gas vapor only. Therefore, all LP-gas containers designed for vapor service must be transported, installed and used in the proper position. Do not transport, install or use a vertical cylinder in a horizontal or upside down position. Proper care must be taken to position a horizontal container in the correct position for vapor withdrawal. Liquid LP-gas could enter the system designed for vapor only, possibly creating a hazardous condition.

Always use a POL plug installed on a POL valve or a dust cap on an ACME/Type 1 valve when transporting or storing disconnected containers (full or empty).

Manchester LP-gas containers are permanently marked with "top" stamped on the tab welded to the tank or "arrows must point up" stamped in the guard or bracket to identify the proper position.

All LP-gas containers must be securely attached in the proper position for intended use.

FILLING YOUR LP-GAS CONTAINER

Only qualified persons should fill your LP-Gas containers.

CAUTION: OVERFILLING IS HAZARDOUS! Do not allow your LP-gas container to be overfilled. Stop filling when liquid appears at the fixed liquid level gauge. Bleed off excess propane in a safe area. Most LP-gas containers are equipped with a fixed liquid level gauge which contacts the liquid level at 80% of container capacity, allowing 20% for expansion. LP-gas containers not equipped with a fixed liquid level gauge can only be filled by weight.

LP-gas containers must not be filled over 80% of total capacity. Propane expands approximately 1.5% for each 10° F temperature rise. Pumps do not stop filling "automatically." Pumps "by-pass" when containers are dangerously filled to total capacity. If overfilled, excessive pressure could develop within the container causing the relief valve to open, relieving excess pressure. LP-gas released through the relief valve is flammable.

The fixed liquid level gauge is used only to determine safe fill levels and does not indicate lower levels. LP-gas containers are available with visible gauges that monitor the amount of gas in the container at all times, reading from full to empty. Do not use visible gauges for filling.

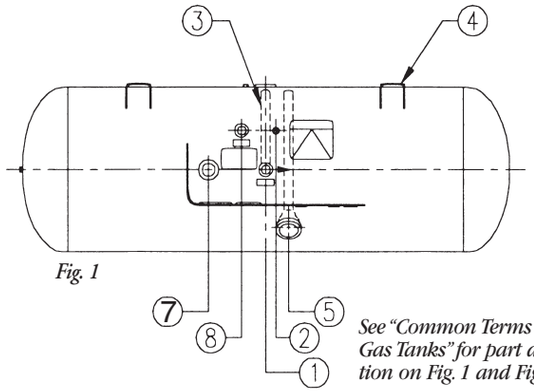


Fig. 1

See "Common Terms of LP-Gas Tanks" for part description on Fig. 1 and Fig. 2.

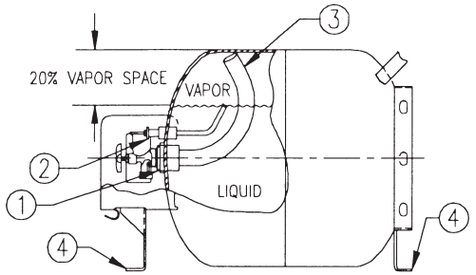


Fig. 2

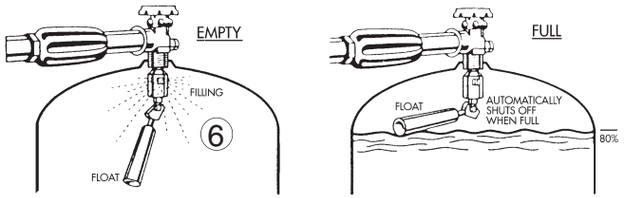


Fig. 3 The OPD Valve helps prevent overfilling of LP-gas in the container.

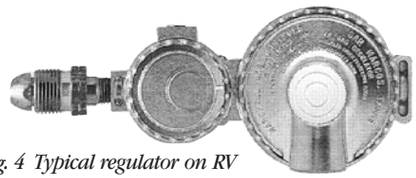


Fig. 4 Typical regulator on RV

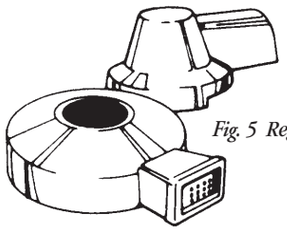


Fig. 5 Regulator Cover

PURGING OF AIR FROM LP-GAS CONTAINERS

Air in LP-gas containers is a contaminant. Purging is done prior to initial filling to remove the air. If the container is not properly purged, air in the container dilutes the LP-gas vapor. Failure to purge may cause excessive tank pressure, slow filling and poor appliance operation of Automatic Stop Fill valve. Appliances then require constant adjustment and pilot lights won't stay lit. This condition would exist until all air is depleted, leaving pure LP-gas vapor.

Have your LP-gas container purged. It only takes a few minutes and your LP-gas dealer is equipped to perform this service. See NPGA bulletin 133(a).

COMMON TERMS OF LP-GAS TANKS

1. POL, ACME and QUICK DISCONNECT VALVES–Types of vapor withdrawal service valves.
2. Fixed Liquid Level Gauge. Clear vapor less than 80%; white mist 80% or above.
3. Vapor Withdrawal Tube–Used on tanks where service valve is not located on top of tank.
4. Base ring, stand legs, or mounting brackets.
5. Relief Valve–discharges LP-gas if the pressure in the container is too high. If LP-gas is discharging, call the Fire Dept. and get away from the container.
6. OPD–or Overfill Prevention Device is a valve designed to assist LP-gas fillers to fill the cylinders to safe levels of propane.
7. Automatic Stop Fill Valve–with 1-3/4" ACME
8. Visible Sight Gauge–Available with remote sender.

DOT AND ASME TANKS

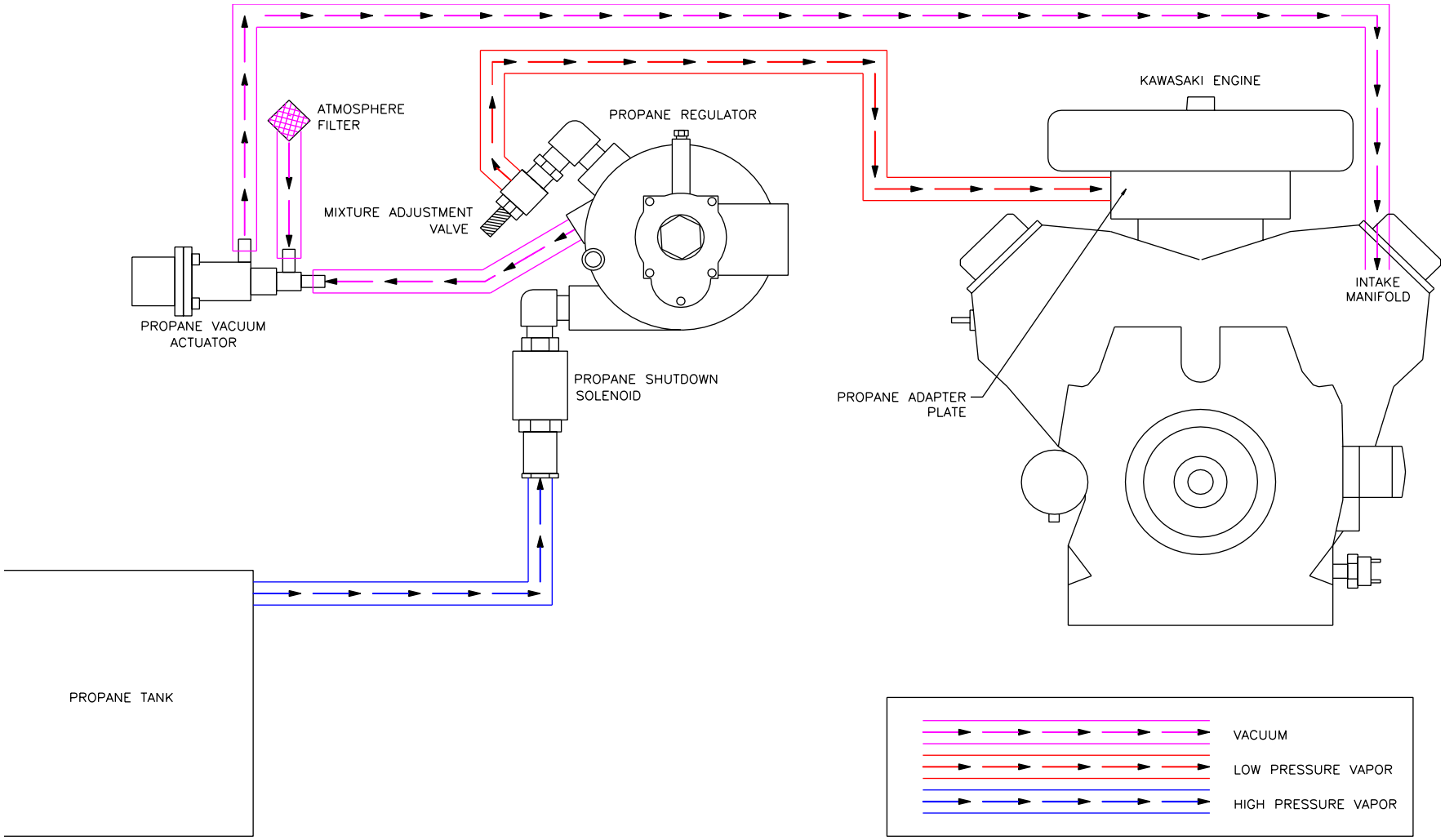
Generally speaking, LP-gas tanks are built to the specifications of either the ASME or DOT pressure safety codes.

Basically, the difference between the two codes is that valves, fittings and brackets may be located on the ends only on DOT cylinders, while on the ASME tanks they may be located on ends as well as sides. These tanks are required to be rated in gallons (ASME) or pounds (DOT) water capacity. Manchester production and testing methods are the most modern available to assure top quality. All valves and fittings on Manchester cylinders are listed by UL.

LP GAS REGULATORS (See Fig. 4)

LP-gas regulators reduce the pressure of LP-gas vapor from tank pressure to 6-1/4 oz. or 11" W.C. for use at the appliances. The regulator is the heart of the LP-gas system. Care should be taken to protect it from the elements which could cause it to malfunction. Your LP-gas system should be kept free of moisture which could cause regulator freeze-up. A good regulator enclosure will protect your regulator. (See Fig. 5) CAUTION–ALWAYS BE SURE THAT THE REGULATOR VENT IS POINTING DOWN WITHIN 45 DEGREES.

Figure 4-1 Propane Flow Diagram
5300-Rev0



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Carbon Monoxide Detector

CleanMaster 402
Section 5-1

CARBON MONOXIDE DETECTOR

Carbon monoxide (CO) is invisible, odorless, tasteless and non-irritating—completely undetectable to your five senses. That's why it's so important to your safety that you have a carbon monoxide detector. But, how do you know what to do if your detector alarms?

You have to *learn* what to do, because your five senses won't tell you. Familiarize yourself with the facts about carbon monoxide, how your new detector works, and what to do if it alarms.

HOW THE DETECTOR DETERMINES WHEN TO ALARM

Your detector uses advanced technology to monitor the environment and warn you of unacceptable levels of carbon monoxide. An internal microcomputer works together with the carbon monoxide sensor inside the detector to determine the levels of carbon monoxide in the air and to calculate the rate that CO would be absorbed into the human body.

The microcomputer is calibrated to trigger the detector's alarm before most people would experience any symptoms of carbon monoxide poisoning. Because carbon monoxide is a cumulative poison, long-term exposures to low levels can cause symptoms, as well as short-term exposures to high levels. Your detector has a **time weighted alarm**, so the higher the level of carbon monoxide present, the sooner the alarm will be triggered.

This detector meets the alarm response time requirements of UL Standard 2034 which are as follows:
At 70 ppm, the detector must alarm within 90 minutes.
At 200 ppm, the detector must alarm within 30 minutes.
At 400 ppm, the detector must alarm within 15 minutes.

HOW TO TEST YOUR DETECTOR

There are two aspects of the detector's operation that can be tested; the electronics and the sensor response. Instructions on testing each are outlined on the following pages.

TESTING THE ELECTRONICS

You should test the detector once a week, following the directions listed below. If at any time you test the detector and it does not perform as described below, have it replaced immediately.

Observe the detector weekly to make sure the green dot is illuminated, indicating normal operation. If the dot is not illuminated, check the power supply. If the monitor has power it may be malfunctioning.

To test the detector, press the Test/Reset button and hold it down for 10 to 15 seconds. If the detector is operating properly, you should notice the following:

> *After holding the test button for 10 to 15 seconds, a loud, constant* alarm will sound. (**Note**: the 85 decibel alarm is quite loud at close range and could cause hearing loss after prolonged exposure. When you test the detector, we advise you to place your finger over the sounder opening in the upper center of the detector.)
>
> **NOTE**: Pressing the Test/Reset button tests the functions of the detector's internal components, circuitry and micro-computer.

You do not need to press the test button to take a co reading.

TESTING THE SENSOR RESPONSE

While it is not required, on occasion you may wish to observe and become familiar with your detector's response in the actual presence of carbon monoxide. The best and safest way to do this is with either a cigarette or an incense stick. To perform this test you will need: your detector (that has been powered up for at least two hours), matches or a butane lighter, an ashtray, and either a cigarette or an incense stick.

WARNING: This test should be done by adults only. Children should be warned never to light matches or butane lighters. Please use caution when performing the test described below. Avoid burns from flame or hot materials. Avoid inhaling excessive smoke from the cigarette or incense stick. Extinguish all flames and properly discard all hot materials.

Step 1. With a match or a lighter, light a single cigarette or incense stick. Extinguish the match or lighter. Make sure an ashtray is available to discard ashes, matches and the burned cigarette or incense stick.

Step 2. Hold the smoldering cigarette or incense stick 12 - 15 inches directly *below* the bottom air vents of the CO detector, making sure the stream of smoke rises into the vents.

Step 3. Continue holding the cigarette or incense stick directly below the detector for 3 - 5 minutes. This time is needed as the detector samples the air every 2½ minutes. **Note**: Do not hold the cigarette or incense stick closer than 12 inches to the detector as smoke *will* cause a yellow stain to develop on the detector's outer case.

Step 4. If the reading is greater than 600 ppm, the detector will alarm in about five minutes.

Step 5. If your detector alarms, you can silence it by pressing Test/Reset button.

Step 6. Extinguish the cigarette or incense stick by pressing the smoldering tip into the ashtray.

HOW TO KNOW IF YOUR DETECTOR IS MALFUNCTIONING

Your detector performs an internal self-diagnosis every two and a half minutes to make sure that it is functioning properly. The detector is designed to alert you in the unusual event of a malfunction.

IF THE DETECTOR MALFUNCTIONS

In the rare event that your detector malfunctions, it will alert you with an alarm and shut the machine off.

WHAT TO DO IF YOU'RE NOT SURE

Please familiarize yourself with the malfunction alert, and do not confuse these signals with an alarm.

If your detector sounder is beeping, and you are not sure if it is a CO alarm or malfunction alert, reset the alarm, open windows for ventilation, turn off fuel-burning appliances (like kerosene or oil heaters, furnaces, gas ranges, wood-burning stoves, water heaters, or other fossil-fuel burning appliances). For furnaces, you can simply turn down the thermostat to its lowest setting. Open windows and doors for ventilation.

Before you call a qualified technician (such as a licensed heating contractor, utility service technician, chimney sweep or fuel provider) to check your residence for CO, remember that you will probably be charged for a service call.

Never ignore a CO detector alarm. A true alarm is an indication of potentially dangerous levels of carbon monoxide. CO detectors are designed to alert you to the presence of carbon monoxide before an emergency, before most people would experience symptoms of carbon monoxide poisoning, giving you time to resolve the problem calmly.

HOW TO CARE FOR YOUR DETECTOR

To keep your detector in good working order, you must follow these simple steps:

DO:

- Test the detector once a week by pressing the Test/Reset button.
- Vacuum the detector cover once a month to remove accumulated dust. Use the soft brush attachment of your vacuum cleaner, and unplug the detector from the electrical outlet before vacuuming.
- Instruct children never to touch, unplug or otherwise interfere with the detector.Warn children of the dangers of CO poisoning.

DON'T:

- Never use detergents or solvents to clean the detector. Chemicals can permanently damage or temporarily contaminate the sensor.
- Avoid spraying air fresheners, hair spray, paint or other aerosols near the detector.
- Do not paint the detector. Paint will seal the vents and interfere with proper sensor operation.

Note: If you will be staining or stripping wood floors or furniture, painting, wall-papering, or using aerosols or adhesives for a do-it-yourself project or hobby, **before you begin, remove the detector to a remote location to prevent possible damage to or contamination of the sensor**. You may wish to store the detector in a plastic bag during the project.

The following is a list of substances that at high levels can affect the sensor:
Methane, propane, iso-butane, ethylene, ethanol, alcohol, iso-propanol, benzene, toluene, ethyl acetate, hydrogen, hydrogen sulfide, sulfur dioxides.

Also most **aerosol sprays, alcohol based products, paints, thinners, solvents, adhesives, hair sprays, after shaves, perfumes, auto exhaust** (cold start) and some cleaning agents.

UNDERSTAND THE EFFECTS OF CARBON MONOXIDE EXPOSURE

Low Levels**:**
Generally 35 ppm and below.

Mid Levels**:**
Generally 35 ppm to 100 ppm.

High Levels**:**
Generally 100 ppm and above if no one is experiencing symptoms.

Dangerous Levels**:**
Generally 100 ppm and above if someone is experiencing symptoms.

Concentration of CO in Air (ppm=parts per million)	**Approximate Inhalation Time and Symptoms Developed**
50 ppm	The maximum allowable concentration for continuous exposure for healthy adults in any 8-hour period, according to OSHA.
200 ppm	Slight headache, fatigue, dizziness, nausea after 2-3 hours.
400 ppm	Frontal headaches within 1-2 hours, life threatening after 3 hours.
800 ppm	Dizziness, nausea and convulsions within 45 minutes. Unconsciousness within 2 hours. Death within 2-3 hours.
1,600 ppm	Headache, dizziness and nausea within 20 minutes. Death within 1 hour.
3,200 ppm	Headache, dizziness and nausea within 5-10 minutes. Death within 25-30 minutes.
6,400 ppm	Headache, dizziness and nausea within 1-2 minutes. Death within 5-10 minutes.
12,800 ppm	Death within 1-3 minutes.

WHAT TO DO WHEN THE ALARM SOUNDS

Determine if anyone in the building is experiencing symptoms of CO poisoning. The following symptoms are related to CARBON MONOXIDE POISONING and should be discussed with ALL members in the building:

Common Mild Exposure Symptoms:
Slight headache, nausea, vomiting, fatigue ("flu-like" symptoms).
Common Medium Exposure Symptoms:
Throbbing headache, drowsiness, confusion, fast heart rate.
Common Extreme Exposure Symptoms:
Convulsions, unconsciousness, heart and lung failure.
It can cause brain damage and death.

If you experience even mild symptoms of CO poisoning, consult your doctor immediately!
WARNING: Actuation of this device indicates the presence of carbon monoxide (CO) which can be fatal.

ALARM

Unit detects 70 ppm or above and someone is experiencing symptoms of CO poisoning.

Emergency Procedure:

Follow if you suspect Co and anyone is experiencing symptoms of CO poisoning:
Gather your crew and other members of the work site together and immediately evacuate the building. This is a potentially life-threatening EMERGENCY situation. Get everyone outside into fresh air. Call 911 or your local fire department from a telephone outside of the building. Do not re-enter the building under any condition until help has arrived and the problem causing the CO has been corrected.

HydraMaster is committed to providing quality carpet cleaning machines and the CM 402 is no exception. Every effort has been made to ensure the technician's safety while operating the propane-powered CM 402. However, unforeseen circumstances or part failures can at times result in problems. Being prepared for these situations can reduce the risk of serious injury.

This information is provided, not in expectation of a crisis, but so that you know what to do in the event of an emergency.

1. Notify appropriate assistance agency (Medical, Police, Fire department, etc.). Alert the agency that propane is involved or suspected to be involved. This will allow them to take appropriate precautions when responding. Cooperate fully with emergency personnel.
2. Notify your local distributor.
3. Your local distributor will notify HydraMaster Corporation.

EMERGENCY PHONE NUMBERS

In the United States, emergency help can be obtained by dialing **911**. However, we suggest that you write in your local emergency numbers below for reference.

Local Fire Department -
Poison Control -
Propane Supplier -

FIRE EXTINGUISHER RECOMMENDATIONS

HydraMaster recommends that a fire extinguisher be carried with the equipment at all times. The NFPA recommends that storage areas containing LP-Gas have a fire extinguisher (minimum capacity of 18 lb. dry chemical and a B:C rate) installed in close proximity.

EMERGENCY PROCEDURES

Follow the steps below for propane leaks and propane fires.

1. Evacuation.
2. Call for assistance.

If you can stop the leak without endangering yourself or others, you can:

1. Identify the source of the propane leak.
2. Shut off the propane, either at the leak point or before the leak point in the system.
3. Move away any ignitable items from the leak area.
4. Put out any fire with a fire extinguisher.

Burns: A liquid propane burn is similar to frostbite. Treat with first aid or seek professional medical attention.

ECD UNIT OPERATION

Your CM 402 carpet cleaning machine is equipped with an emission control device. This unit continually monitors the combustion efficiency of the engine and controls the fuel-to-air ratio to keep the engine running as efficiently as possible.

The ECD unit has an indicator light that allows you to see when it is operating.

PROPANE EMISSION SYSTEM

The CM 402 carpet cleaning system is designed specifically for warehouse operation with a minimum of 10,000 square feet. The CM 402 utilizes a four-layer safety system to ensure the lowest possible emissions. First, a propane engine is used which even by itself would meet all emissions standards. Second, a catalytic converter has been incorporated to reduce the emission level even further. The third level of safety protection is an ECD unit (Emission Control Device). A fourth layer of safety is accomplished by utilizing a carbon monoxide sensor. This sensor continuously measures the air around the unit for carbon monoxide and will turn the unit off if OSHA limits are exceeded. This four-layer safety system is vital to indoor operation.

"THE MACHINE WITH A CONSCIENCE"

The CM 402 knows when it is not operating correctly. It is designed to meet the most stringent of standards. When the machine is manufactured and tuned properly the emission levels are very low. However as the machine operates the air cleaner becomes dirty and the spark plugs begin to deteriorate. This is normal but the result is incomplete combustion of the fuel. Incomplete combustion results in higher emission of toxic substances. Since the technician's safety is vital, toxic emissions must be maintained at their lowest possible levels. In order to accomplish this a unique emission control system combined with a catalytic converter has been utilized. This unit continuously monitors the air-to-fuel ratio of the engine to maintain efficient combustion. If the emission level can not be maintained by the system the machine will be shut off and a warning light illuminated, signaling the technician as to the cause of the shut down.

Freeze Guard

CleanMaster 402
Section 6-1

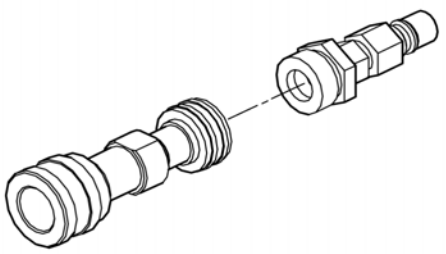
VACUUM FREEZE GUARD PROCEDURE:

To freeze guard your machine:

1. Start the machine.
2. Spray all of the water out of the system until the engine stops.
3. Add a half gallon of 50/50 antifreeze and water mix to the chemical mix tank and draw the antifreeze into the flow meter.

When using the recirculation kit (part no. 078-058), fill a third of the mix tank with a 50/50 antifreeze mix. Verify that the upper float is not lying horizontal,but floats below.

Figure 6-1 Recirculation Fitting



Attach the recirculation fitting provided in the kit to the garden hose quick connect (see Fig. 6-1) and this combination to the front of the machine.

Attach one section of female/female solution hose to the outgoing solution fitting on the front of the machine and the other end to the garden hose and recirculation fitting combination that is attached to the front of the machine(or as many sections as you want, if you wish to freeze guard your hoses).

4. Start the machine. Allow it to run for 2 to 3 minutes.

With the recirculation kit, skip ahead to step 6.

5. Remove the quick connect fitting from the end of the garden hose. Attach the garden hose quick connect to the machine. Using a vacuum hose attached to the recovery tank, vacuum the water out of the garden hose quick connect.

6. Spray the antifreeze and water mix out of the machine and into a container to reclaim the solution. Run the machine until it stops.

   NOTE: The reclaimed antifreeze solution may be used 3 times before being discarded.

   NOTE: **To freeze guard hoses and wand**, perform the above step with all the hoses and wand attached.

The machine is now freeze guarded. Remember to flush antifreeze from the system prior to carpet cleaning.

Recovering Antifreeze For Re-use:

Before cleaning with the machine again, flush the remaining anti-freeze solution from the system into a sealable container so that it may be used again. To do this, spray water through the hoses and wand until all signs of antifreeze are gone.

⚠ CAUTION

One manufacturer of antifreeze cautions: **"WHEN DISPOSING OF USED ANTIFREEZE COOLANT:** Follow local laws and regulations. If required, dispose at facilities licensed to accept household hazardous waste. If permitted, dispose in sanitary sewer systems. Do not discard into storm sewers, septic systems, or onto the ground."

⚠ WARNING

This warning appears on the label of one brand of antifreeze: **"HARMFUL OR FATAL IF SWALLOWED.** Do not drink antifreeze coolant or solution. If swallowed, induce vomiting immediately. Call a physician. Contains Ethylene Glycol which caused birth defects in animal studies. Do not store in open or unlabeled containers.

"KEEP OUT OF REACH OF CHILDREN AND ANIMALS."

FREEZE PROTECTION OF THE PUMP-IN SYSTEM

1. Drain the fresh water tank.
2. Remove the garden hose adapter from the pump-in pump hose and position the hose so it is pointing outside the van.
3. Turn on the pump-in pump and run for 1-2 minutes till all the water is purged from the hose.

NOTE: The next time the unit is used it may take a few minutes before the mix tank begins to fill.

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Water and Chemical System

CleanMaster 402
Section 7-1

This high pressure chemical system has been designed to be simple and trouble free.

WATER AND CHEMICAL FLOW OPERATION

The chemical pump draws the chemical from the inlet filter which is in the chemical container. It flows through the flow meter indicating the GPH's of chemical being used. The chemical then flows through the chemical pump to the chemical selector valve. The chemical valve can be used to prime the pump (evacuate air from the system), inject chemical into the system or turn the chemical flow off. In the "ON" position, chemical flows through the metering valve, and is injected into the heated water path just prior to its leaving the machine.

The low water float switch in the water box, is a safety switch that is designed to protect your system from sudden or unexpected loss of water supply. If, for example, the water source at the house were turned off, the water level of the water box would drop, activating the low water float switch, which automatically disengages the system and prevents the water pump from running dry.

The desired chemical injection ratio may be obtained by an adjustment of the chemical flowmeter during the spraying of water through the cleaning tool.

BEFORE CLEANING BEGINS:

1. Turn the Chemical Selector Valve to the "PRIME" position to purge any air from the system. If the chemical does not begin to flow through the flowmeter within 60 seconds, remove the Chemical PRIME Line (the one without the filter) from the chemical container and insert it into the vacuum hose connection at the front of the machine.

BEFORE CLEANING BEGINS (cont.):

2. When the chemical begins to flow through the flowmeter, with the flow indicator indicating maximum flow and the PRIME line pulsing, turn the Chemical Selector Valve to "ON".

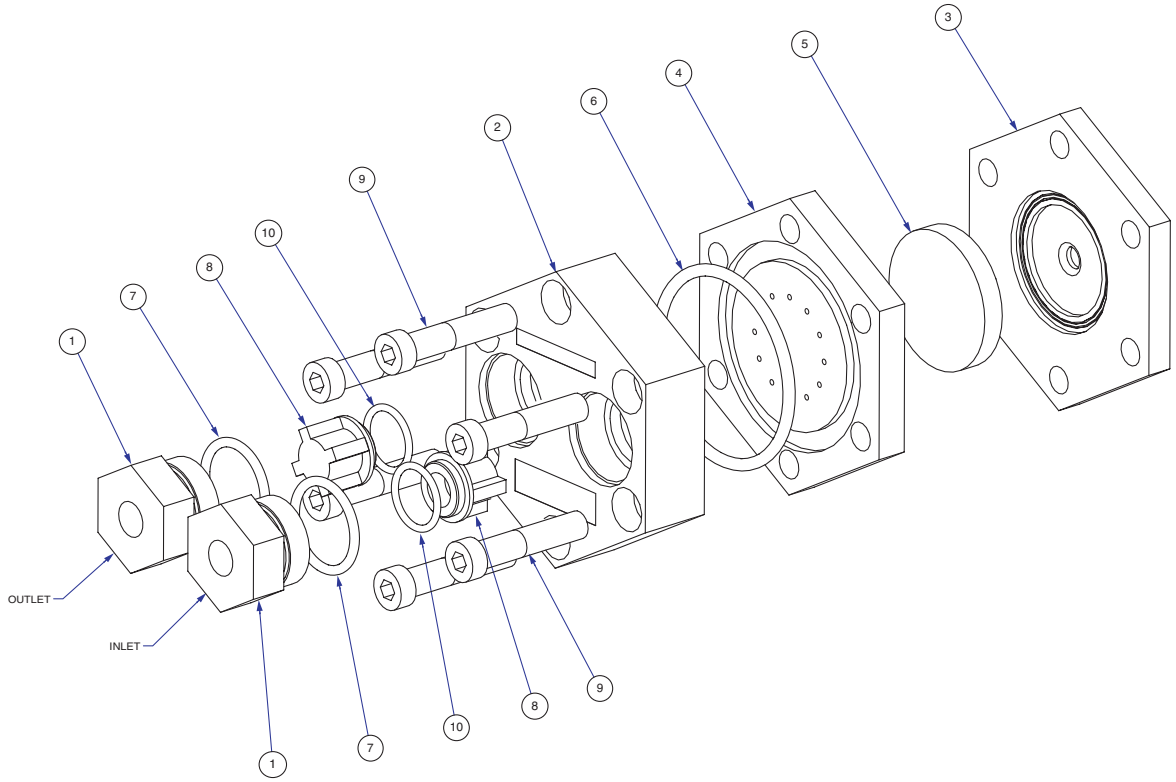
3. Place the Chemical PRIME Line back into the chemical container.

4. While spraying solution from the cleaning tool, adjust the chemical flow by turning the Chemical Adjustment Knob as necessary.

CHEMICAL SYSTEM MAINTENANCE

The chemical lines may need to be flushed with vinegar periodically to prevent abnormal chemical build-up. This flushing may be done by removing the clear plastic hose from the chemical jug and inserting it into a one quart container of vinegar. This should be done with the chemical flowmeter setting 10 GPH. Simply spray water from the wand until the quart of vinegar is exhausted. Then repeat the process with one quart of clear water to void all lines of vinegar.

Figure 7-1 **Chemical Pump Assembly**
C4416 Rev B



Chemical Pump Assembly Parts List

Item	Part Number	Description	Qty
1	000-106-110	Plug, Check Valve - Chemical Pump	2
2	000-064-015	Cover, Chemical Pump	1
3	000-111-030	Body, Chemical Pump	1
4	000-105-071	Mid Plate, Chemical Pump	1
5	000-046-010	Diaphragm, Chemical Pump	1
6	000-097-055	O-Ring, Chemical Pump Midplate An Size -227 Viton	1
7	000-097-056	O-Ring, Check Valve Plug - Chemical Pump	2
8	000-169-155	Valve, Check - Last Step Chemical Injection	2
9	000-143-152	Screw, 5/16"-24UNF x 1.50" Lg. Socket Head	6
10	000-097-054	O-Ring, Chem. Pump Valve Viton-Parker 2-114	2

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Figure 7-1 **Flow Diagram**
D-5297 Rev -

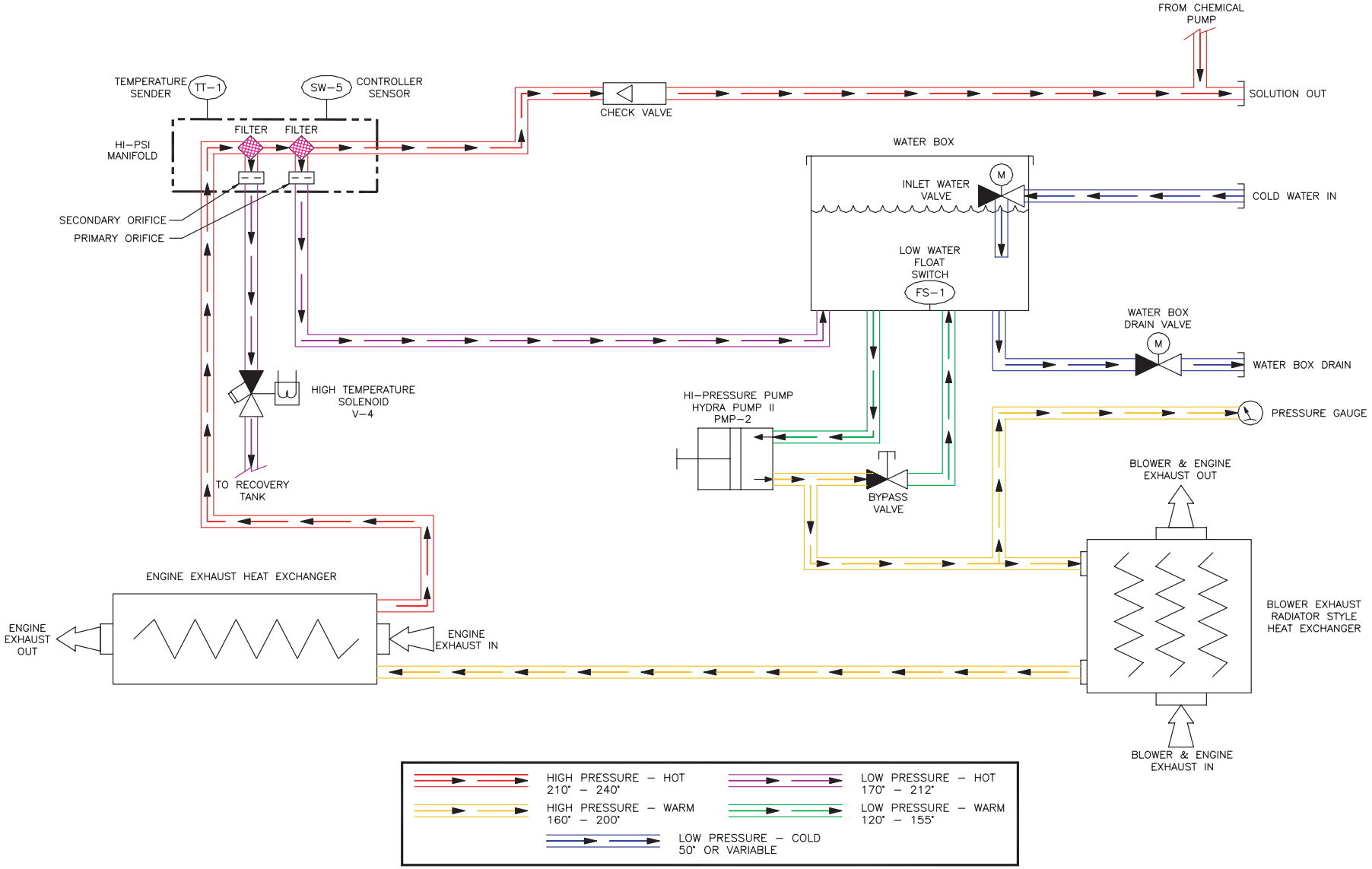


Figure 7-2 **Flow Diagram**
D-5297 Rev -

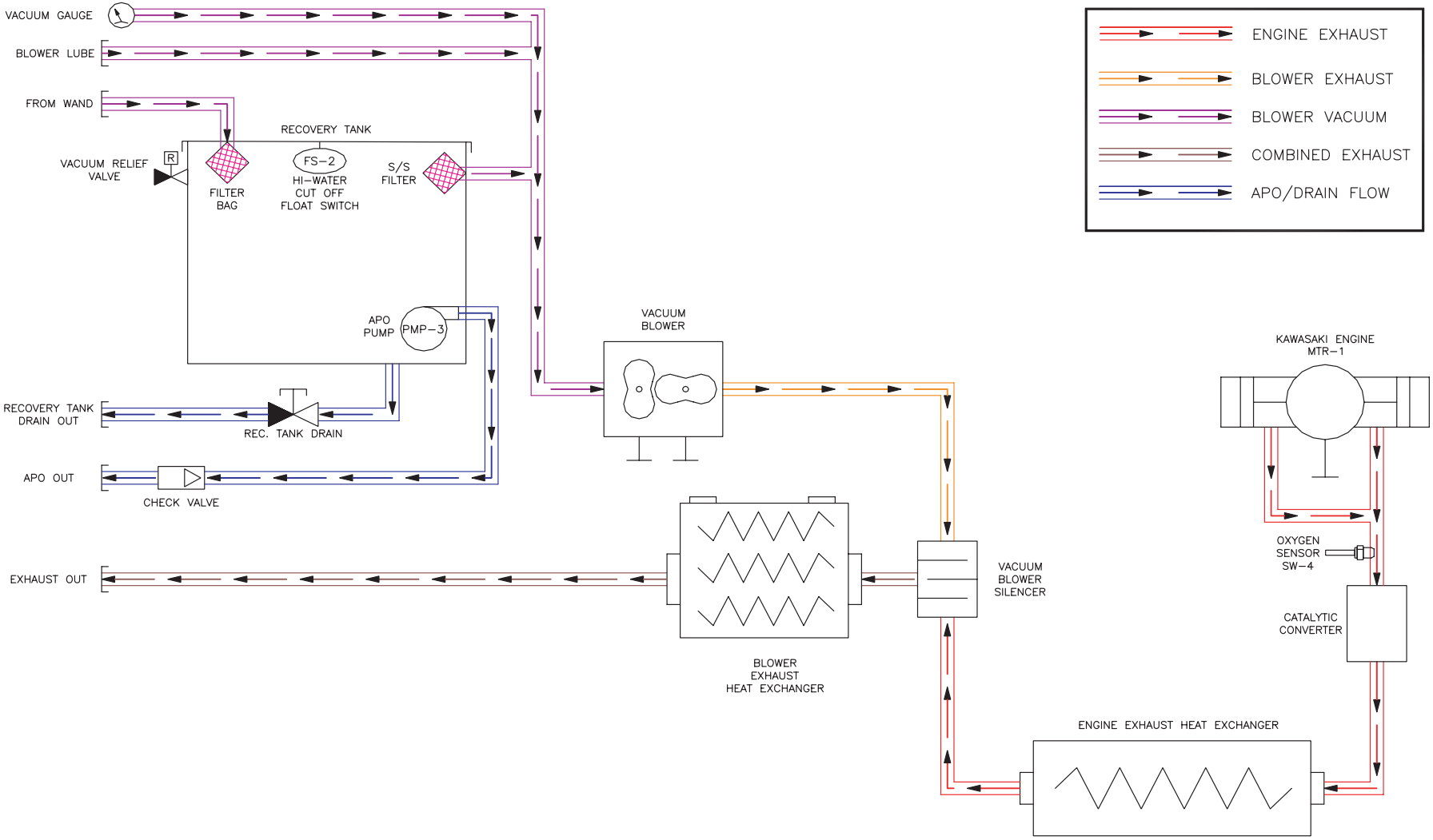
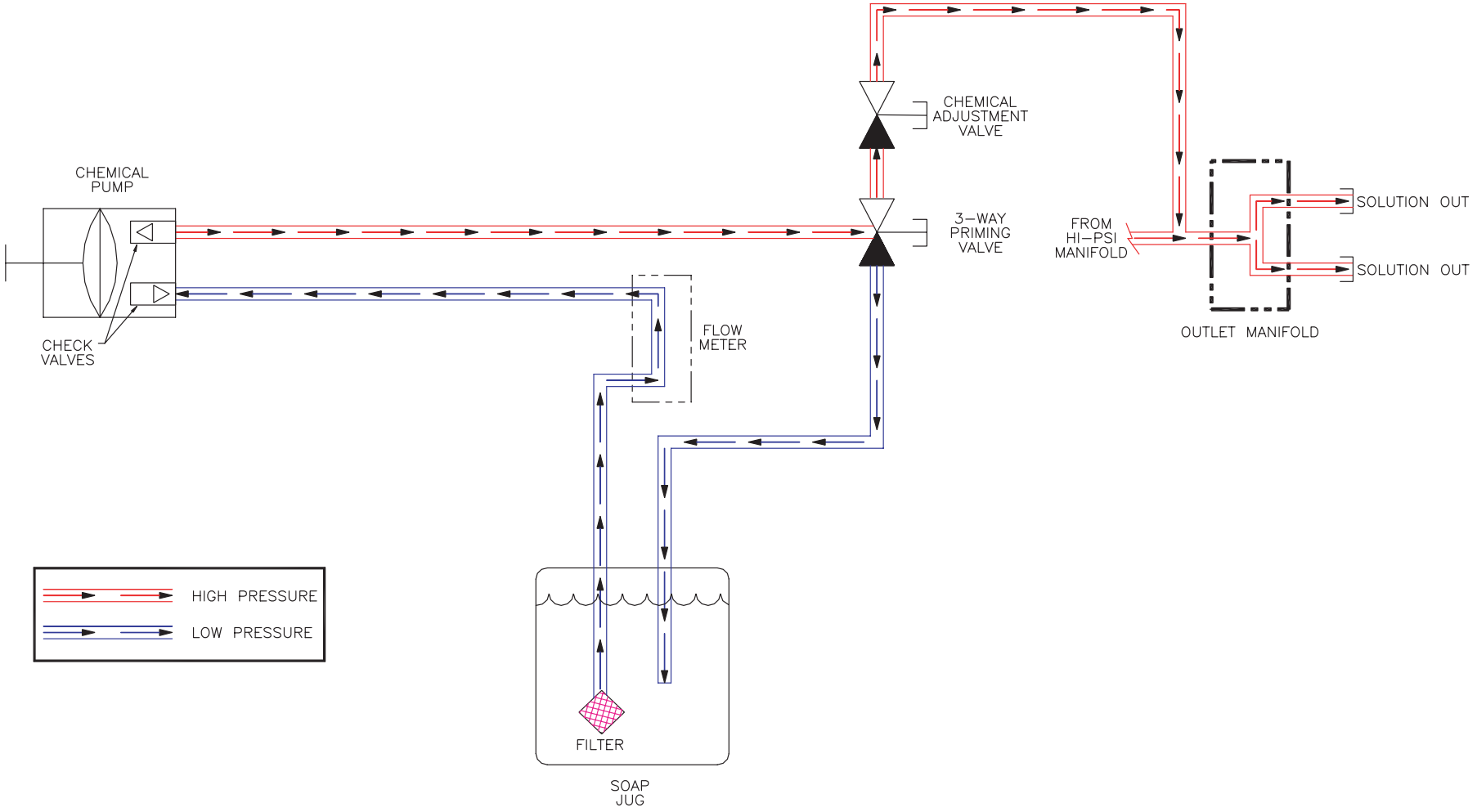


Figure 7-3 **Flow Diagram**
D-5297 Rev -



Chemical Tank Troubleshooting

CleanMaster 402 Water System

1.0. System will not prime

1.1. **Check valves in chemical pump are faulty.** Remove valves and inspect. Clean or replace as necessary.

1.2. **Chemical pump diaphragm is faulty.** Remove and inspect. Replace as necessary.

1.3. **Check valve in high pressure pump (the one that the chemical pump attaches to) is faulty.** Remove valve and inspect. Clean or replace as necessary.

1.4. **Filter on feed line in chemical jug is clogged.** Inspect and clean.

1.5. **Feed line from chemical jug is loose, pinched or cut.** Inspect and repair.

1.6. **Three-way prime valve is faulty.** Inspect valve for leaks between ports. Replace as necessary. *Note: if the chemical system has been run dry, it is frequently necessary to insert the prime hose from the chemical jug into the vacuum inlet for a "boost" to purge all of the air from the system. Machines produced after April, 2001 will have the prime hose connected directly to the vacuum system.*

2.0. Chemical flow is unstable or low

2.1. **Air in lines.** Check that all fittings and connections in the chemical system are tight and in good condition. Repair or replace as necessary.

2.2. **Filter screen in chemical jug is partially clogged.** Inspect and clean.

2.3. **Three-way chemical valve is faulty.** Inspect valve for leaks between ports. Replace as necessary.

2.0. Chemical flow is unstable or low - Continued:

2.4. **Chemical metering valve is faulty or partially obstructed.** Inspect valve and clean or replace as necessary.

2.5. **High-pressure check valve is faulty.** Remove and inspect. Clean or replace as necessary.

3.0. Solution jug fills with water

3.1. **Three-way chemical valve is defective.** inspect valve for leaks between ports. Replace as necessary

3.2. **Inlet check valve in chemical pump is faulty.** Remove and inspect valve. Clean or replace as necessary.

4.0. Chemical in water box

4.1. **Chemical pump diaphragm is faulty.** Remove and inspect. Replace as necessary.

4.2. **High-pressure check valve is faulty.** Remove and inspect. Clean or replace as necessary.

High Pressure Pump -Maintenance

CleanMaster 402
Section 8-1

DAILY

Check the oil level and the condition of the oil. The oil level should be up to the center of the sight glass on the back of the pump.

Use a 30 weight, non-detergent oil.

⚠ CAUTION

If the oil becomes discolored and contaminated, one of the oil seals may be damaged. Refer to the Service Section.

Do not operate the pump if the crankcase has been contaminated with water.

⚠ CAUTION

Do not leave contaminated oil in the pump housing or leave the housing empty. Remove contaminated oil as soon as it is discovered and replace it with clean oil.

PERIODICALLY

Change the oil after the first 100 hours of operation, and every 400 operating hours thereafter. When changing, remove the drain plug on the oil drain center located on the frame so all oil and accumulated sediment will drain out.

⚠ CAUTION

Do not turn the drive shaft while the oil reservoir is empty.

⚠ CAUTION

Protect the pump from freezing.

Service

The next few pages explain how to disassemble and inspect all easily-serviceable parts of the pump.

⚠ CAUTION

Do not disassemble the hydraulic end unless you are a skilled mechanic. For assistance, contact HydraMaster (425-775-7275) or the distributor in your area.

Servicing the Valves (See Figure 6-1)

1. Remove the hex valve plugs;
   top—discharge
   bottom—inlet

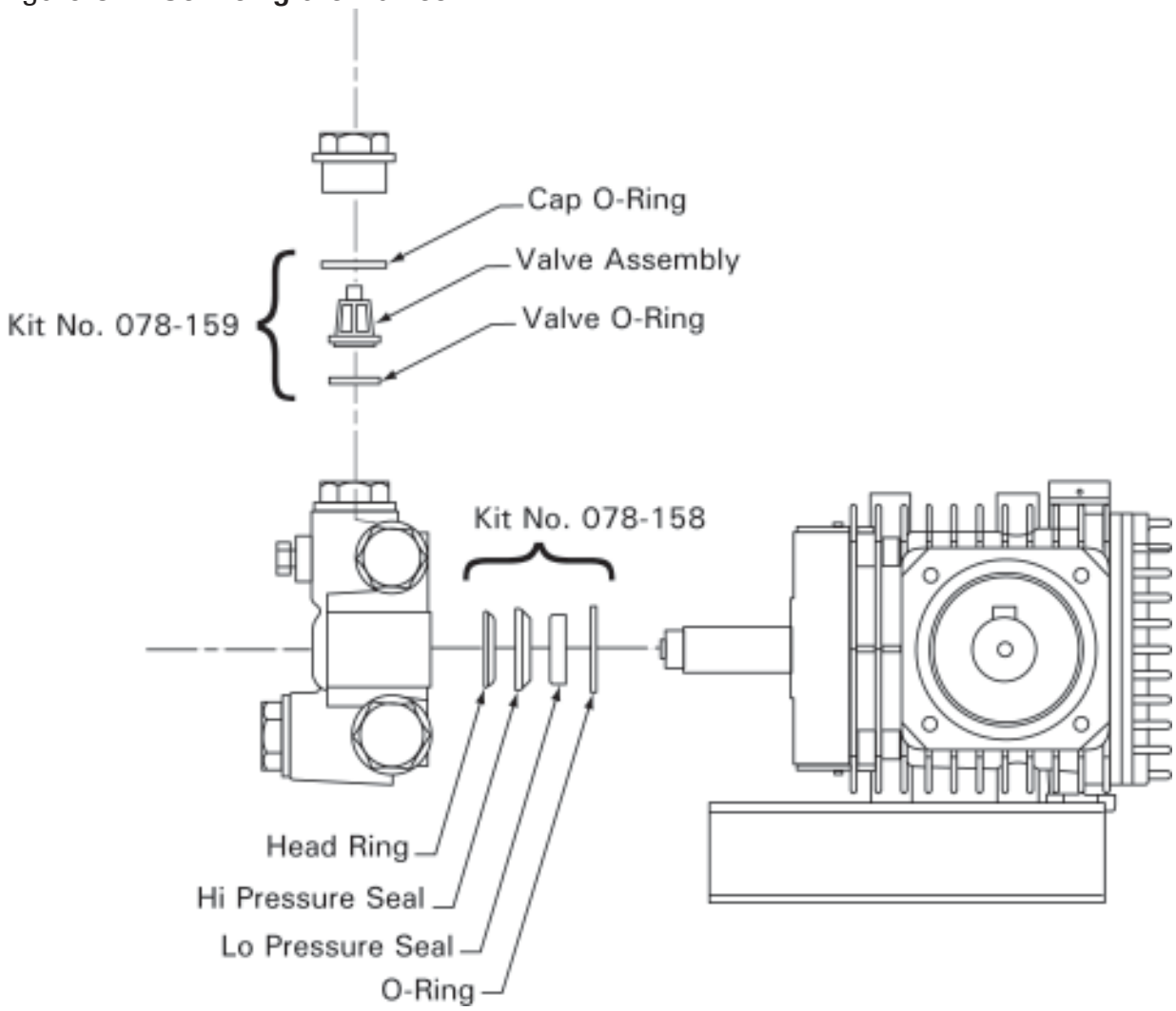
2. Unthread the valve plug and examine the O-ring under the plug for cuts or distortion. Replace it if it is worn. Lubricate new O-rings before installing.

3. Grasp the valve retainer by the tab at the top with needle-nose pliers, then remove the O-ring at the bottom of the valve chamber.

4. Inspect all valve parts for pitting, gouges, or wear. If wear is excessive, replace valve assembly.

5. Reinstall valve assemblies:
   a) Using a clean towel, clean the valve chamber.
   b) Install the O-ring into the high pressure manifold.
   c) Install the valve assemblies into the high pressure manifold (the metal side of the valve faces the manifold).
   d) Replace the O-ring on the hex valve plug.
   e) Torque the plug to 30 foot pounds.

Figure 8-1 **Servicing the Valves**



Removing the High Pressure Manifold

1. Using an M6 allen wrench, remove all eight of the socket head bolts.

2. Rotate the crankshaft by hand to start separation of the manifold head from the crankshaft.

3. Insert two flat-head screwdrivers on opposite sides to further separate the manifold from the crankshaft.

⚠ CAUTION

To avoid damage to either plunger or seal, keep the manifold properly aligned with the ceramic plungers when removing it.

4. Remove the seal retainer from the manifold and inspect for wear.

5. Examine the ceramic plunger for cracks or scoring (refer to *Servicing the Plungers* for replacement).

Servicing the Low Pressure Seals and High Pressure Seals (See Figure 6-1)

1. Remove the low pressure seal from the seal retainer using a 90 degree pick tool.

2. Remove the high pressure seal from the manifold

3. Inspect the low pressure seal and high pressure seal for wear and replace if necessary.

4. Reinstall the low pressure seal into the seal retainers with the garter spring down.

5. Reinstall the high pressure seal:
   a) Lubricate the seal chamber in the manifold.
   b) Carefully square the high pressure seal into position by hand, with the grooved side down (metal back facing out).
   c) Examine the seal retainer's O-ring and replace if worn. Lubricate the new O-ring before installing.
   d) Press the seal retainers into the manifold until completely seated.

Servicing the Plungers

1. Using a hex tool, loosen the plunger retainer about three to four turns. Push the back to separate it from the retainer and finish unthreading the plunger retainer by hand.

2. Unthread the plunger retainer with sealing washer.

3. Remove the ceramic plunger, keyhole washer and barrier slinger from the plunger rod.

Reinstall the Ceramic Plungers:

1. Examine the sealing washer on the plunger retainer and replace it if it is cut or worn. Lubricate the new sealing washer for ease of installation and to avoid damage.

2. Apply Loctite 242™ to the threads of the plunger retainer and press it into the ceramic plunger. Thread 'hand'-tight, then torque the bolt to 4.4 foot pounds.

3. Install the seal retainer with holes to the top and bottom, and forward.

Reinstall High Pressure Manifold

1. Slip the seal retainer over the ceramic plungers with the holes to the top and bottom and forward.

2. Turn the shaft by hand to line up the plungers so that the end plungers are parallel.

3. Lightly lubricate the plungers and carefully slide the manifold head onto the plungers while supporting it from the underside to avoid damaging the plungers.

4. Reinstall the socket head bolts and torque to 4.4 foot pounds.

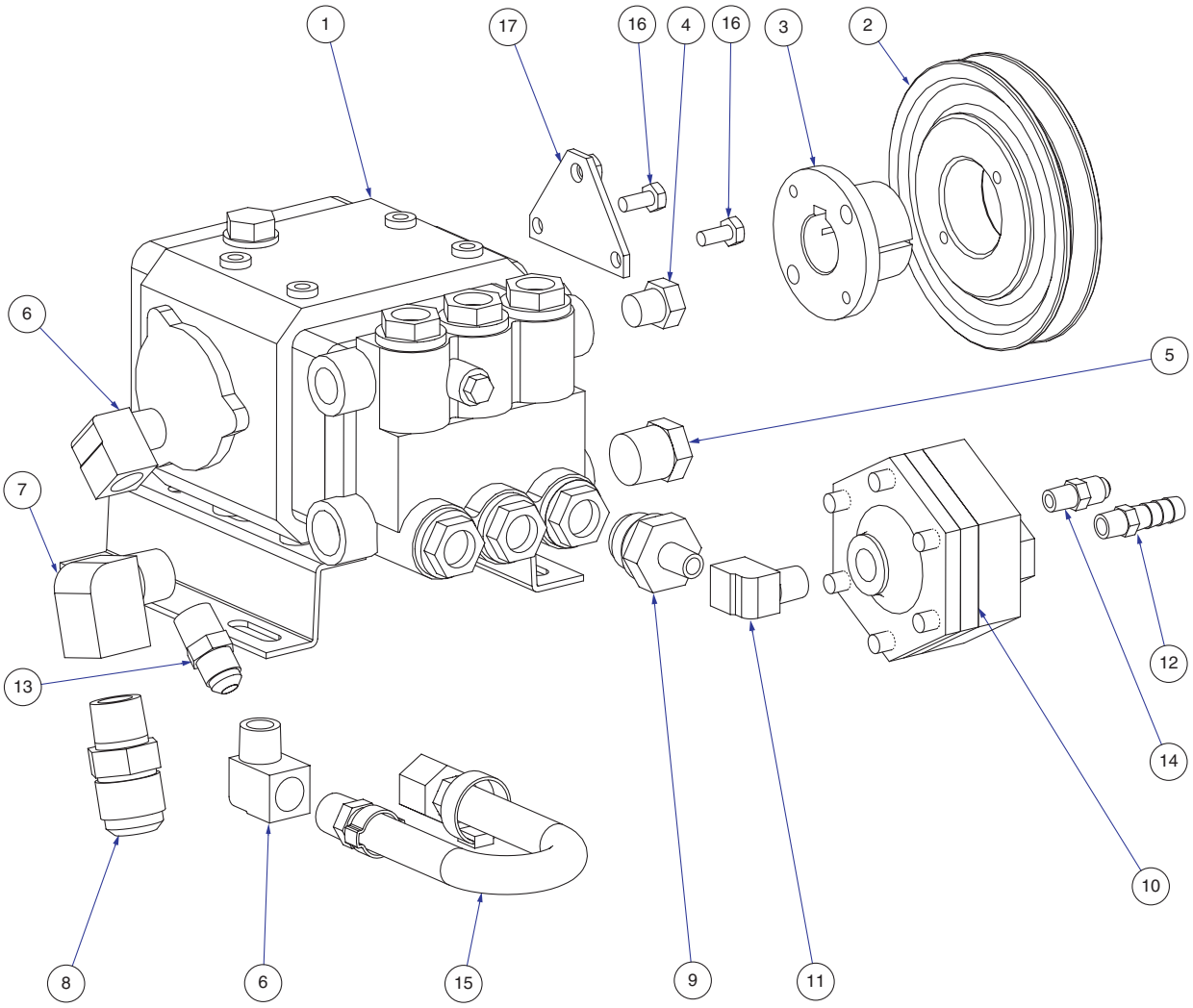
Servicing the Crankcase

1. While manifold, plungers, and seal retainers are removed, examine the crankcase seals for wear.

2. Rotate the crankshaft oil seal externally for drying, cracking or leaking.

3. Consult your HydraMaster distributor if crankcase servicing is necessary.

Figure 8-2 **Pump Assembly**
C-5348 Rev A



Chemical Pump Assembly Parts List

Item	Part Number	Description	Qty
1	000-111-042	Pump, Hydra II Hi PSI 3.5 GPM	1
2	000-109-028	Pulley, AK49H	1
3	000-020-013	Coupler, H x 24mm Spitfire 3.2 & 4.0	1
4	000-106-003	Plug, 3/8" NPT Hex	1
5	000-106-004	Plug, 1/2" NPT Hex	1
6	000-052-086	Elbow, 3/8" NPT Street	2
7	000-052-087	Elbow, 1/2" NPT Street	1
8	000-052-547	Nipple, 1/2 NPT x 3/4 SAE	1
9	000-001-096	Adapter, Chemical Pump To Comet Pump	1
10	000-111-035	Assembly, Chemical Pump	1
11	000-052-085	Elbow, 1/4" NPT Street	1
12	000-052-099	Insert, #26 (1/8" NPT x 3/8" Barb)	1
13	000-052-128	Nipple, 3/8" NPT x 3/8" Male Propane	1
14	000-052-530	Nipple, 1/8" MNPT x 1/4" SAE	1
15	000-068-219	Hose, Spitfire Pump Drain	1
16	000-143-221	Screw, M6-1 x 14mm Lg. Hex Head	2
17	000-015-295	Bracket, Upper Belt Guard	1

High Pressure System Troubleshooting

1.0. Will not come up to normal cleaning pressure

1.1. **Pressure adjusting valve is defective or dirty.** Disassemble valve. Repair or replace as necessary.

1.2. **Worn seals or valves in pump.** Test pump output directly from pump at normal operating RPM. If volume is below manufacturers specifications, replace seals and inspect for defective valves.

1.3. **Pump RPM is too low.** Check engine RPM and adjust as necessary. Check for loose pump belt. Adjust tension as necessary.

1.4. **High temperature dump solenoid is activated.** Refer to Heating System, section IV.

1.5. **Primary system control orifice is missing or loose.** Remove filter and inspect. Tighten or replace as necessary.

1.6. **Primary system control orifice has been exchanged with secondary (hot water dump) orifice.** Inspect and reverse as necessary.

1.7. **Primary orifice is worn.** Measure orifice size and replace as necessary.

2.0. No pressure reading on PSI gauge

2.1. **No water in water box.** Refer to section 5.0.

2.2. **Pump belt is broken.** Replace belt.

3.0. PSI gauge reads normal; low pressure from wand

3.1. **There is a restriction in the cleaning tool.** Inspect tool jet and clean or replace as necessary. Inspect any filters in the cleaning tool and clean or replace as necessary.

3.2. **There is a defective quick connect in the system.** Inspect each quick connect and replace as necessary.

3.3. **There is a restriction in one of the solution hoses.** Remove quick connects and inspect hoses. Clean or replace as necessary.

3.4. **There are hard water deposits restricting the system between the after-burner heat exchanger and the high-pressure solution connection at the front of the machine.** Descale the machine. If this doesn't solve the problem, disassemble this portion of the system and locate restriction.

4.0. Pressure pulsation

4.1. **There is an air leak between the water box outlet and the pump inlet.** Physically check all hoses and fittings for cuts, breaks, cracks or tightness. Repair as necessary.

4.2. **One of the intake or outlet valves in the high pressure pump is defective or is being held open by debris.** Remove each valve and inspect for correct operation.

4.3. **Water in the water-box is too hot and is approaching boiling point.** Check temperature of water in the water-box. If it is too high, refer to Heating System, section IV, 1.0.

5.0. Water box empty or fills slowly

5.1. **There is a restriction in the water supply system.** Inspect the supply system from the source through the incoming quick connects for kinks, clogs or restricted filters. Clean or repair as necessary.

5.2. **The float valve in the water box is defective.** If there is adequate water flow to the incoming valve in the water box, disassemble and inspect the valve. Repair or replace as necessary.

6.0. Water box overflows

6.1. **There is either debris caught in the valve or the valve seal is bad.** Disassemble valve and repair or replace as necessary.

6.2. **The float has absorbed water and has lost buoyancy.** Detach float and check to see if it will float to the surface. Replace as necessary.

6.3. **The float has come out of adjustment.** Readjust float as necessary.

Heating System Troubleshooting

1.0. Machine overheats and shuts down

1.1. **One or both orifices or filter screens are restricted.** Remove and inspect. Clean as necessary. Note: Make sure orifices are not interchanged.

1.2. **High-pressure dump solenoid is restricted.** Inspect solenoid and the hose that delivers water to it. Clean or replace as necessary.

1.3. **High-pressure dump solenoid is not functioning.** Check fuse that provides power to the temperature controller.

1.3.1. If a fuse is blown, inspect electrical system for worn or damaged wires. Repair or replace as necessary.

1.3.2. If switch and relay are good, refer to qualified service technician to test temperature controller and RTD sensor.

1.4. **Engine RPM is too high.** Check RPM with accurate tachometer and adjust as necessary.

2.0. Unable to achieve normal cleaning solution temperature

2.1. **Cleaning solution flow is too great.** Measure flow at cleaning tool. If flow is too high;

2.1.1. Cleaning tool jet is too large or worn out. Inspect jet. Replace as necessary.

2.1.2. Cleaning solution pressure is too high. Adjust pressure to normal. Inspect pressure gauge for accurate reading.

2.2. **Engine RPM is too low.** Check RPM with accurate tachometer and adjust as necessary.

2.3. **Heat exchangers have hard water scale build up internally.** Descale system.

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Machine Assemblies and Parts Lists

Figure 9-1 **Final Assembly - Front View**
D-5549 Rev -

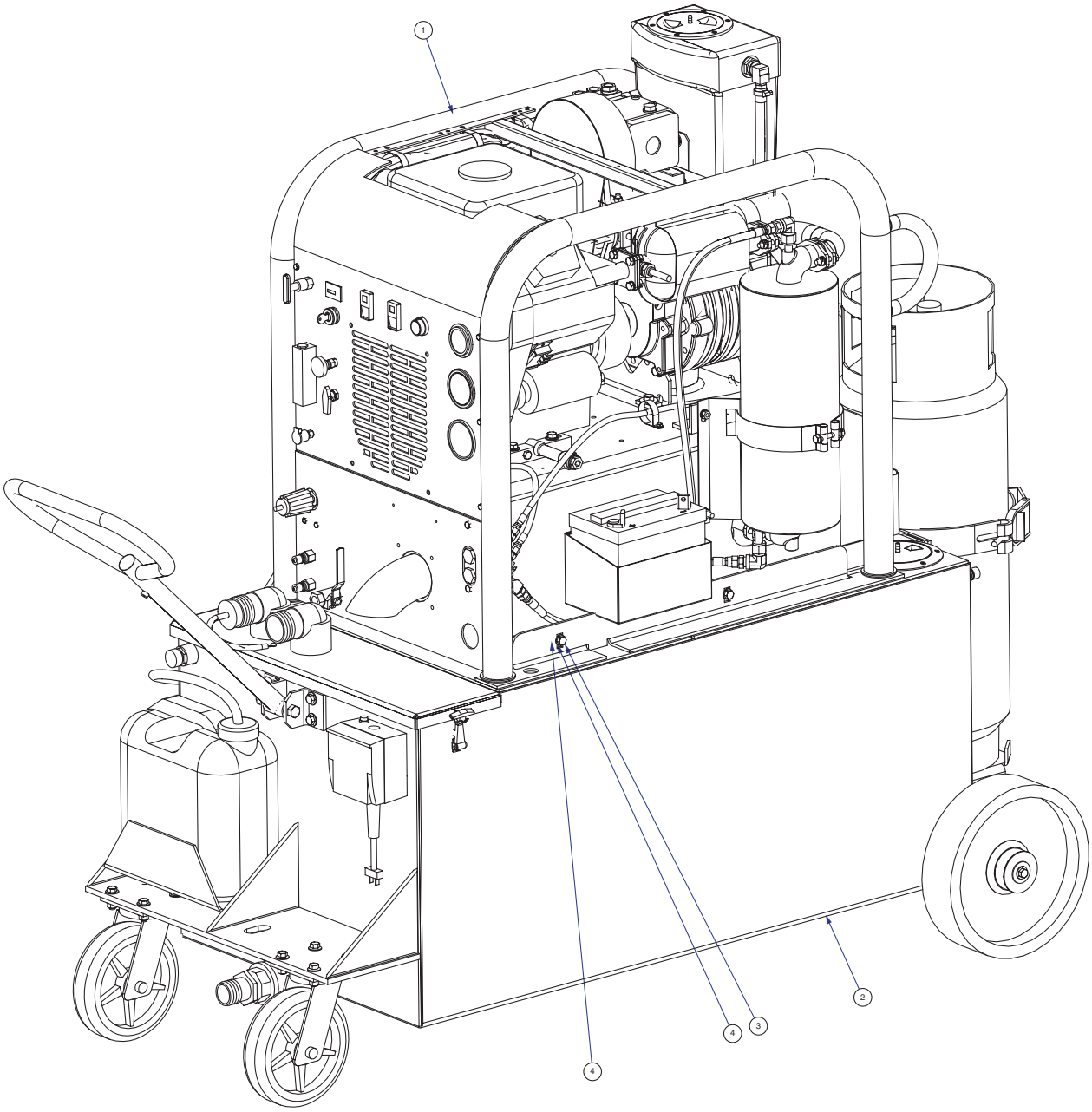
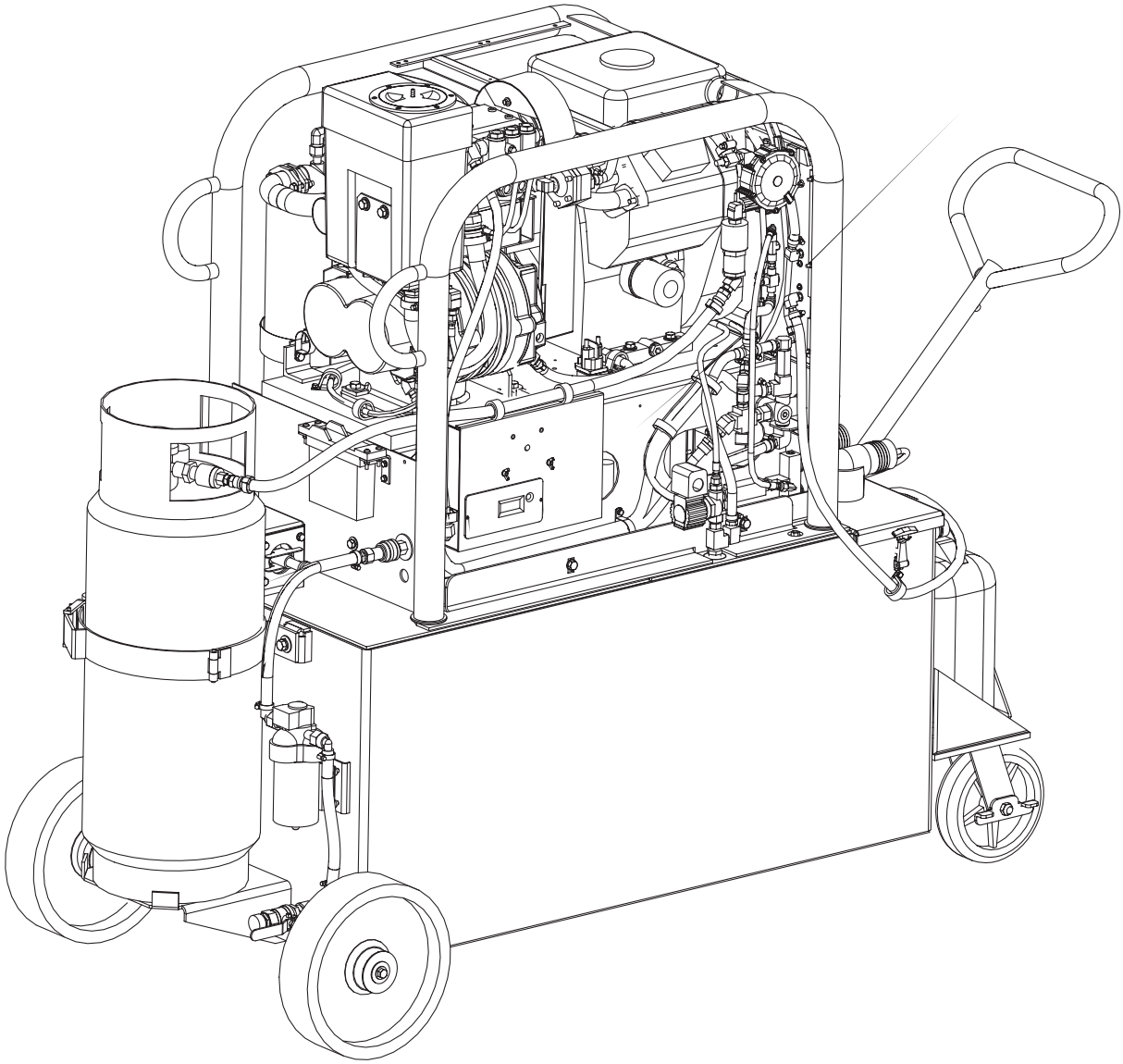


Figure 9-2 **Final Assembly - Rear View**
D-5549 Rev -



Final Assembly Parts List

Item	Part Number	Description	Qty
1	Fig. 9-3 - 9-6	Assembly, Machine - CM402LP	1
2	Fig. 9-23 - 9-24	Assembly, Recovery Tank - CM402LP	1
3	000-143-018	Screw, 3/8"-16UNC x 1.00" Lg. Grade 8	4
4	000-174-005	Washer, 3/8" Flat	8
5	000-094-015	Nut, 3/8"-16UNC Hex 2-Way Locking	4

Figure 9-3 **Machine Assembly - Front View - Left Side**
D-5347 Rev A

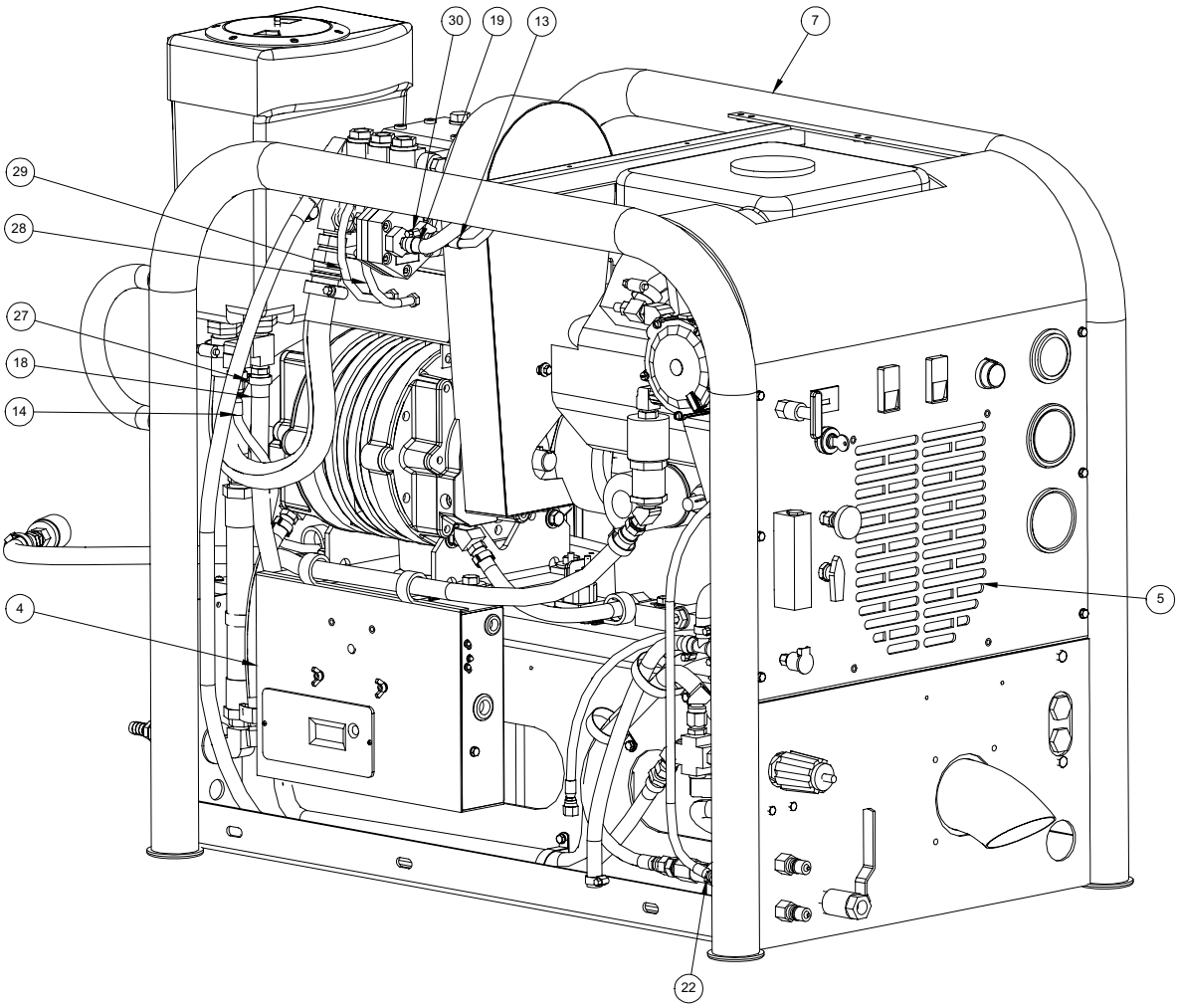


Figure 9-4 **Machine Assembly - Rear View - Left Side**
D-5347 Rev A

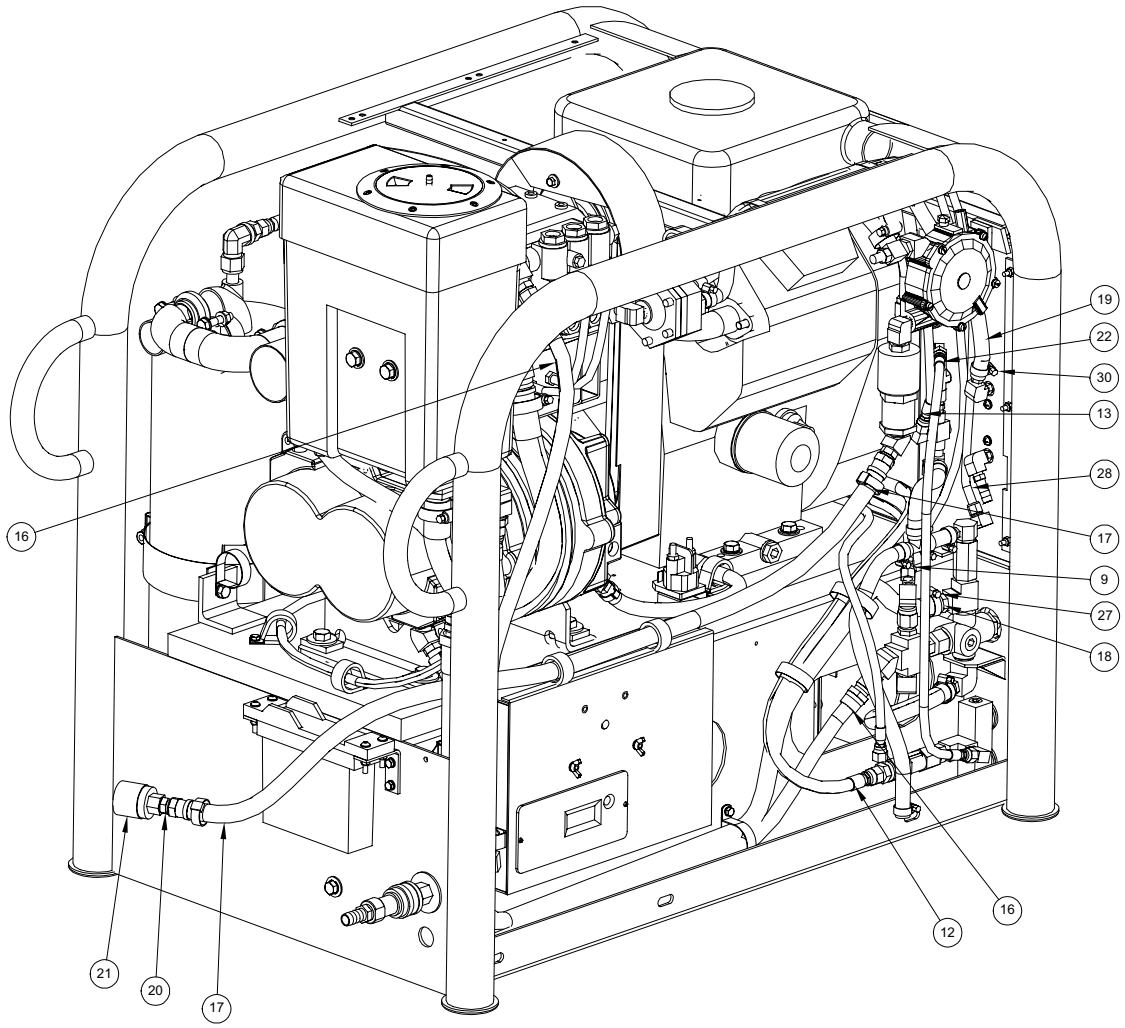


Figure 9-5 **Machine Assembly - Rear View - Right Side**
D-5347 Rev A

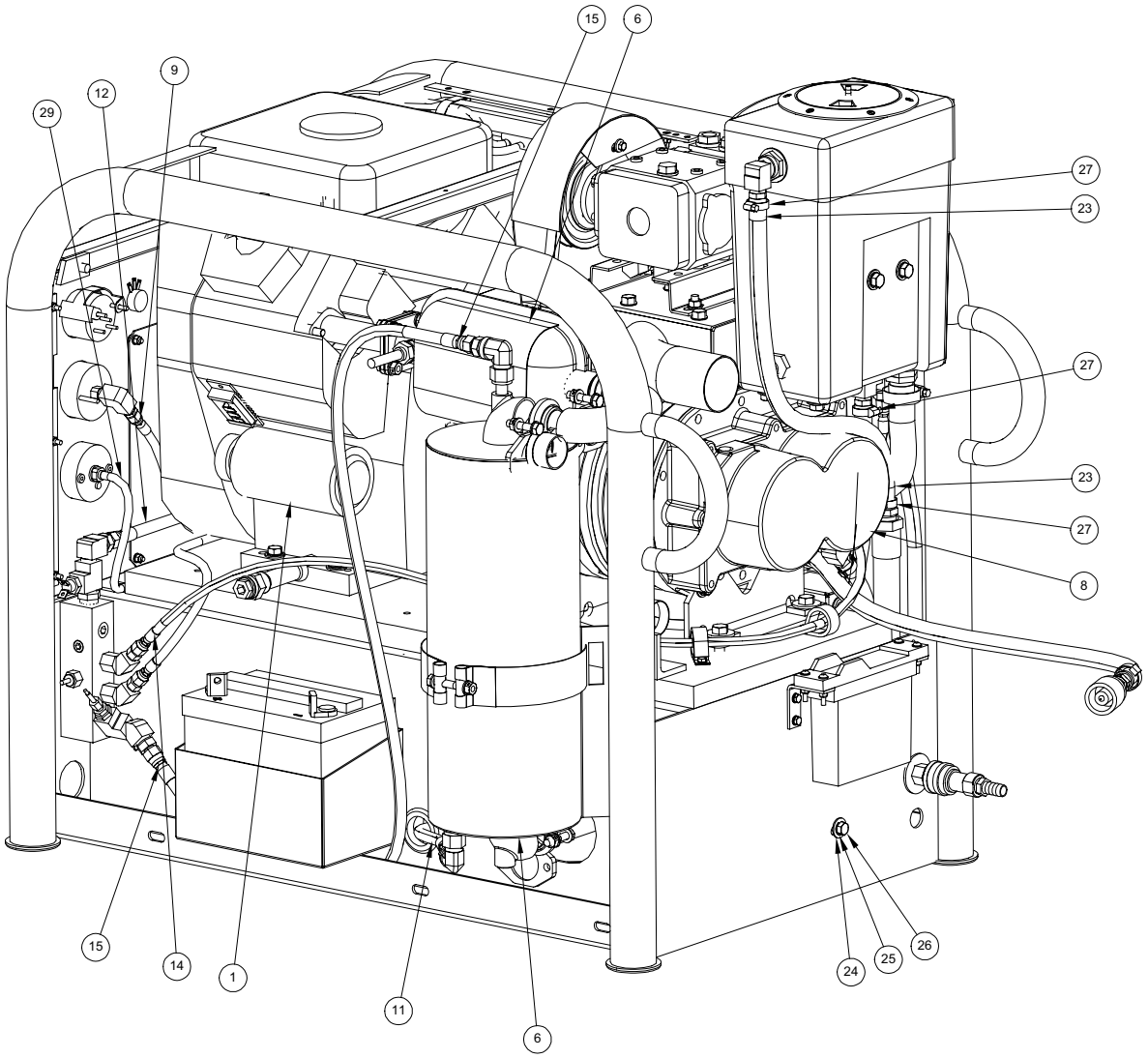
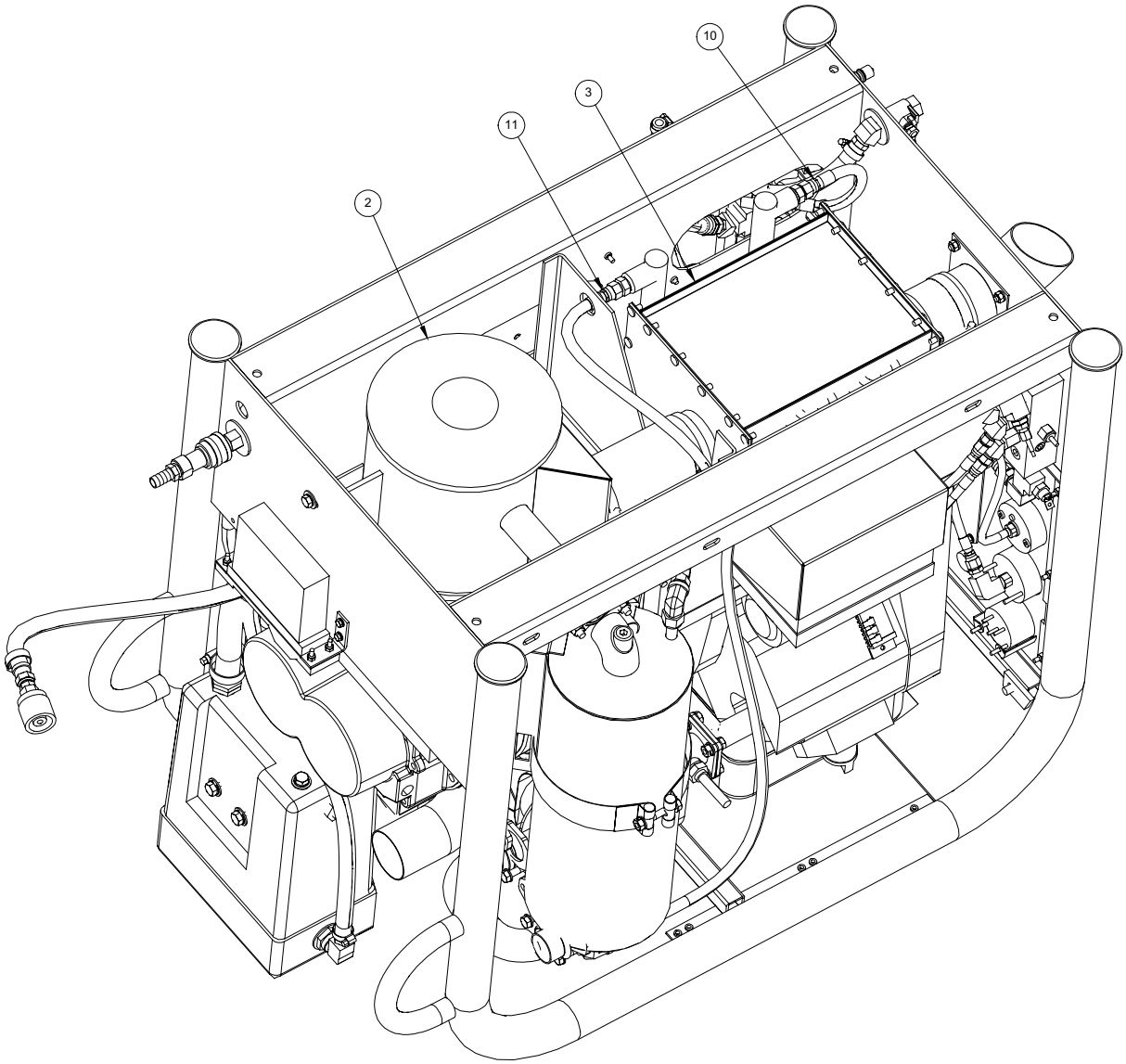


Figure 9-6 **Machine Assembly - Bottom View**
D-5347 Rev A



Machine Assembly Parts List

Item	Part Number	Description	Qty
1	**Fig. 9-13**	Assembly, Engine - CM402LP	1
2	000-093-080	Silencer, Weldment - Boxxer 421	1
3	**Fig. 9-18**	Assembly, Blower Heat Exchanger - Boxxer 421	1
4	**Fig. 9-22**	Assembly, Electrical Control Panel - CM402LP	1
5	**Fig. 9-19 - 9-20**	Assembly, Dash - CM402LP	1
6	**Fig. 9-17**	Assembly, Exhaust - CM402LP	1
7	**Fig. 9-7 - 9-9**	Assembly, Frame - CM402LP	1
8	**Fig. 9-14**	Assembly, Blower - CM402LP	1
9	000-068-517	Hose, 3/16" x 23" Lg. Teflon W F JIC Ends	1
10	000-068-641	Hose, 3/8" x 10" Lg. Teflon w/ JIC Ends	1
11	000-068-642	Hose, 3/8" x 19.5" Lg. Teflon w/ JIC Ends	1
12	000-068-643	Hose, 3/8" x 30.5" Lg. Teflon w/ JIC Ends	1
13	000-068-646	Hose, 3/16" x 29.25" Lg. Teflon w/ JIC Ends	1
14	000-068-647	Hose, 3/16" x 47.25" Lg. Teflon w/ JIC Ends	1
15	000-068-661	Hose, 3/8" x 45" Lg. Teflon w/ JIC Ends	1
16	000-068-588	Hose, 3/8" Throb	1
17	000-068-666	Hose, 3/8" x 36" Lg. Propane	1
18	000-068-018	Hose, 1/2" I.D. Bulk	1
19	000-068-085	Hose, 3/8" I.D. Hi-Temp Black - Bulk	1
20	000-052-490	Nipple, 3/8" Flare x 1/4" NPT	1
21	000-052-047	Quick Connect, Propane - Female	1
22	000-068-645	Hose, 3/16" x 19.75" Lg. Teflon w/ JIC Ends	1
23	000-068-018	Hose, 1/2" I.D. - Bulk	1
24	000-174-004	Washer, 5/16" Flat	2
25	000-174-018	Washer, 5/16" Lock	2
26	000-143-143	Screw, 5/16"-18UNC x 1.00" Lg. Hex Head	2
27	000-033-004	Clamp, Size #6	5
28	000-068-030	Hose, 5/32" I.D. Vacuum	1
29	000-068-030	Hose, 5/32" I.D. Vacuum	1
30	000-033-005	Clamp, Size #5 Hose	2

Figure 9-7 **Frame Assembly - Front View**
D-5337 Rev C

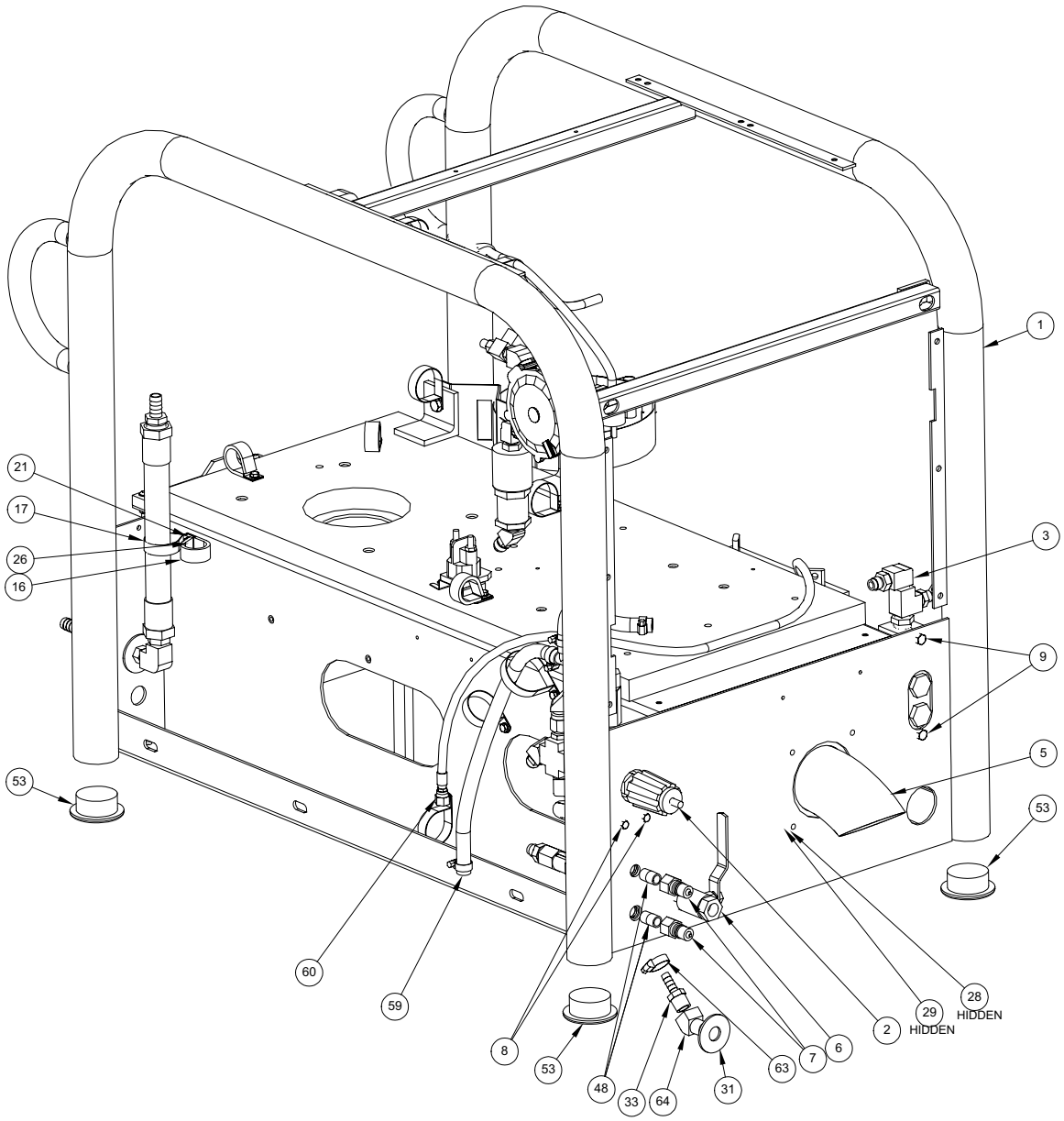


Figure 9-8 **Frame Assembly - Rear View - Left Side**
D-5337 Rev C

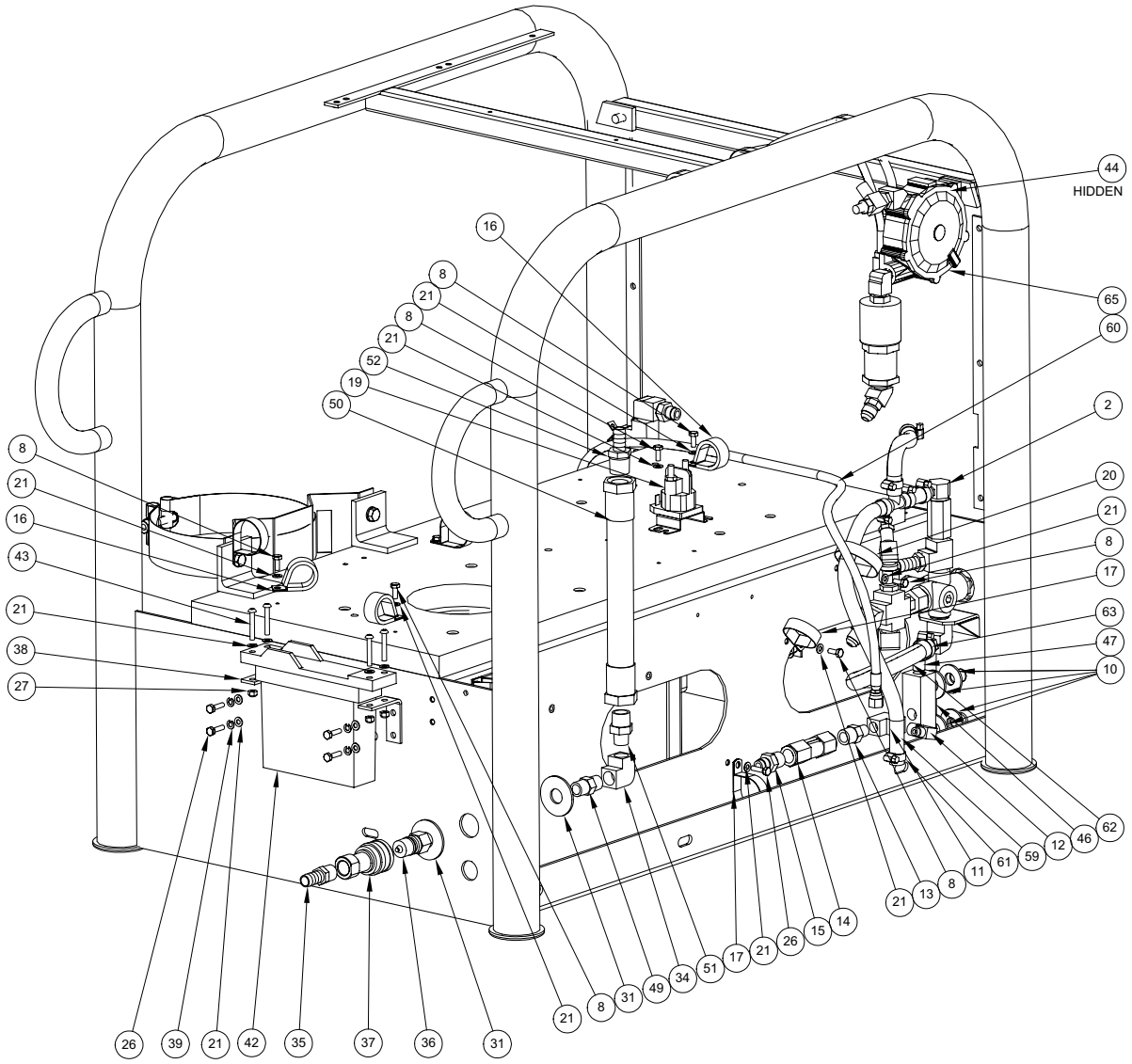
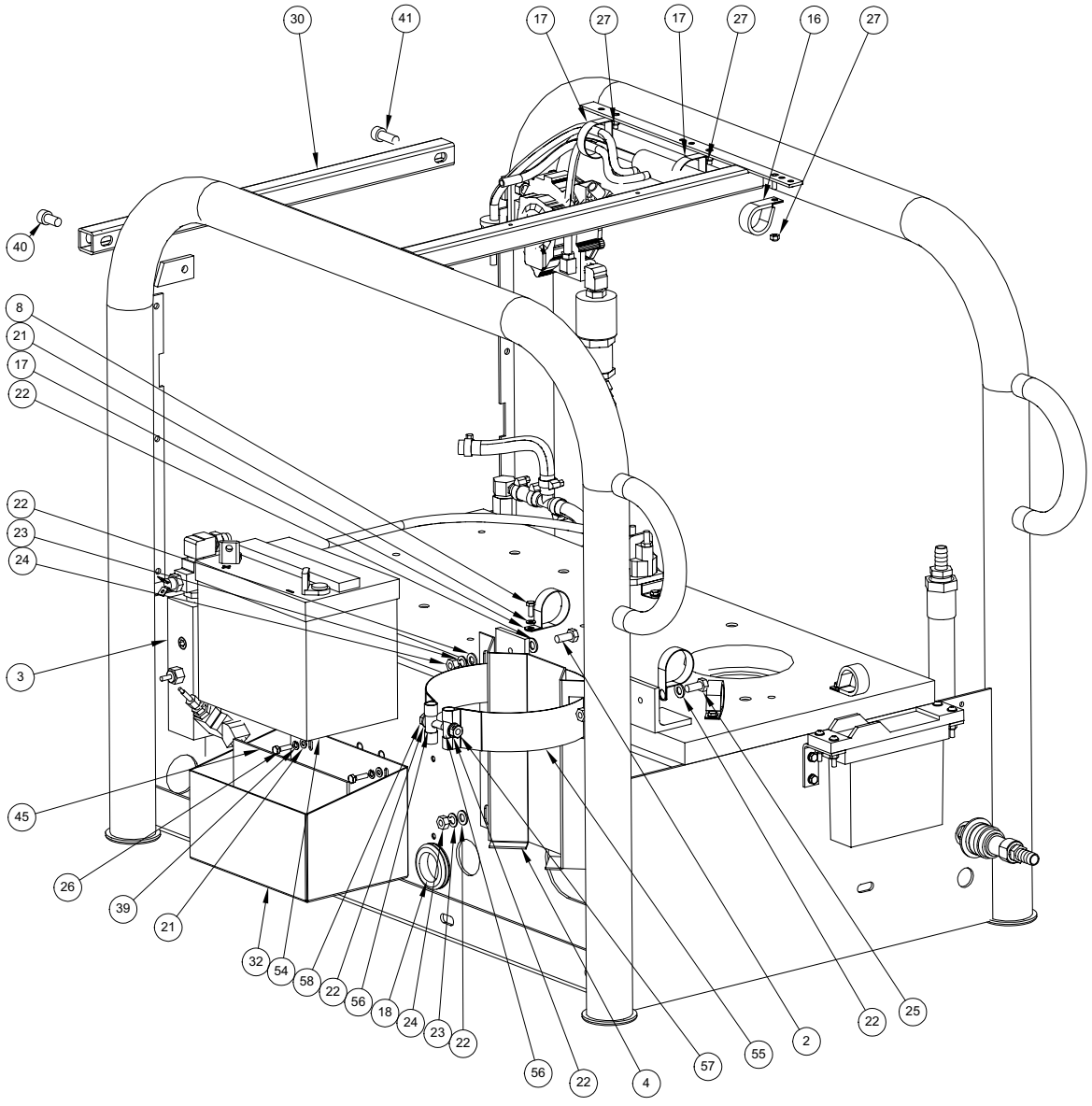


Figure 9-9 **Frame Assembly - Rear View - Right Side**
D-5337 Rev C



Frame Assembly Parts List

Item	Part Number	Description	Qty
1	000-055-161	Frame, Weldment - CM402LP	1
2	**Fig. 9-10**	Assembly, By-Pass Valve - Boxxer 421	1
3	**Fig. 9-11**	Assembly, Hi-PSI Manifold - CM402LP	1
4	000-015-745	Bracket, Coil Heat Exchanger Saddle - Boxxer 421	1
5	000-001-098	Adapter, Exhaust Turndown - Weldment	1
6	000-169-064	Valve, 3/8" NPT Full Port Ball	1
7	000-052-050	Quick Connect, 440 Male w/ Viton Standard	2
8	000-143-126	Screw, #10-24UNC x 0.50" Lg. Hex Head	9
9	000-143-542	Screw, 1/4"-28UNF x 0.50" Lg.	2
10	000-174-007	Washer, 1/2" Flat	4
11	000-052-090	Tee, 1/4" NPT Branch M-F-F	1
12	000-052-532	Elbow, 1/4" SAE x 1/4" JIC x 90°	1
13	000-052-073	Nipple, 3/8" NPT x 1/4" NPT Hex	1
14	000-169-177	Valve, 3/8" FPT Check 65 PSI	1
15	000-052-528	Nipple, 3/8" M JIC x 3/8" NPT	1
16	000-033-057	Clamp, 1" Cushion Loop	5
17	000-033-053	Clamp, 1-1/2" Cushion Loop	6
18	000-060-010	Grommet, 1-5/16" I.D.	1
19	000-157-012	Switch, Starter Solenoid 14 HP B&S	1
20	000-033-067	Clamp, 2" Cushion Loop	1
21	000-174-001	Washer, #10 Flat	21
22	000-174-049	Washer, 5/16" Flat	8
23	000-174-018	Washer, 5/16" Lock	4
24	000-094-012	Nut, 5/16-18"UNC Hex	4
25	000-143-012	Screw, 5/16"-18UNC x 0.75" Lg. Hex Head	2
26	000-143-132	Screw, #10-24UNC x 0.75" Lg. Hex Head	10
27	000-094-034	Nut, #10-24UNC Nylock	7
28	000-174-003	Washer, 1/4" Flat	4
29	000-094-009	Nut, 1/4"-20UNC Hex Nylock	4
30	000-154-125	Spacer, Frame Tube Removable - Boxxer 421	1

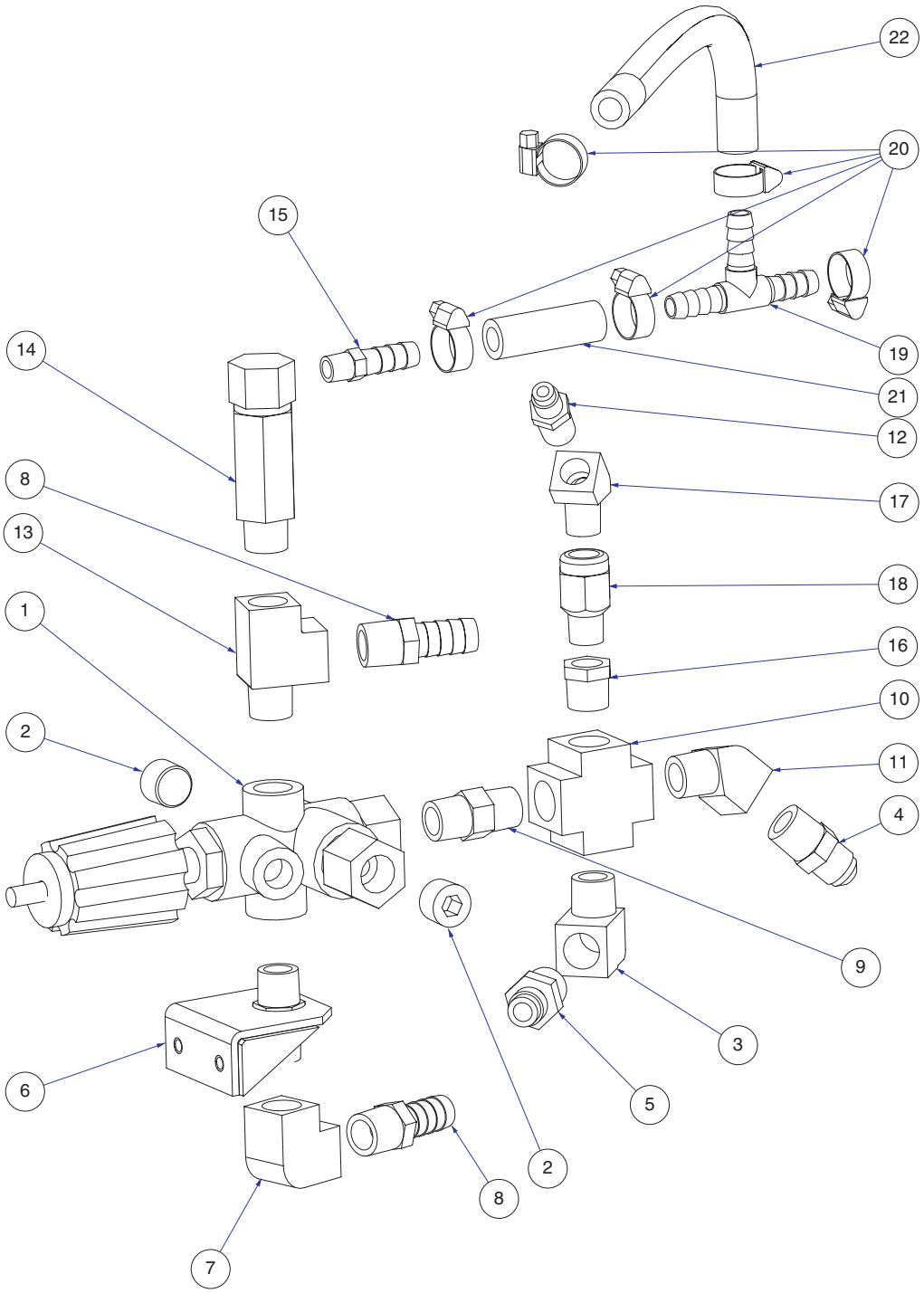
Frame Assembly Parts List

Item	Part Number	Description	Qty
31	000-174-008	Washer, 5/8" Flat	3
32	000-013-058	Box, Battery - Welded CM402LP	1
33	000-052-104	Insert, #66 (3/8" NPT x 3/8" Barb)	1
34	000-052-142	Elbow, 3/8" FPT x FPT	1
35	000-052-105	Insert, #68 (3/8" NPT x 1/2" Barb)	1
36	000-052-052	Quick Connect, 660 Male w/ Viton Standard	1
37	000-052-053	Quick Connect, 3/8 Female	1
38	000-015-809	Bracket, Engine Controller Mounting - CM402LP	2
39	000-174-014	Washer, #10 Lock	8
40	00-143-094-	Screw, 3/8"-16UNC x 0.75" Lg. Socket Head	1
41	000-143-081	Screw, 3/8"-16UNC x 1.00" Lg. Socket Head	1
42	000-074-150	Controler, Propane Engine Emission Control	1
43	000-143-167	Screw, #10-24UNC x 1.25" Lg. Button Head	4
44	000-094-014	Nut, 3/8"-16UNC Hex Zink Plated	1
45	000-108-132	Protector, Battery Box - CM402LP	1
46	000-090-061	Manifold, Double Solution Hose - CM402LP	1
47	000-106-007	Plug, 1/4" NPT Allen Head	1
48	000-052-072	Nipple, 1/8" NPT Close	2
49	000-052-074	Nipple, 3/8" NPT Hex	1
50	000-163-056	Magnaclean, Hard Water Protector - Complete	1
51	000-052-075	Nipple, 3/8" NPT x 1/2" NPT	1
52	000-052-107	Insert, #88 (1/2" NPT x 1/2" Barb)	1
53	000-106-040	Plug, Frame End	4
54	000-007-001	Battery, MVP-1 AGM Class U1R	1
55	000-033-123	Clamp, After Burner Mount - Boxxer 421	1
56	000-141-033	Rod, Heat Exchanger Strap - Retainer	2
57	000-094-081	Nut, 5/16"-18UNC Hex 2-Way Locking	1
58	000-143-316	Screw, 5/16"-18UNC x 2.00" Lg. Hex Head	1
59	000-068-085	Hose, 3/8" I.D.	1
60	000-068-509	Hose, 3/16" x 37.5" Lg. Teflon w/ JIC Ends	1

Frame Assembly Parts List

Item	Part Number	Description	Qty
61	000-033-005	Clamp, Size #5 Hose	1
62	000-068-018	Hose, 1/2" I.D.	1
63	000-033-004	Clamp, Size #6	2
64	000-052-083	Elbow, 3/8" NPT Street x 45°	1
65	**Fig. 9-12**	Assembly, Propane Regulator - CM402LP	1
66	000-033-116	Clamp, 1-1/2" Cushion Loop w/ 7/16" Mounting Hole	1

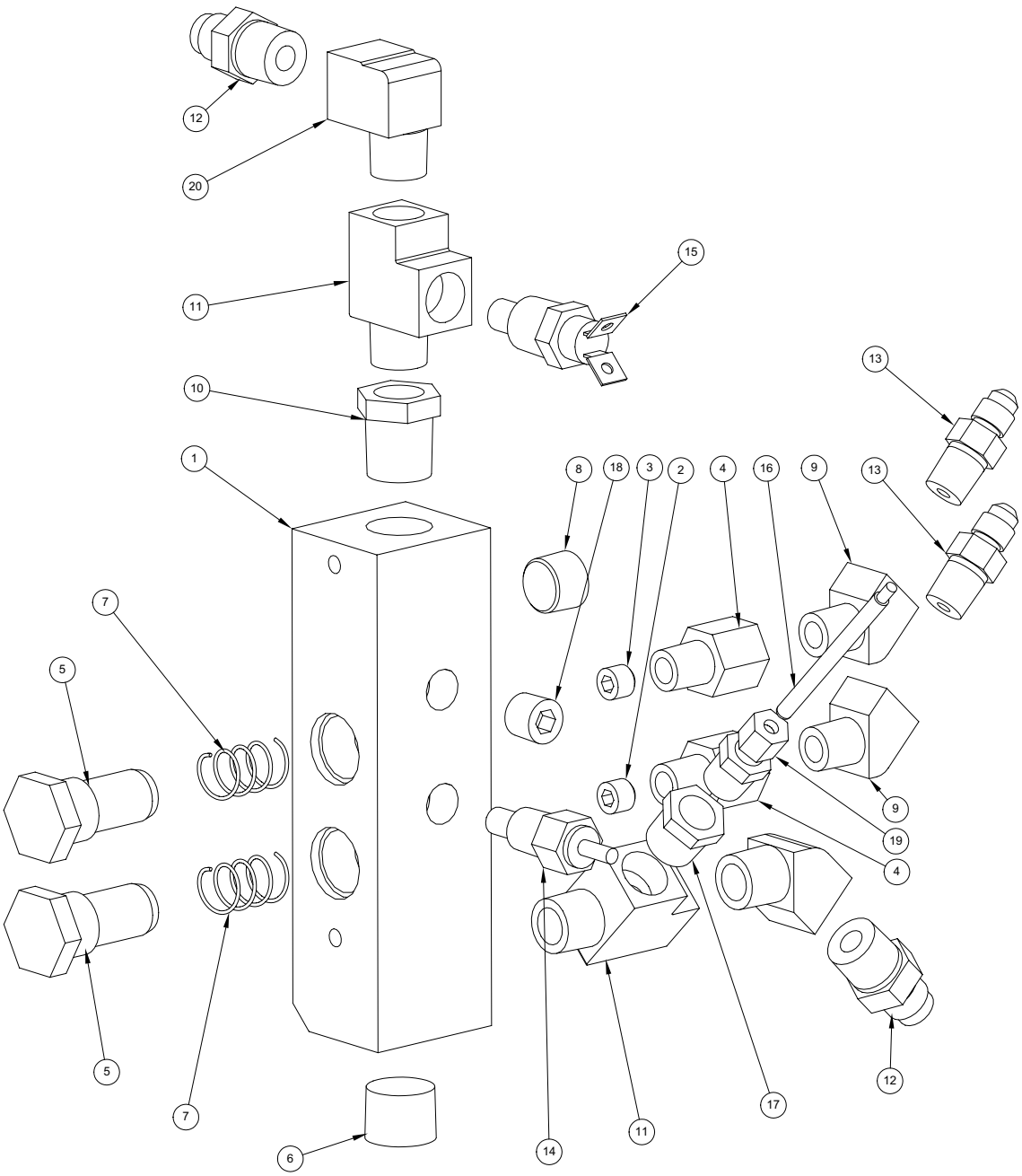
Figure 9-10 **By-Pass Valve Assembly**
C-5342 Rev A



By-Pass Valve Assembly Parts List

Item	Part Number	Description	Qty
1	000-169-083	Valve, Hi PSI By-Pass - Modified	1
2	000-106-008	Plug, 3/8" NPT Allen Head	2
3	000-052-086	Elbow, 3/8" NPT Street	1
4	000-052-128	Nipple, 3/8" NPT x 3/8" Male Propane	1
5	000-052-528	Nipple, 3/8" M JIC x 3/8" NPT	1
6	000-015-515	Bracket, By-Pass Valve Mounting	1
7	000-052-142	Elbow, 3/8" FPT x FPT	1
8	000-052-105	Insert, #68 (3/8" NPT x 1/2" Barb)	2
9	000-052-074	Nipple, 3/8" NPT Hex	1
10	000-052-113	Cross, 3/8" FPT	1
11	000-052-083	Elbow, 3/8" NPT Street x 45°	1
12	000-052-527	Nipple, 1/4" SAE x 1/4" NPT	1
13	000-052-023	Tee, 3/8" NPT Male Street	1
14	000-169-011	Valve, Hi Temp Control 180°	1
15	000-052-099	Insert, #26 (1/8" NPT x 3/8" Barb)	1
16	000-052-061	Bushing, 3/8" NPT x 1/4" FPT	1
17	000-052-082	Elbow, 1/4" NPT Street x 45°	1
18	000-135-052	Regulator, Hi PSI Snubber	1
19	000-052-022	Tee, 3/8" Insert	1
20	000-033-005	Clamp, Size #5 Hose	5
21	000-068-085	Hose, 3/8" I.D.	1
22	000-068-085	Hose, 3/8" I.D.	1

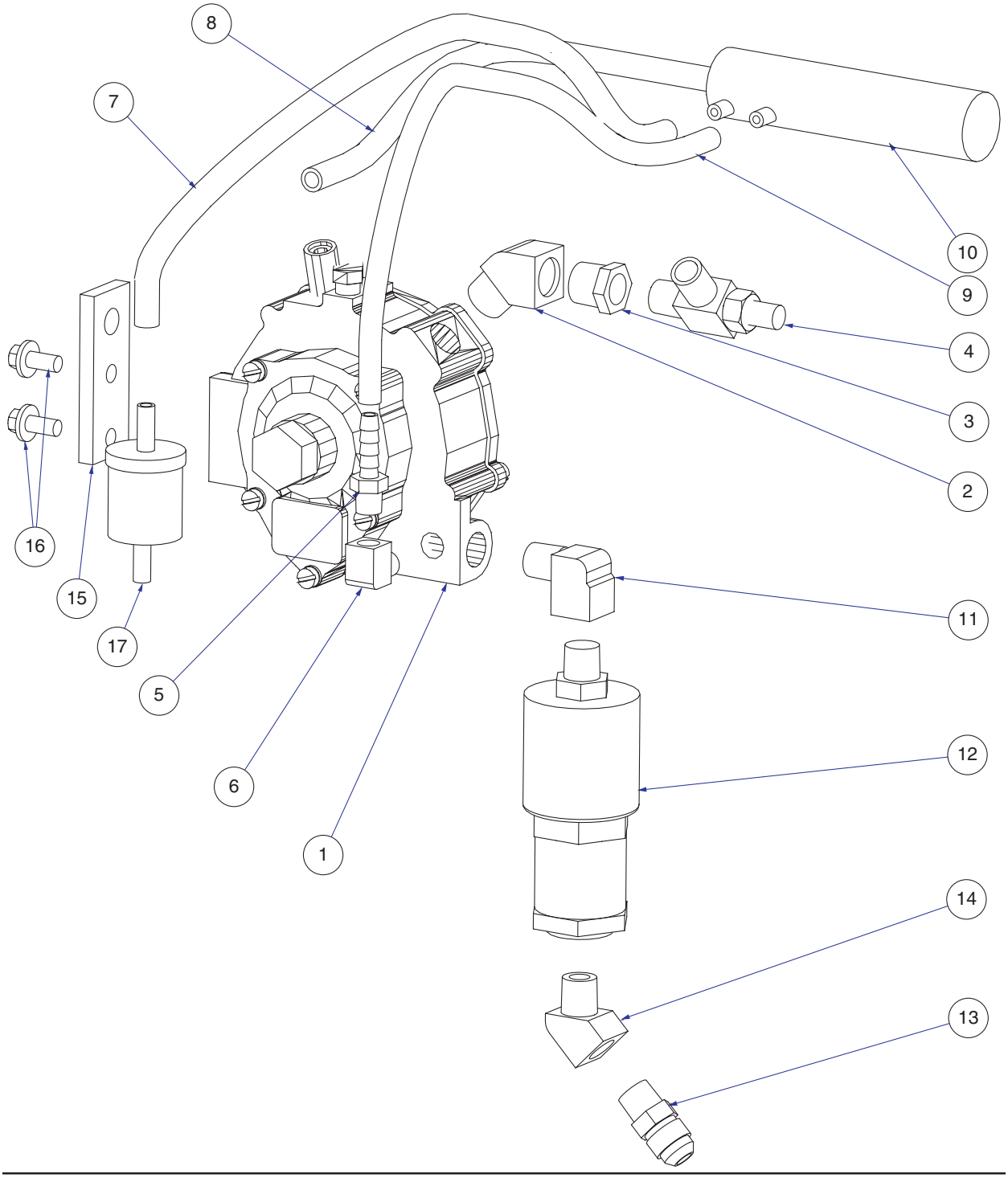
Figure 9-11 **HI-PSI Manifold Assembly**
C-5343 Rev A



HI-PSI Manifold Assembly Parts List

Item	Part Number	Description	Qty
1	000-090-010	Manifold, Hi-PSI	1
2	000-180-006	Orifice, Set Screw 0.061"	1
3	000-180-004	Orifice, Set Screw 0.033"	1
4	000-052-423	Bushing, Modified Set Screw Orifice	2
5	000-049-016	Filter, 1/4" NPT Replacement “Y”	2
6	000-106-111	Plug, 1/2" NPT Allen	1
7	000-155-020	Spring, 0.540 O.D. x 0.041 Wire x 1.00 Lg.	2
8	000-106-008	Plug, 3/8" NPT Allen Head	1
9	000-052-082	Elbow, 1/4" NPT Street x 45°	2
10	000-052-064	Bushing, 1/2" NPT x 3/8" FPT	1
11	000-052-023	Tee, 3/8" NPT Male Street	2
12	000-052-528	Nipple, 3/8" M JIC x 3/8" NPT	2
13	000-052-509	Nipple, 1/4" NPT x 1/4" M JIC	2
14	000-149-039	Sender, Temperature	1
15	000-149-027	Sensor, 285° Nason - 3/8" NPT	1
16	000-149-540	Sensor, RTD Compresion Fitting Style	1
17	000-052-061	Bushing, 3/8" NPT x 1/4" FPT	1
18	000-106-007	Plug, 1/4" NPT Allen Head	1
19	000-052-587	Compression, 3/16" x 1/4" NPT Thermocouple Fitting	1
20	000-052-086	Elbow, 3/8" NPT Street	1
21	000-052-083	Elbow, 3/8" NPT Street x 45°	1

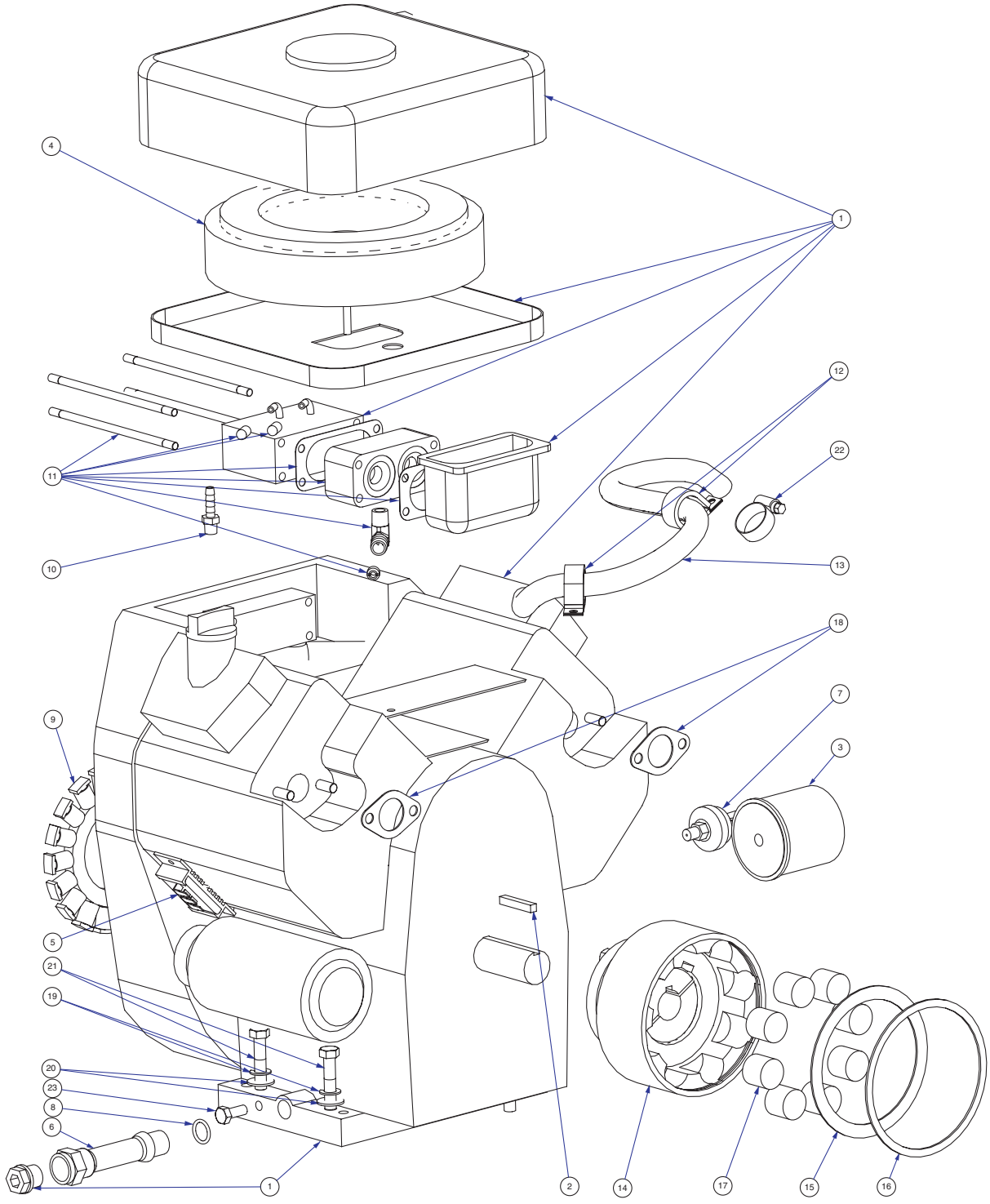
Figure 9-12 **Propane Regulator Assembly**
C-5551 Rev -



Propane Regulator Assembly Parts List

Item	Part Number	Description	Qty
1	000-135-065	Regulator, Propane Kawasaki 19Hp	1
2	000-052-083	Elbow, 3/8" NPT Street x 45°	1
3	000-052-061	Bushing, 3/8" NPT x 1/4" FPT	1
4	- - -	Valve, Main Power (Part Of Propane Kit)	1
5	000-050-097	Insert, #24 (1/8" NPT x 1/4" Barb)	1
6	000-052-084	Elbow, 1/8" NPT Street	1
7	000-068-019	Hose, 1/4" I.D. Vacuum	1
8	000-068-019	Hose, 1/4" I.D. Vacuum	1
9	000-068-030	Hose, 5/32" I.D. Vacuum	1
10	000-169-163	Actuator, Propane System - CM402LP	1
11	000-052-085	Elbow, 1/4" NPT Street	1
12	000-169-190	Valve, 12V Solenoid Propane - CM402LP	1
13	000-052-490	Nipple, 3/8" Flare x 1/4" NPT	1
14	000-052-082	Elbow, 1/4" NPT Street x 45°	1
15	000-015-806	Bracket, Propane Regulator - CM402LP	1
16	000-143-141	Screw, 1/4"-20UNC x 1/2" Lg. Whiz Lock	2
17	- - -	Filter, In-Line	1

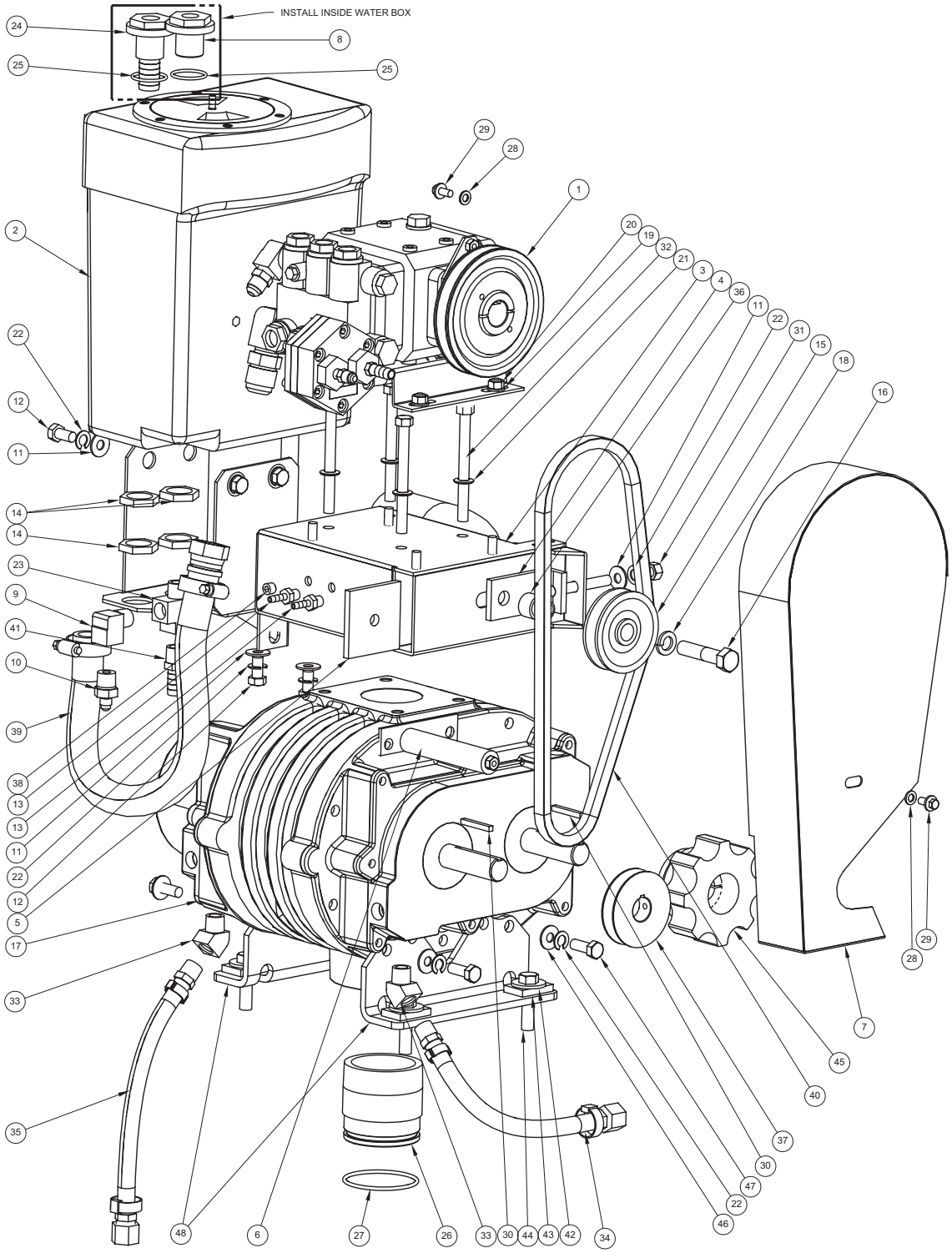
Figure 9-13 **Engine Assembly**
D-5345 Rev -



Engine Assembly Parts List

Item	Part Number	Description	Qty
1	000-047-025	Engine, Kawasaki 19 Hp	1
2	000-077-006	Key, 0.25" x 1.5" Lg.	1
3	000-049-048	Filter, Oil - Kawasaki	1
4	000-049-027	Filter, Air - Kawasaki	1
5	000-135-111	Regulator, Voltage - 19 Hp Kawasaki	1
6	000-001-110	Adapter, Oil Drain Extension Tube - Kawasaki	1
7	000-157-130	Switch, Oil Pressure	1
8	000-097-065	O-Ring, Oil Drain Extention Tube - Kawasaki	1
9	000-004-008	Stator, 20 Amp - 19 Hp Kawasaki	1
10	000-050-097	Insert, #24 (1/8" NPT x 1/4" Barb)	1
11	000-001-105	Adapter, Carb	1
12	000-033-057	Clamp, 1" Cushion Loop	2
13	000-068-063	Hose, 1/2" I.D.	1
14	000-039-050	Coupler, Balenced w/ 1-1/8" Bushing & Outer Hub	1
15	000-174-080	Washer, 5.00" O.D. x 4.13" I.D. x 0.060" Thk.	1
16	000-139-022	Ring, 5" Retaining	1
17	000-106-045	Plug, Coupler (EPDM, 70 Durometer)	8
18	000-047-025	Gasket, Engine Exhaust - Kawasaki 19 Hp	2
19	000-174-057	Washer, 3/8" Lock	4
20	000-174-004	Washer, 5/16" Flat	4
21	000-143-022	Screw, 3/8"-16UNC x 1.75" Lg. Hex Head Grd 8	4
22	000-033-026	Clamp, Size 10 Hose	1
23	000-143-185	Screw, 8mm x 20mm Grade 8.8 Hex Head	1

Figure 9-14 **Blower Assembly**
D-5349 Rev B



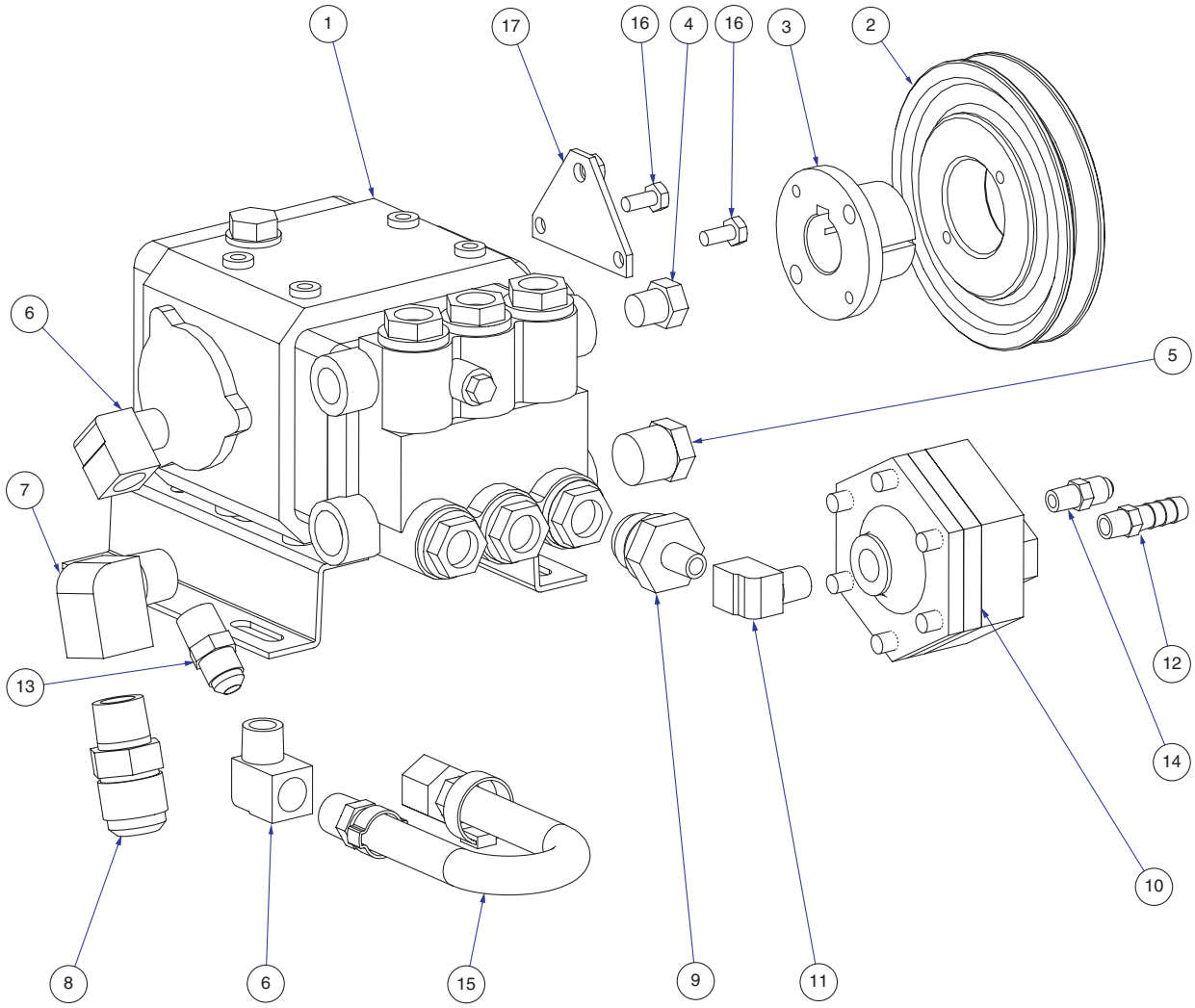
Blower Assembly Parts List

Item	Part Number	Description	Qty
1	Fig. 9-15	Assembly, Pump - CM402LP	1
2	Fig. 9-21	Assembly, Water Box - Poly - Boxxer 421	1
3	000-013-051	Box, Blower Collector	1
4	000-015-746	Bracket, Pump Idler - Boxxer 421	1
5	000-105-207	Plate, Pump Idler Nut - Boxxer 421	1
6	000-015-296	Bracket, Belt Guard Lower	1
7	000-108-120	Protector, Belt Guard - Boxxer 421	1
8	000-052-660	Bulkhead, 3/8" FPT x 3/8" FPT	1
9	000-052-086	Elbow, 3/8" NPT Street	1
10	000-052-662	Nipple, 3/8" NPT x 1/4" M SAE	1
11	000-174-032	Washer, 3/8" Flat	7
12	00-143-017-	Screw, 3/8"-16UNC x 3/4" Lg. Hex Head	6
13	000-052-293	Insert, #23 (1/8" NPT x 3/16" Barb)	2
14	000-094-096	Nut,3/4-16 Brass Water Box	4
15	000-109-093	Pulley, 3" x 0.635/0.640 Bore, “A” Sect. Ball Bearing	1
16	000-143-041	Screw, 1/2"-13UNC x 2.25" Lg. Hex Head	1
17	000-111-145	Blower, 4005 Dominator	1
18	000-174-023	Washer, 1/2" Lock	1
19	000-174-049	Washer, 5/16" Flat	4
20	000-094-038	Nut, 5/16"-18UNC Nylock	4
21	000-174-029	Washer, 3/8" Rubber Back	4
22	000-174-057	Washer, 3/8" Lock	11
23	000-052-023	Tee, 3/8" NPT Male Street	1
24	000-052-661	Insert, 3/4" Barb x Straight	1
25	000-097-041	O-Ring, Bulkhead Fitting w/ 5/8" Hose Barb	2
26	000-001-111	Adapter, 2-1/2" NPT Blower To O-Ring Silencer - n/s	1
27	000-097-029	O-Ring, Blower To Silencer (2 3/4" Id x 2 1/2" Od x 1/8"	1
28	000-174-003	Washer, 1/4" Flat	2
29	000-143-141	Screw, 1/4"-20UNC x 1/2" Lg. Whiz Lock	2
30	000-077-001	Key, #3 & #4 Vacuum Pump Drive	2

Blower Assembly Parts List

Item	Part Number	Description	Qty
31	000-094-014	Nut, 3/8"-16UNC Hex Zink Plated	1
32	000-143-198	Screw, 3/8"-16UNC x 4" Lg. Hex Head Full Thread	4
33	000-052-083	Elbow, 3/8" NPT Street x 45°	2
34	000-068-219	Hose, Spitfire Pump Drain	1
35	000-068-219	Hose, Spitfire Pump Drain	1
36	000-154-127	Spacer,Pump Idler Mounting - CM402LP	1
37	000-109-003	Pulley, AS28 Modified	1
38	000-106-009	Plug, 1/8" NPT Allen Head	1
39	000-068-649	Hose, 3/4" x 23" Lg. Steam Out	1
40	000-010-065	Belt, 3.2 Pump Drive Belt	1
41	000-052-105	Insert, #68 (3/8" NPT x 1/2" Barb)	1
42	000-174-012	Washer, 1/2" SAE H/D Flat	4
43	000-174-068	Washer, Blower Feet	4
44	000-143-028	Screw, 7/16"-14UNC x 1.75" Lg. Hex Head Grd 5 Zinc	4
45	000-039-040	Coupler, Balenced 7/8" Bushing & Inner Sleeve	1
46	000-174-004	Washer, 5/16" Flat	4
47	000-143-018	Screw, 3/8"-16UNC x 1.00" Lg. Grade 8	4
48	000-015-804	Foot, Modified CM402LP Blower Mounting	2

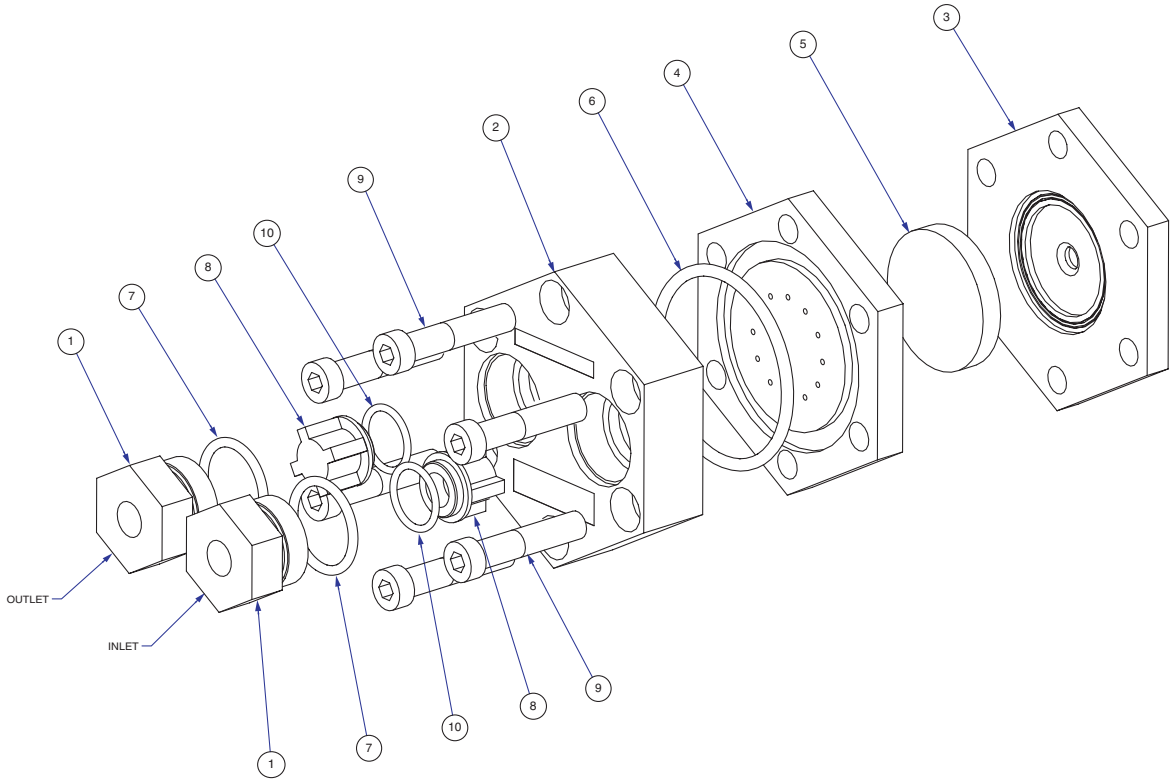
Figure 9-15 **Pump Assembly**
C-5348 Rev A



Pump Assembly Parts List

Item	Part Number	Description	Qty
1	000-111-042	Pump, Hydra II Hi PSI 3.5 GPM	1
2	000-109-028	Pulley, AK49H	1
3	000-020-013	Coupler, H x 24mm Spitfire 3.2 & 4.0	1
4	000-106-003	Plug, 3/8" NPT Hex	1
5	000-106-004	Plug, 1/2" NPT Hex	1
6	000-052-086	Elbow, 3/8" NPT Street	2
7	000-052-087	Elbow, 1/2" NPT Street	1
8	000-052-547	Nipple, 1/2 NPT x 3/4 SAE	1
9	000-001-096	Adapter, Chemical Pump To Comet Pump	1
10	000-111-035	Assembly, Chemical Pump (Fig. 9-16)	1
11	000-052-085	Elbow, 1/4" NPT Street	1
12	000-052-099	Insert, #26 (1/8" NPT x 3/8" Barb)	1
13	000-052-128	Nipple, 3/8" NPT x 3/8" Male Propane	1
14	000-052-530	Nipple, 1/8" MNPT x 1/4" SAE	1
15	000-068-219	Hose, Spitfire Pump Drain	1
16	000-143-221	Screw, M6-1 x 14mm Lg. Hex Head	2
17	000-015-295	Bracket, Upper Belt Guard	1

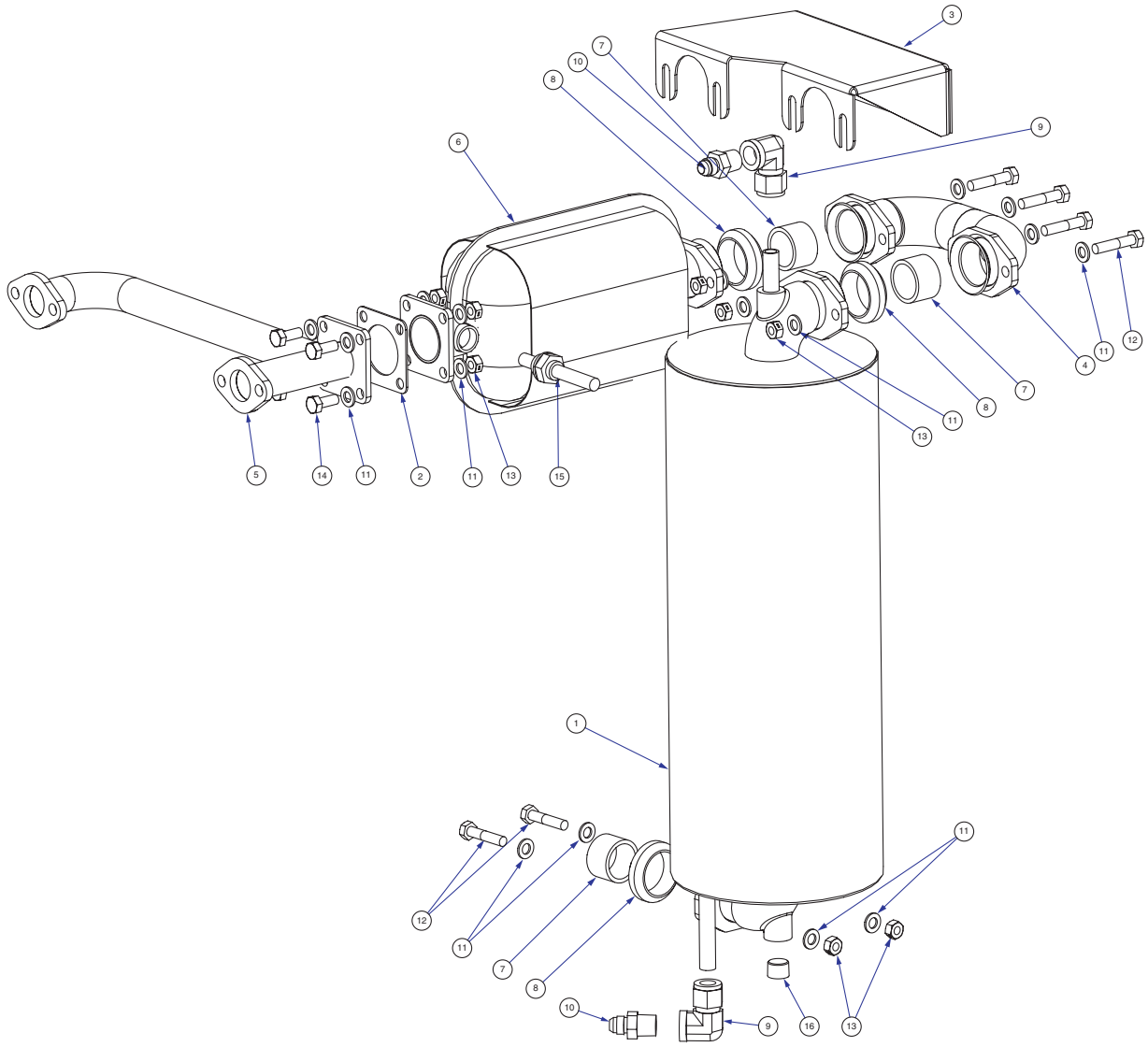
Figure 9-16 **Chemical Pump Assembly**
C-4416 Rev B



Chemical Pump Assembly Parts List

Item	Part Number	Description	Qty
1	000-106-110	Plug, Check Valve - Chemical Pump	2
2	000-064-015	Cover, Chemical Pump	1
3	000-111-030	Body, Chemical Pump	1
4	000-105-071	Mid Plate, Chemical Pump	1
5	000-046-010	Diaphragm, Chemical Pump	1
6	000-097-055	O-Ring, Chemical Pump Midplate An Size -227 Viton	1
7	000-097-056	O-Ring, Check Valve Plug - Chemical Pump	2
8	000-169-155	Valve, Check - Last Step Chemical Injection	2
9	000-143-152	Screw, 5/16"-24UNF x 1.50" Lg. Socket Head	6
10	000-097-054	O-Ring, Chem. Pump Valve Viton-Parker 2-114	2

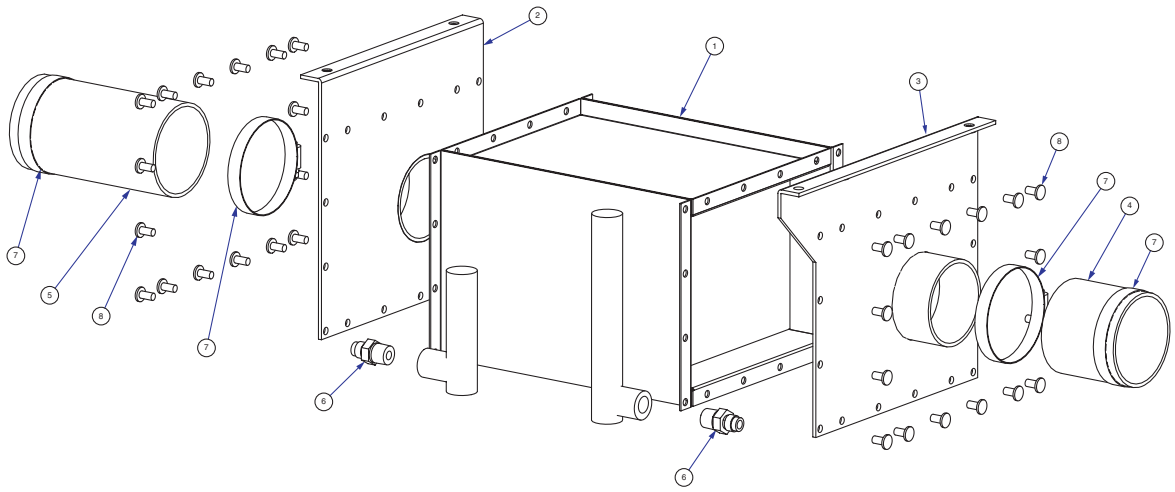
Figure 9-17 **Exhaust Assembly**
D-5346 Rev A



Exhuast Assembly Parts List

Item	Part Number	Description	Qty
1	000-038-060	Core, CM402LP After Burner Heat Exchanger - Weldme	1
2	000-057-146	Gasket, Four Hole Exhaust Diverter	1
3	000-041-398	Cover, Exhaust - CM402LP	1
4	000-001-106	Adapter, Exhaust Kawasaki Catalytic To Coil - CM402L	1
5	000-090-055	Manifold, Exhaust - CM402LP	1
6	000-093-085	Catalytic Converter w/ O2 Sensor Nut - Kawasaki - CM	1
7	000-125-128	Tube, 1-3/8" Od x 1/8" Wall x 7/8" Long	3
8	000-057-177	Gasket, Exhaust Donut 1.50"	3
9	000-052-600	Elbow, 1/2" Tube x 3/8" FPT	2
10	000-052-507	Nipple, 3/8" NPT x 9/16"-18 37° JIC	2
11	000-174-049	Washer, 5/16" Flat	20
12	000-143-501	Screw, 5/16"-18UNC x 1-1/2" Lg.	6
13	000-094-081	Nut, 5/16"-18UNC Hex 2-Way Locking	10
14	000-143-012	Screw, 5/16"-18UNC x 0.75" Lg. Hex Head	4
15	000-157-145	Sensor, Oxygen Kawasaki 19Hp	1
16	000-106-008	Plug, 3/8" NPT Allen Head	1

Figure 9-18 **Blower Heat Exchanger Assembly**
C-4944 Rev A



Blower Heat Exchanger Assembly Parts List

Item	Part Number	Description	Qty
1	000-038-053	Core, Blower Heat Exchanger - Boxxer 421	1
2	000-100-116	Plate, End - Weldment - Blower Heat Exchanger	1
3	000-100-117	Panel, End - Weldment - Blower Heat Exchanger	1
4	000-068-398	Hose, 3" x 3" Lg. Blue Silicon	1
5	000-068-398	Hose, 3" x 6" Lg. Blue Silicon	1
6	000-052-528	Nipple, 3/8" M JIC x 3/8" NPT	2
7	000-033-012	Clamp, Size #44 Hose	4
8	000-140-021	Rivet, 1/4" Blind x 0.50" Lg.	32

Figure 9-19 **Dash Assembly - Front View**
D-5339 Rev B

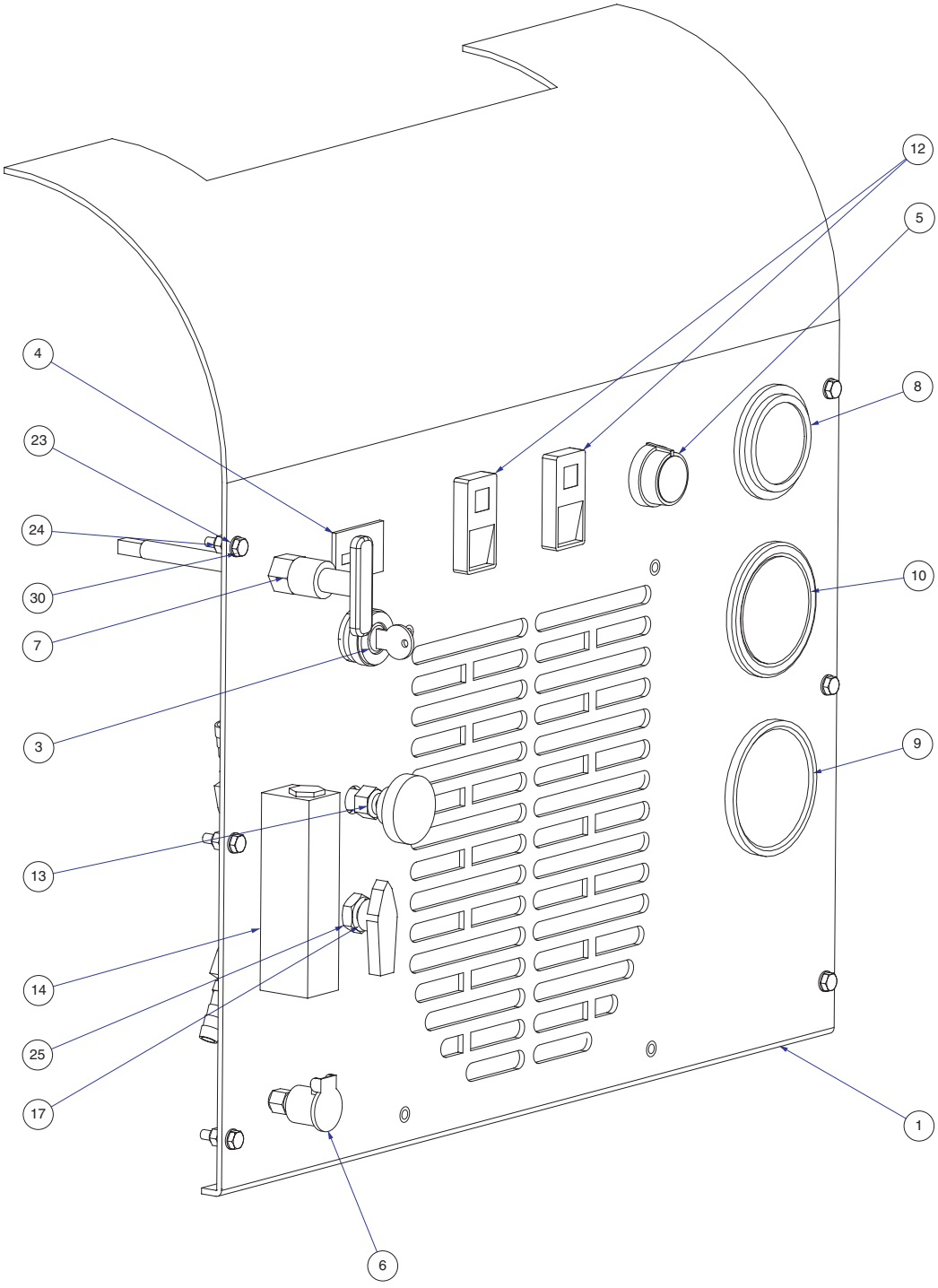
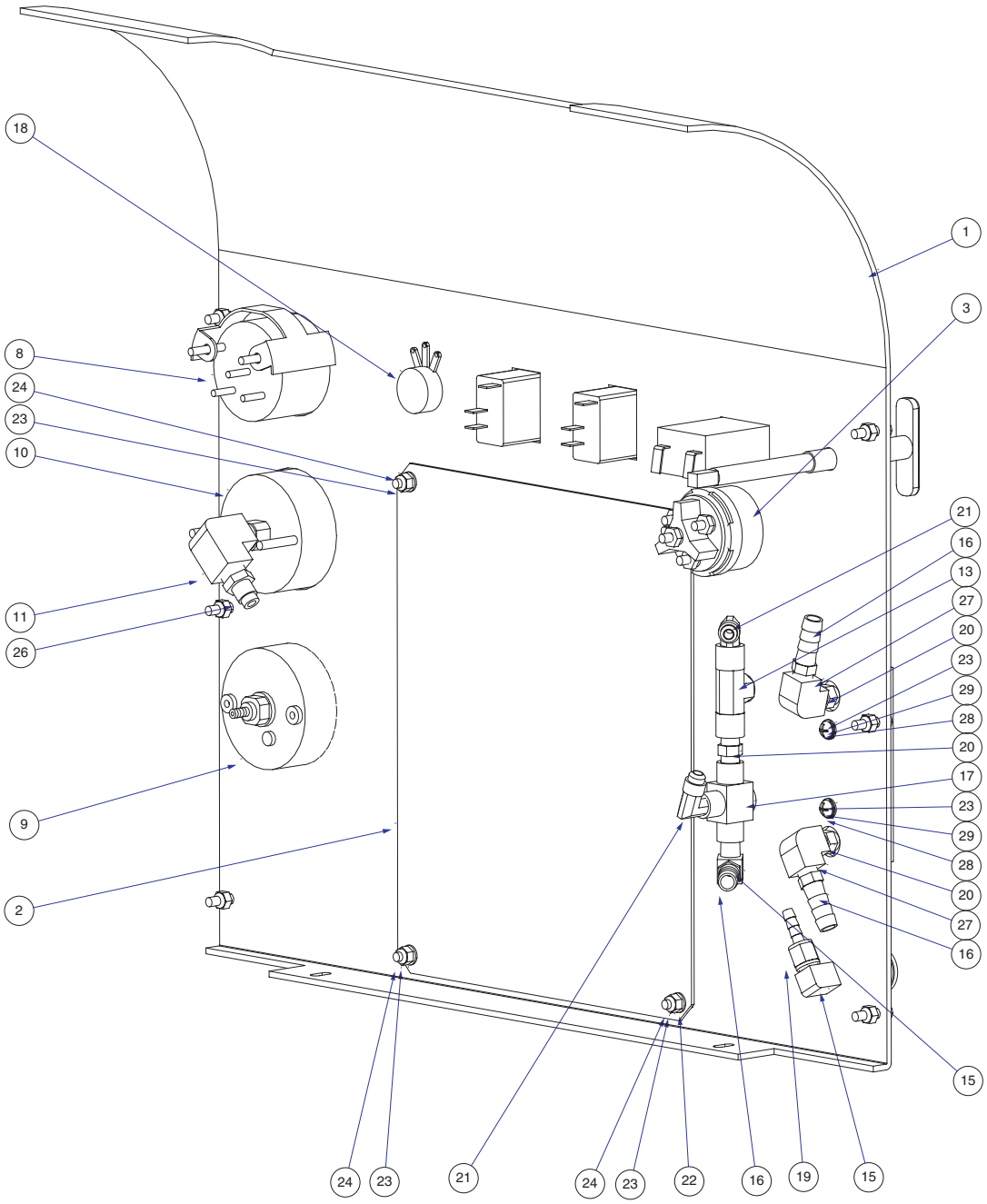


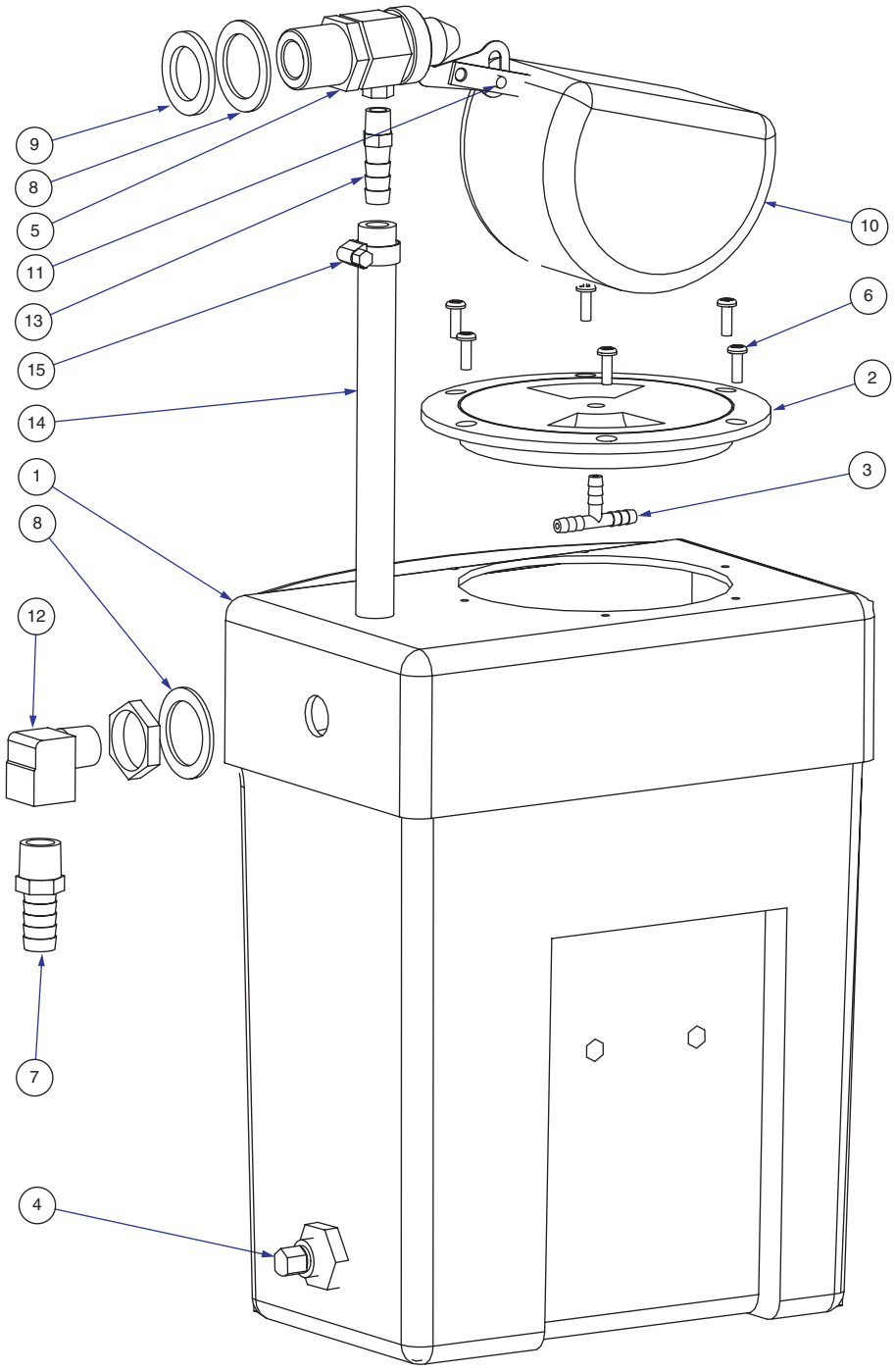
Figure 9-20 **Dash Assembly - Rear View**
D-5339 Rev B



Dash Assembly Parts List

Item	Part Number	Description	Qty
1	000-100-127	Panel, Dash - CM402LP	1
2	000-100-123	Panel, Perforated Grill - Boxxer 421	1
3	000-157-008	Switch, Ignition	1
4	000-074-018	Meter, Rectangular w/o Bezel	1
5	000-061-056	Knob, Temperature Adjustment	1
6	000-052-272	Cup, Gravity Feed Oil Blower Lubrication Port	1
7	000-025-020	Cable, Throttle Kohler	1
8	000-074-024	Gauge, Temperature	1
9	000-074-017	Guage, 0-30" Hg Vac. 2 1/2" HydraMaster Face	1
10	000-074-026	Gauge, 2" Dia. 0-1500 PSI	1
11	000-052-088	Elbow, 1/4" FPT x FPT	1
12	000-157-040	Switch, 20 Amp Rocker	2
13	000-169-160	Valve, Chemical Metering	1
14	000-074-030	Meter, Chemical Flow Raw	1
15	000-052-084	Elbow, 1/8" NPT Street	2
16	000-052-099	Insert, #26 (1/8" NPT x 3/8" Barb)	3
17	000-169-0171	Valve, 3-Way Ball O-Ring Style	1
18	000-149-560	Thermostat, Potentiometer Use w/ Rtd	1
19	000-052-096	Insert, #F23 (1/8" FPT x 3/16" Barb)	1
20	000-052-069	Nipple, 1/8" NPT Hex	3
21	000-052-531	Elbow, 1/8" NPT x 1/4" SAE	2
22	000-094-027	Nut, #10-24UNC Hex	4
23	000-174-001	Washer, #10 Flat	12
24	000-094-034	Nut, #10-24UNC Nylock	10
25	000-094-098	Nut, 7/16"-24UNF - 2 Way Metering Valve	1
26	000-052-527	Nipple, 1/4" SAE x 1/4" NPT	1
27	000-052-089	Elbow, 1/8" NPT Female	2
28	000-143-328	Screw, #10-32UNF x 1/2" Lg. Phillips Head	2
29	000-174-014	Washer, #10 Lock	2
30	000-143-132	Screw, #10-24UNC x 0.75" Lg. Hex Head	6

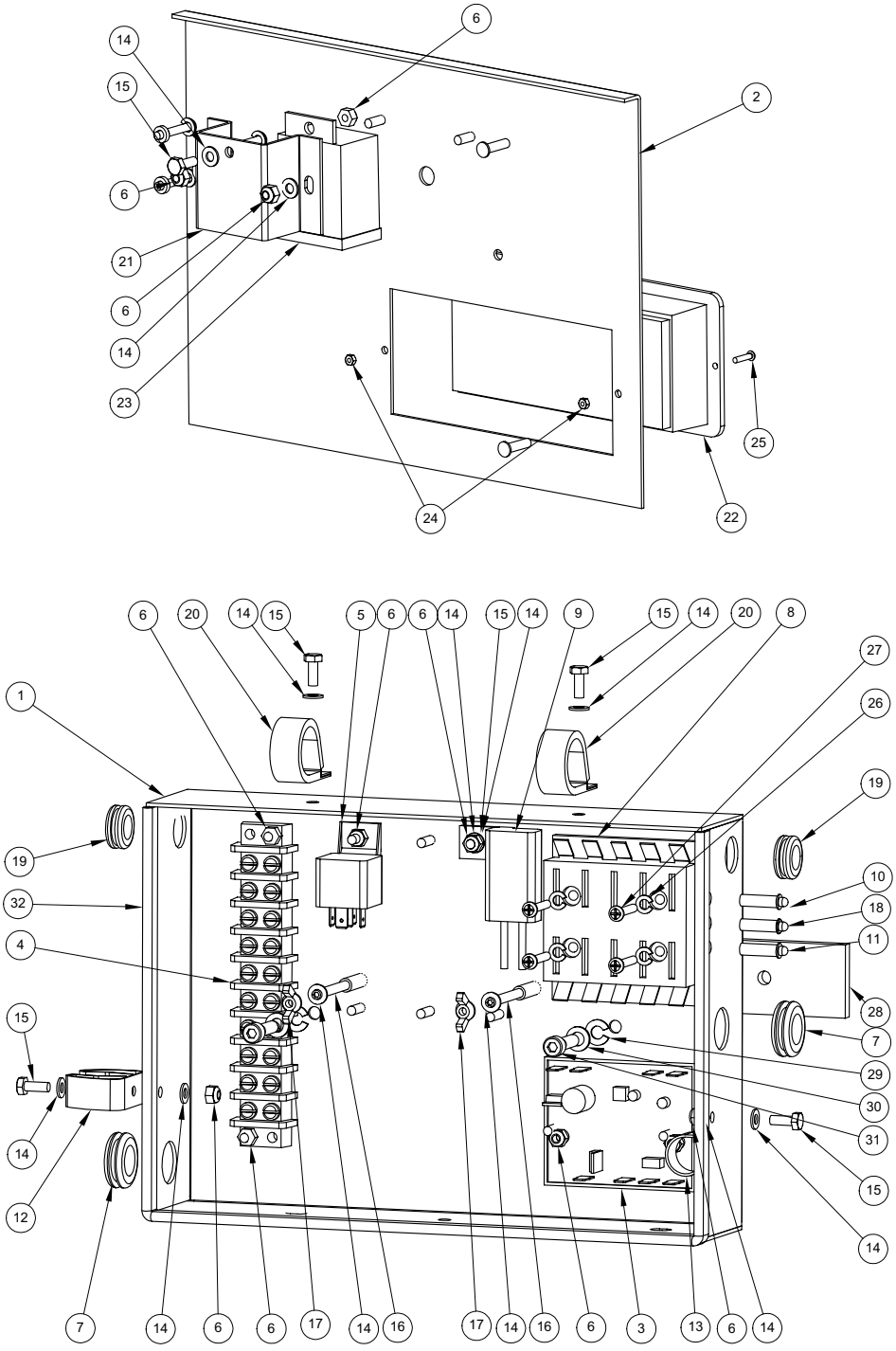
Figure 9-21 **Water Box Assembly**
C-5045 Rev A



Water Box Assembly Parts List

Item	Part Number	Description	Qty
1	000-159-105	Tank, Poly Water Box	1
2	000-041-237	Cover, Water Box 4"	1
3	000-052-155	Tee, 3/16" Plastic Vacuum Insert	1
4	000-157-031	Switch, Side Mount w/ Bulkhead Fitting	1
5	000-169-167	Valve, Mechanical Incoming Water - Water Box	1
6	000-143-314	Screw, #8 x 1/2" Lg. Pan Head	6
7	000-052-105	Insert, #68 (3/8" NPT x 1/2" Barb)	1
8	000-174-063	Washer, 1.5" O.D. x 1.073" I.D. x 0.075" Thk.	2
9	000-057-052	Gasket, 1" Garden Hose	1
10	000-005-007	Float, Water Box	1
11	000-143-336	Screw, #10-32UNF x 0.25" Lg. Pan Head Phillips	1
12	000-052-086	Elbow, 3/8" NPT Street	1
13	000-052-099	Insert, #26 (1/8" NPT x 3/8" Barb)	1
14	000-068-326	Hose, 3/8" Clear w/ Braid Solution	1
15	000-033-005	Clamp, Size #5 Hose	1

Figure 9-22 **Electrical Control Panel Assembly**
C-5344 Rev B



Electrical Control Panel Assembly Parts List

Item	Part Number	Description	Qty
1	000-100-113	Panel, Electrical Control - Boxxer 421	1
2	000-041-396	Cover, Electrical Panel - CM402LP	1
3	000-074-125	Controller, Temp. Single Analog RTD Input	1
4	000-012-010	Block, Terminal 10 Post	1
5	000-157-022	Switch, Relay	1
6	000-094-034	Nut, #10-24UNC Nylock	11
7	000-060-002	Grommet, Large Wiring	2
8	000-056-020	Fuse Panel	1
9	000-056-006	Fuse Holder, Inline Weather Proof	1
10	000-084-010	Light, Green Led Indicator Mini	1
11	000-084-011	Light, Red Led Indicator Mini	1
12	000-033-066	Clamp, 3/4" Spring	1
13	000-033-023	Clamp, 3/4" Nylon Hose	1
14	000-174-001	Washer, #10 Flat	13
15	000-143-126	Screw, #10-24UNC x 0.50" Lg. Hex Head	6
16	000-156-030	Stud, #10-32UNF x 2" Lg. Boxxer Elec. Panel Cover	2
17	000-094-108	Nut, #10-32UNF Wing	2
18	000-084-012	Light, Yellow Led Indicator Mini	1
19	000-060-009	Grommet, 1/2" I.D. w/ 3/32" Groove	2
20	000-033-057	Clamp, 1" Cushion Loop	2
21	000-015-817	Bracket, Alarm Module Mounting - CM402LP	1
22	000-149-565	Sensor, CO Propane Monitor	1
23	000-074-151	Module, Hi Emissions Warning Light - CM402LP	1
24	000-094-044	Nut, #4-40UNC Hex	2
25	000-143-195	Screw, #4-40UNC x 0.50" Lg. Round Head Phillips	2
26	000-174-014	Washer, #10 Lock	4
27	000-143-545	Screw, #8-32UNC x 1.00" Lg. Phillips Head	4
28	000-154-111	Spacer, Electrical Panel - Boxxer 421	1
29	000-174-019	Washer, 1/4" Lock	2
30	000-174-003	Washer, 1/4" Flat	2
31	000-143-080	Screw, 1/4"-20UNC x 1.00" Lg. Socket Head	2
32	000-131-027	Trimlok, 3/8" Wrinkled	1

Figure 9-23 **Tank Assembly - Rear View**
D-5215 Rev C

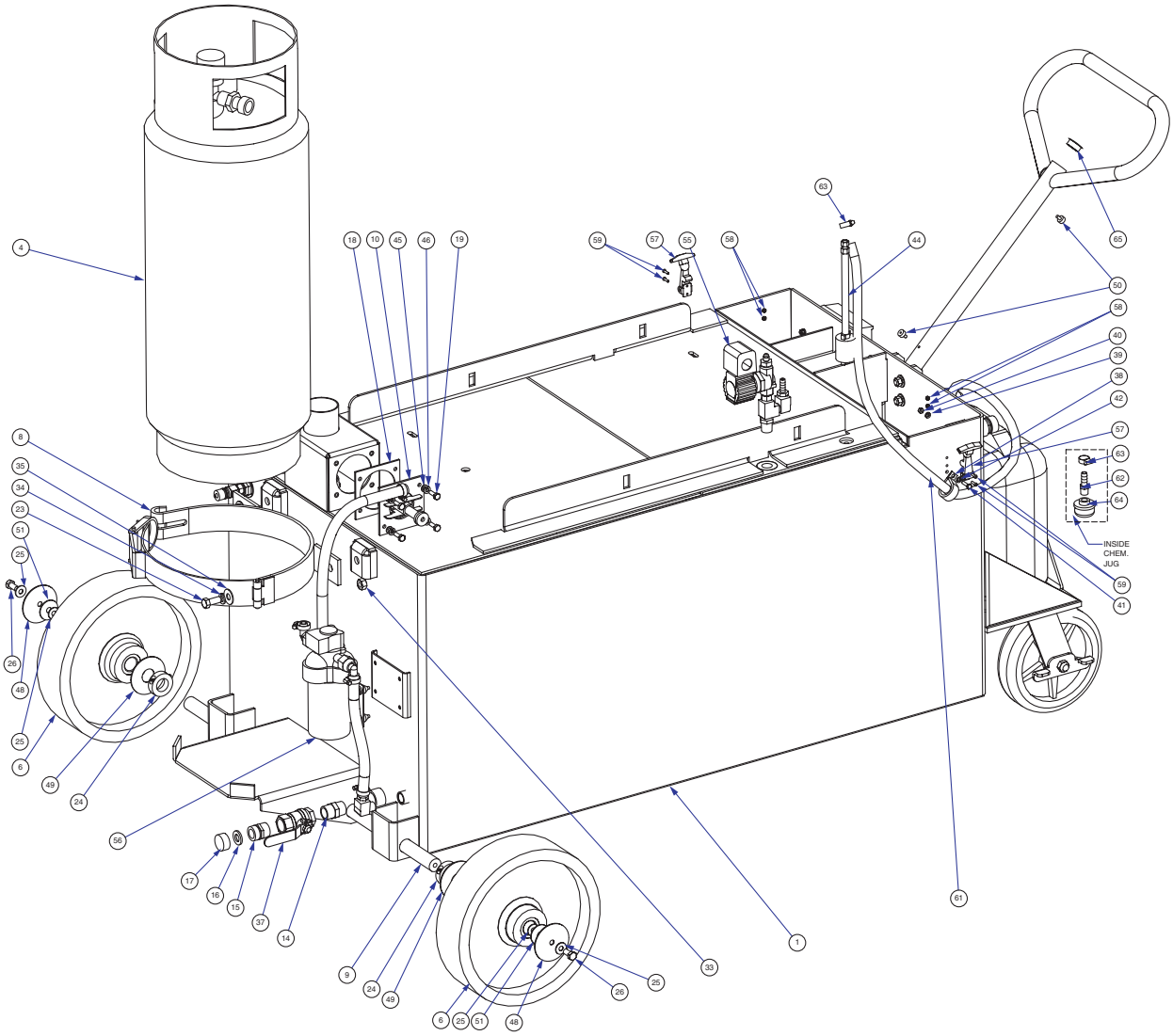
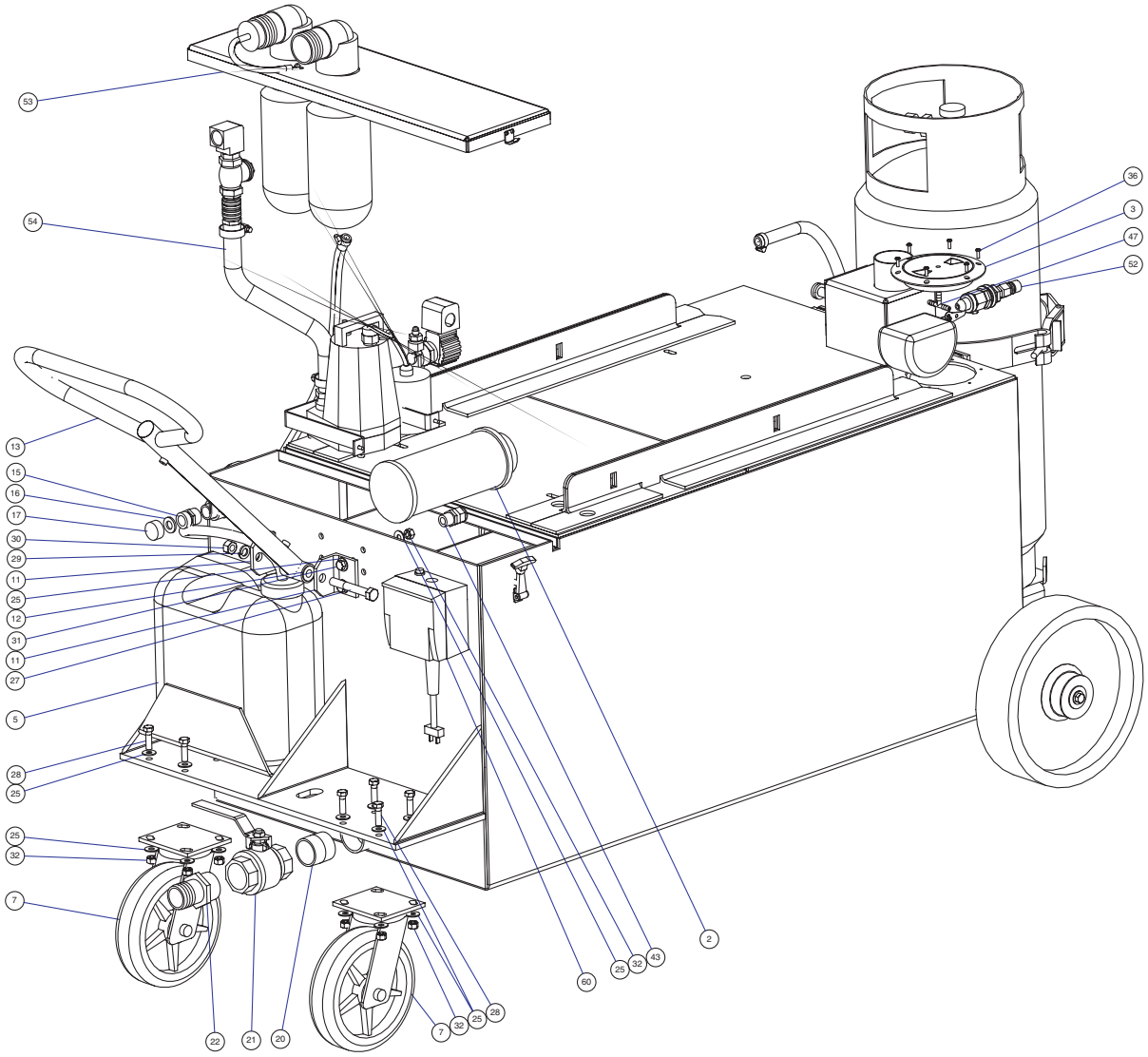


Figure 9-24 **Tank Assembly - Front View**
D-5215 Rev C



Tank Assembly Parts List

Item	Part Number	Description	Qty
1	000-159-082	Tank, Weldment - Recovery Tank - CM402LP	1
2	000-049-008	Filter, 2-1/2" Recovery Tank - CDS 4.6/Boxxer 421	1
3	000-041-365	Cover, 4" Round Poly Water Box	1
4	000-159-108	Tank, 40 Lbs. Propane	1
5	000-159-022	Jug, 2-1/2 Gallon Chemical	1

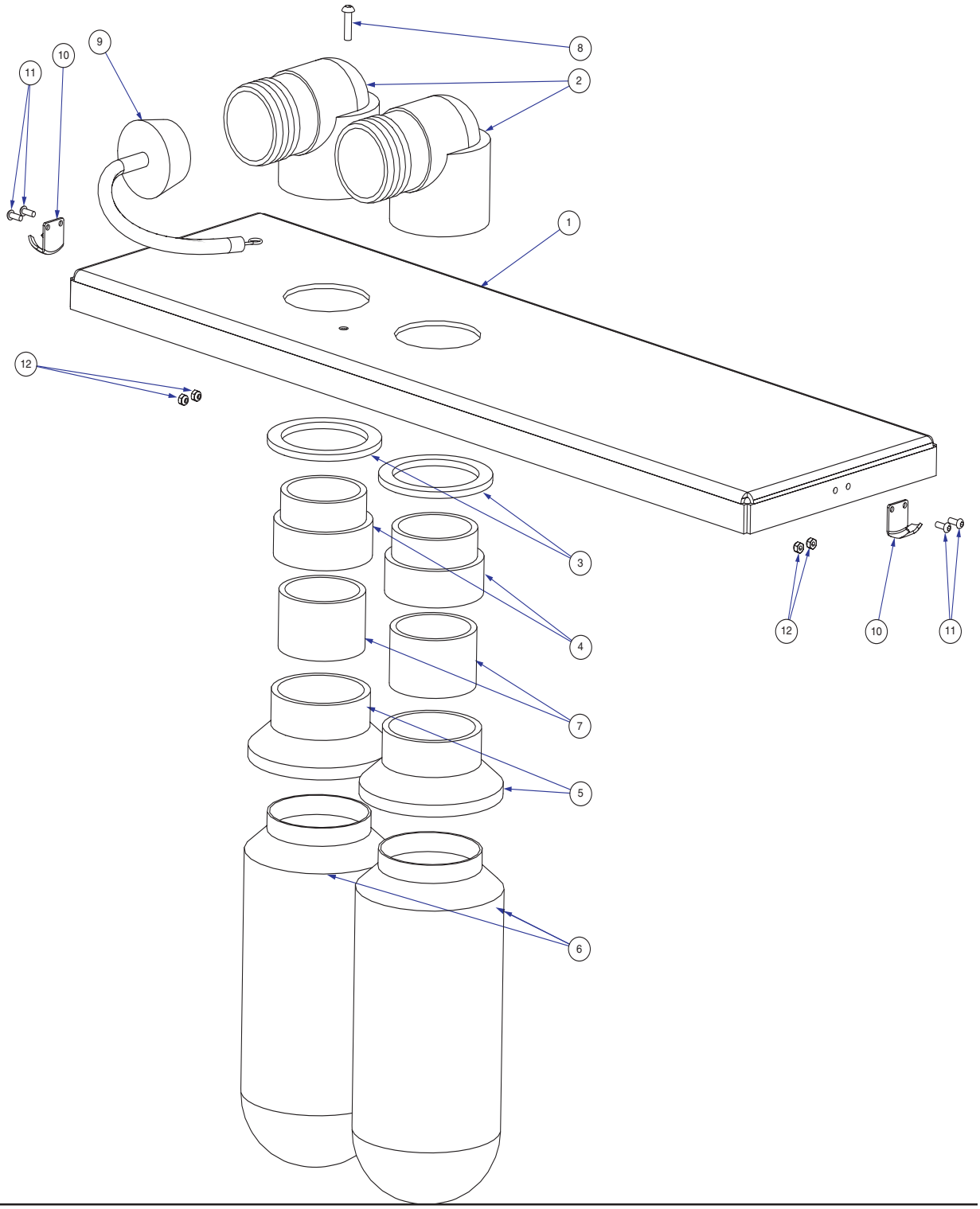
Tank Assembly Parts List

Item	Part Number	Description	Qty
6	000-177-032	Wheel, 12" x 3" x 1" Bore N/S Steel Hub - CM402LP	2
7	000-177-030	Caster, 8" Wheel Lock - CM402LP	2
8	000-033-127	Strap, Propane Tank Modified - CM402LP	1
9	000-141-041	Axil, Tank - CM402LP	1
10	Fig. 9-31	Vacuum Relief Valve Assembly	1
11	000-015-815	Bracket, Handle Mounting - CM402LP	2
12	000-154-121	Spacer, 1" O.D. x 0.50" I.D. x 2.13" Lg. Handle - CM40	1
13	000-061-133	Handle, Weldment - CM402LP	1
14	000-052-330	Nipple, 3/4" NPT Hex	1
15	000-052-281	Nipple, 3/4" NPT x 3/4" Male Garden Hose	2
16	000-057-055	Gasket, Garden Hose	2
17	000-027-014	Cap, Garden Hose	2
18	000-057-178	Gasket, Vacuum Relief Plate	1
19	000-143-001	Screw, 1/4"-20UNC x 0.75" Lg. Hex Head	4
20	000-052-182	Nipple, 1-1/2" NPT Close Galvanized	1
21	000-169-022	Valve, 1-1/2" Full Port Ball	1
22	000-052-226	Insert,1-1/2" NPT x 1-1/2" Barb	1
23	000-143-026	Screw, 7/16"-14UNC x 1.00" Lg. Hex Head	2
24	000-020-012	Collar, Spitfire Engine Shaft - Double Screw Type	2
25	000-174-032	Washer, 3/8" Flat	28
26	000-143-017	Screw, 3/8"-16UNC x 0.75" Lg. Hex Head Grd. 8	2
27	000-143-155	Screw, 1/2"-13UNC x 3.50" Lg. Hex Head	1
28	000-143-019	Screw, 3/8"-16UNC x 1.25" Lg. Hex Head Grd 5 Zinc	8
29	000-174-023	Washer, 1/2" Lock	1
30	000-094-019	Nut, 1/2"-13UNC Hex	1
31	000-143-096	Screw, 3/8"-16UNC x 1.00" Lg. Hex Head	4
32	000-094-100	Nut, 3/8"-16UNC Hex Nylock	12
33	000-094-018	Nut, 7/16"-14UNC Hex	2
34	000-174-022	Washer, 7/16" Lock	2
35	000-174-006	Washer, 7/16" Flat	2

Tank Assembly Parts List

Item	Part Number	Description	Qty
36	000-143-314	Screw, #8 x 1/2" Lg. Pan Head	6
37	000-169-180	Valve, 3/4" FPT Full Port All	1
38	000-033-057	Clamp, 1" Cushion Loop	1
39	000-174-036	Washer, #10 Flat Rubber Backed	1
40	000-094-034	Nut, #10-24UNC Nylock	1
41	000-143-132	Screw, #10-24UNC x 0.75" Lg. Hex Head	1
42	000-174-001	Washer, #10 Flat	1
43	000-108-050	Protector, Electric Cord Lock Bulk Head Fitting	1
44	000-157-140	Switch, Multi Level Recovery Tank	1
45	000-174-003	Washer, 1/4" Flat	4
46	000-174-019	Washer, 1/4" Lock	4
47	000-052-156	Tee, 1/4" Plastic Vacuum Insert	1
48	000-174-101	Washer, 3/8" I.D. x 2.88" O.D. - CM402LP	2
49	000-174-102	Washer, 1.03" I.D. x 2.88" O.D. - CM402LP	2
50	000-108-115	Protector, 5/8" Bumper	2
51	000-174-013	Washer, 3/8" Fender	2
52	Fig. 9-30	Assembly, Fresh Water Float Valve - CM402LP	1
53	Fig. 9-25	Assembly, Recovery Tank Cover- CM402LP	1
54	Fig. 9-29	Assembly, APO Pump - CM402LP	1
55	Fig. 9-28	Assembly, Dump Solenoid - CM402LP	1
56	Fig. 9-27	Assembly, Fresh Water Pump - CM402LP	1
57	000-086-008	Latch, Bungie	2
58	000-094-063	Nut, #6-32UNC Nylock	4
59	000-143-539	Screw, #6-32UNC x 0.50" Lg. Button Head Allen	4
60	Fig. 9-26	Assembly, GFI Box - CM402LP	1
61	000-068-326	Hose, 3/8" I.D. Clear Braid	1
62	000-052-102	Insert, #46 (1/4" NPT x 3/8" Barb)	1
63	000-033-005	Clamp, Size #5 Hose	2
64	000-049-118	Filter, Chemical Inlet High Pressure	1
65	000-106-029	Plug, 1" Hole	1

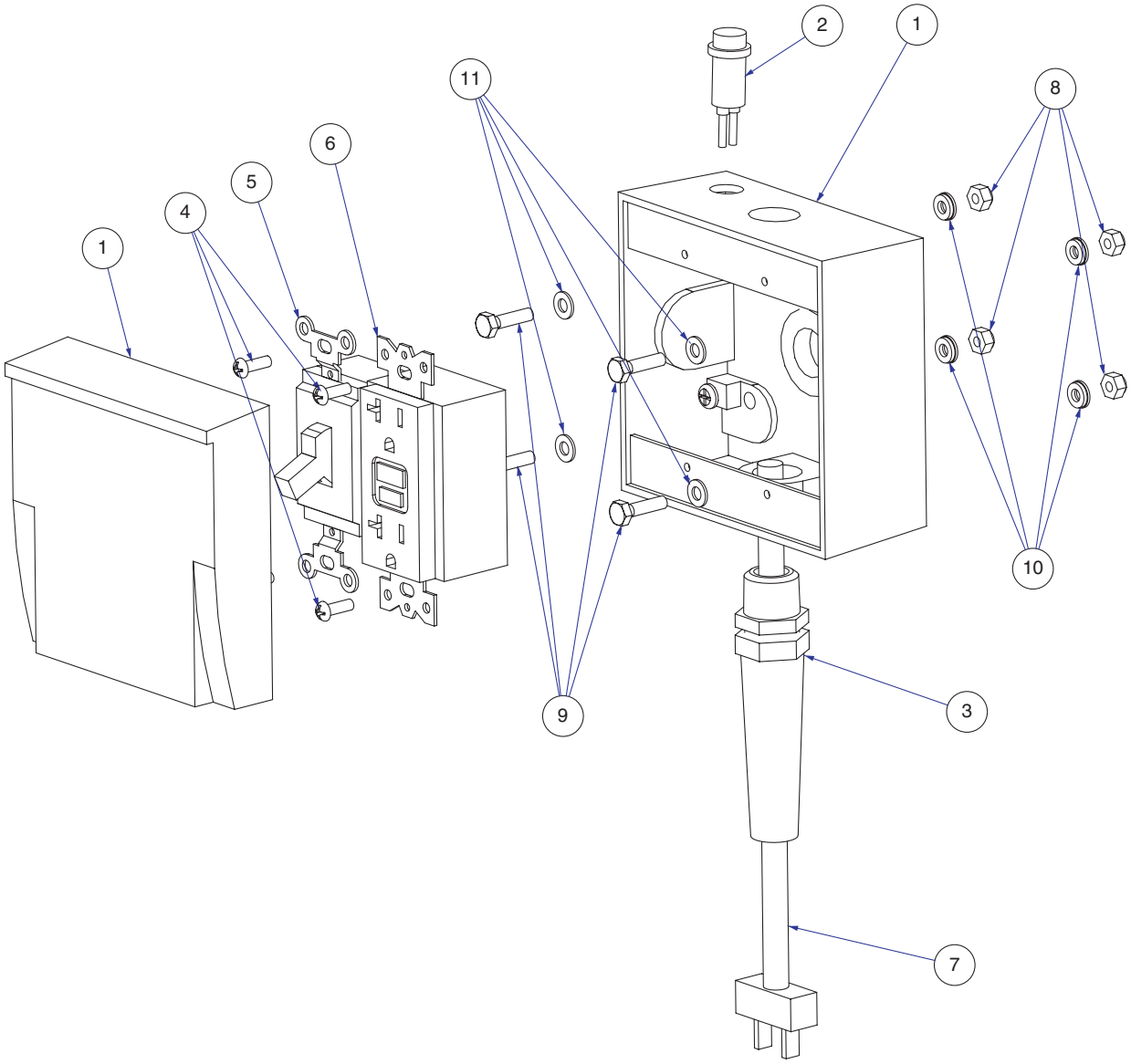
Figure 9-25 **Recovery Tank Cover Assembly**
C-5540 Rev A



Recovery Tank Cover Assembly Parts List

Item	Part Number	Description	Qty
1	000-041-395	Cover, Tank - Weldment - CM402LP	1
2	000-052-222	Elbow, 2" Barb x 2" FPT	2
3	000-057-015	Gasket, 1-1/2" Bulkhead Fitting	2
4	000-052-219	Adapter, 2" NPT x 2" F Slip	2
5	000-052-708	Adapter, 3" F Slip x 2" F Slip - Modified	2
6	000-049-030	Filter Bag, 92+Truck Mount	2
7	000-125-052	Tube, 2" Pvc x 1.50" Lg. Filter Bag Adapter Sleeve	2
8	000-143-168	Screw, #10-24UNC x 0.75" Lg.	1
9	000-078-039	Vacuum Inlet Stopper Assembly - Recovery Tank	1
10	000-086-008	Latch, Bungie - Strike	2
11	000-143-165	Screw, #6-32UNC x 3/8" Lg. Pan Head	4
12	000-094-063	Nut, #6-32UNC Nylock	4

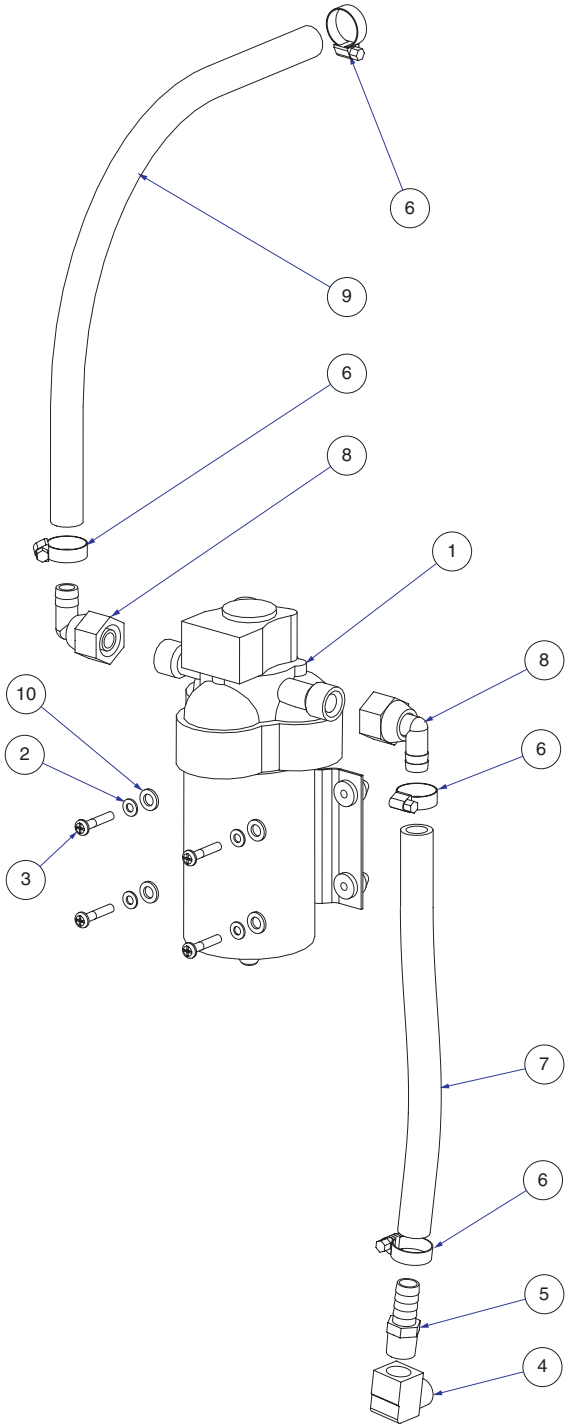
Figure 9-26 **GFI Box Assembly**
C-5550 Rev -



GFI Box Assembly Parts List

Item	Part Number	Description	Qty
1	000-013-056	Box, Electrical w/ Cover - Modified - CM402LP APO	1
2	000-084-100	Lamp, 110V Vacuum Red Pilot	1
3	000-108-012	Protector, Power Cord Relief Grip	1
4	000-143-050	Screw, #8-32UNC x 0.50" Lg. Round Head Phillips	4
5	000-157-146	Switch, APO On/Off CM402LP	1
6	000-134-011	Receptacle, GFI CM402LP Apo	1
7	000-178-046	Cord, 14/3 x 31" Lg. Gray - Modified	1
8	000-094-034	Nut, #10-24UNC Nylock	4
9	000-143-132	Screw, #10-24UNC x 0.75" Lg. Hex Head	4
10	000-174-036	Washer, #10 Flat Rubber Backed	4
11	000-174-001	Washer, #10 Flat	4

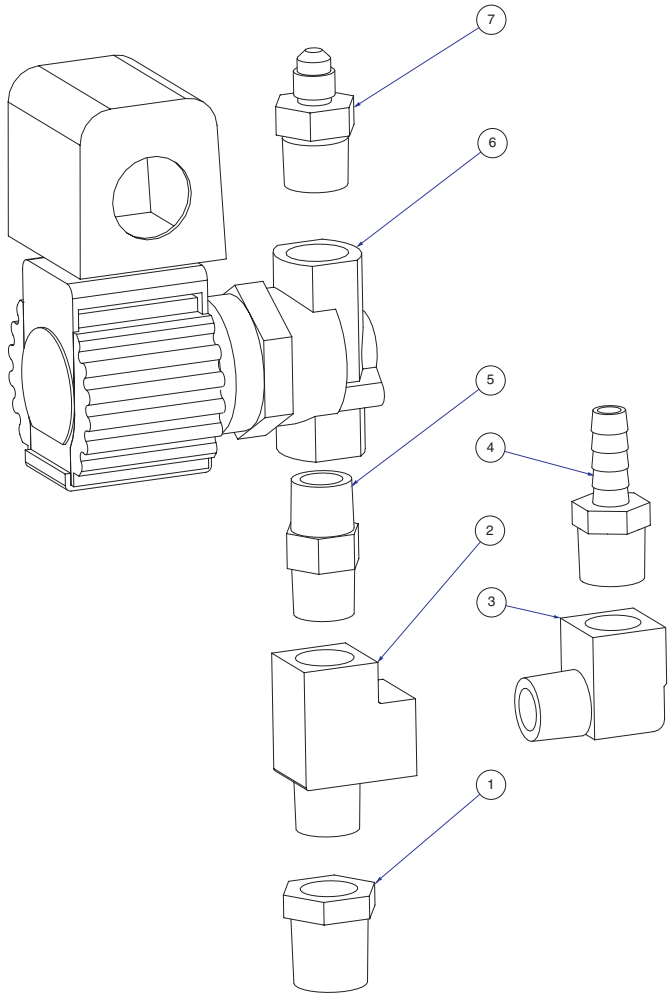
Figure 9-27 **Fresh Water Pump Assembly**
C-5544 Rev A



Fresh Water Pump Assembly Parts List

Item	Part Number	Description	Qty
1	000-111-010	Pump, 35 PSI Elect. Pump In w/ Male Inlet/Outlet Thrds	1
2	000-174-001	Washer, #10 Flat	4
3	000-143-534	Screw, #10-24UNC x 1.00" Lg. Pan Head Phillips	4
4	000-052-086	Elbow, 3/8" NPT Street	1
5	000-052-105	Insert, #68 (3/8" NPT x 1/2" Barb)	1
6	000-033-004	Clamp, Size #6	4
7	000-068-327	Hose, 1/2" Clear Braid	1
8	000-052-312	Insert,1/2" x 90 Degree Plastic Swivel	2
9	000-068-018	Hose, 1/2" I.D. Black	1
10	000-174-003	Washer, 1/4" Flat	4

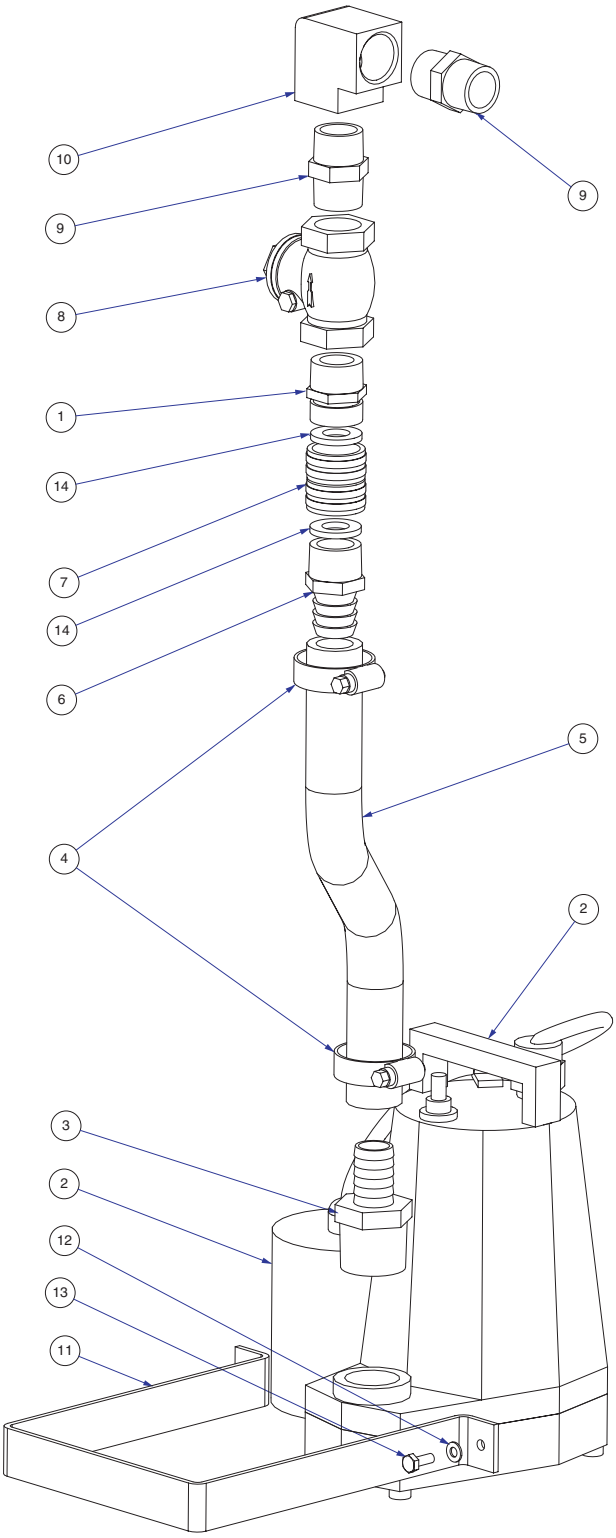
Figure 9-28 **Dump Solenoid Assembly**
C-5543 Rev -



Dump Solenoid Assembly Parts List

Item	Part Number	Description	Qty
1	000-052-064	Bushing, 1/2" NPT x 3/8" FPT	1
2	000-052-023	Tee, 3/8" NPT Male Street	1
3	000-052-086	Elbow, 3/8" NPT Street	1
4	000-052-104	Insert, #66 (3/8" NPT x 3/8" Barb)	1
5	000-052-074	Nipple, 3/8" NPT Hex	1
6	000-169-082	Valve, 12 Volt Solenoid 1200 PSI	1
7	000-052-662	Nipple, 3/8" NPT x 1/4" M SAE	1

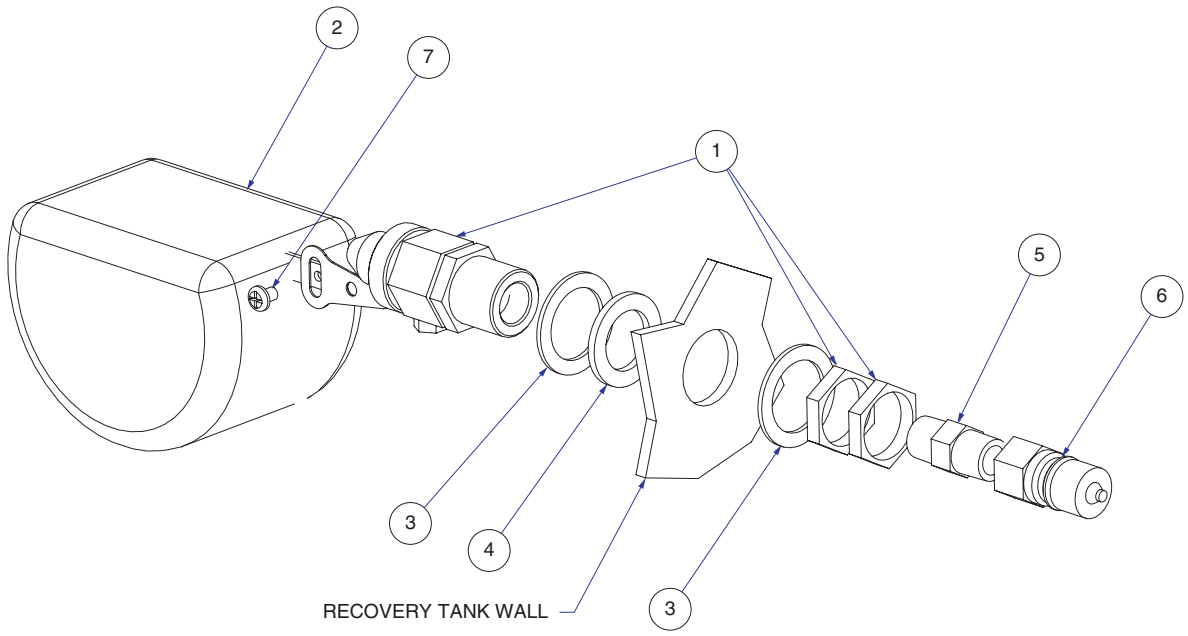
Figure 9-29 **APO Pump Assembly**
C-5542 Rev A



APO Pump Assembly Parts List

Item	Part Number	Description	Qty
1	000-052-281	Nipple, 3/4" NPT x 3/4" Male Garden Hose	1
2	000-111-160	Pump, Little Giant 115V APO	1
3	000-052-654	Insert, #1612 (1" NPT x 3/4" Barb)	1
4	000-033-020	Clamp, Size #16	2
5	000-068-004	Hose, 3/4" I.D. Steam	1
6	000-052-338	Insert, #1212 (3/4" NPT x 3/4" Barb)	1
7	000-052-244	Swivel, 3/4" Female Garden x 3/4" Female Garden	1
8	000-169-009	Valve, 3/4" FPT Swing Check	1
9	000-052-330	Nipple, 3/4" NPT Hex	2
10	000-052-345	Elbow, 3/4" FPT x 3/4" FPT	1
11	000-015-818	Bracket, Apo Holding - CM402LP	1
12	000-174-001	Washer, #10 Flat	2
13	000-143-126	Screw, #10-24UNC x 0.50" Lg. Hex Head	2
14	000-057-055	Gasket, Garden Hose	2

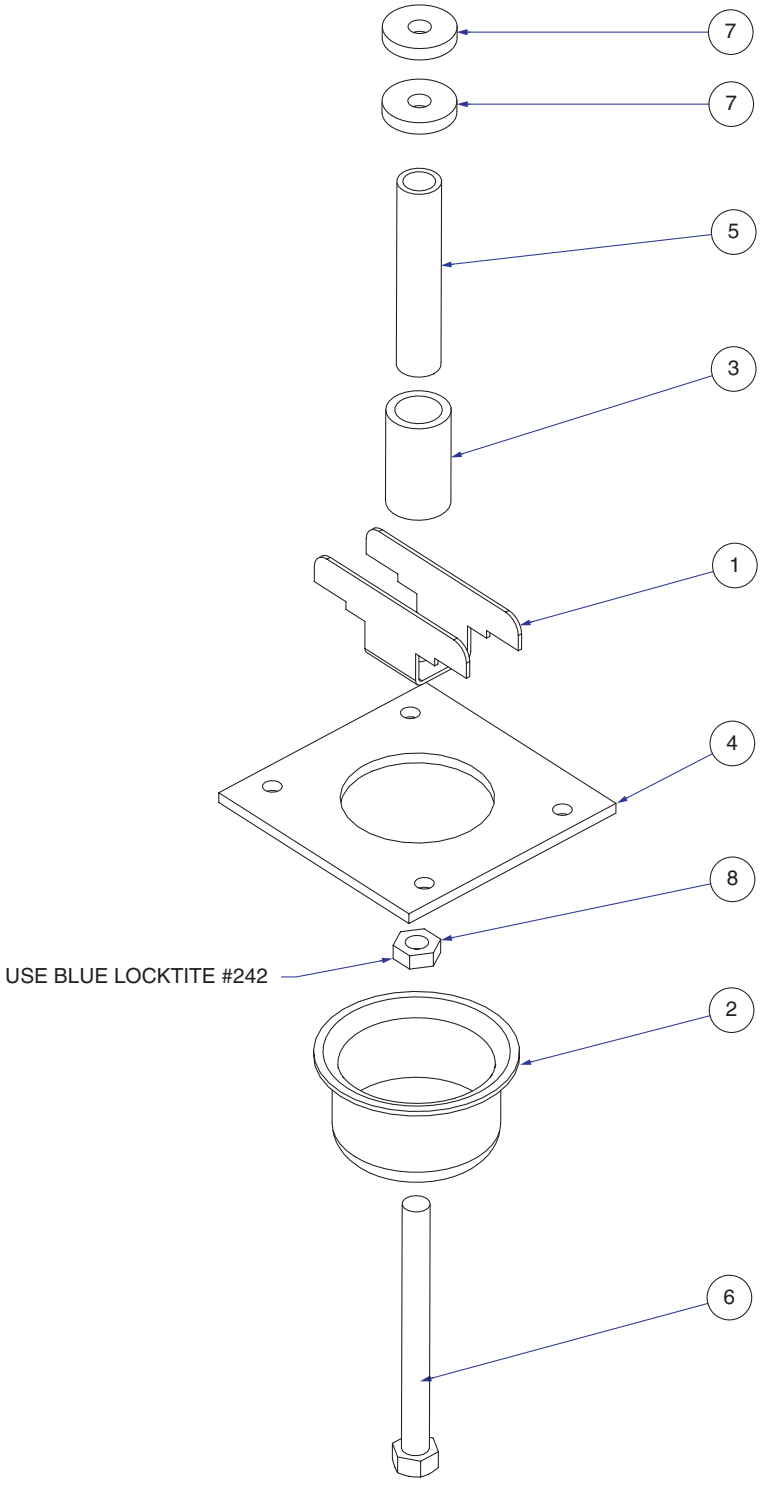
Figure 9-30 **Fresh Water Float Assembly**
C-5541 Rev -



Fresh Water Float Assembly Parts List

Item	Part Number	Description	Qty
1	000-169-167	Valve, Mechanical Incoming Water - Water Box	1
2	000-005-007	Float, Water Box	1
3	000-174-063	Washer, 1.5" O.D. x 1.073" I.D. x 0.075" Thk.	2
4	000-057-052	Gasket, 1" Garden Hose	1
5	000-052-074	Nipple, 3/8" NPT Hex	1
6	000-052-052	Quick Connect, 660 Male w/ Viton Standard	1
7	000-143-336	Screw, #10-32UNF x 0.25" Lg. Pan Head Phillips	1

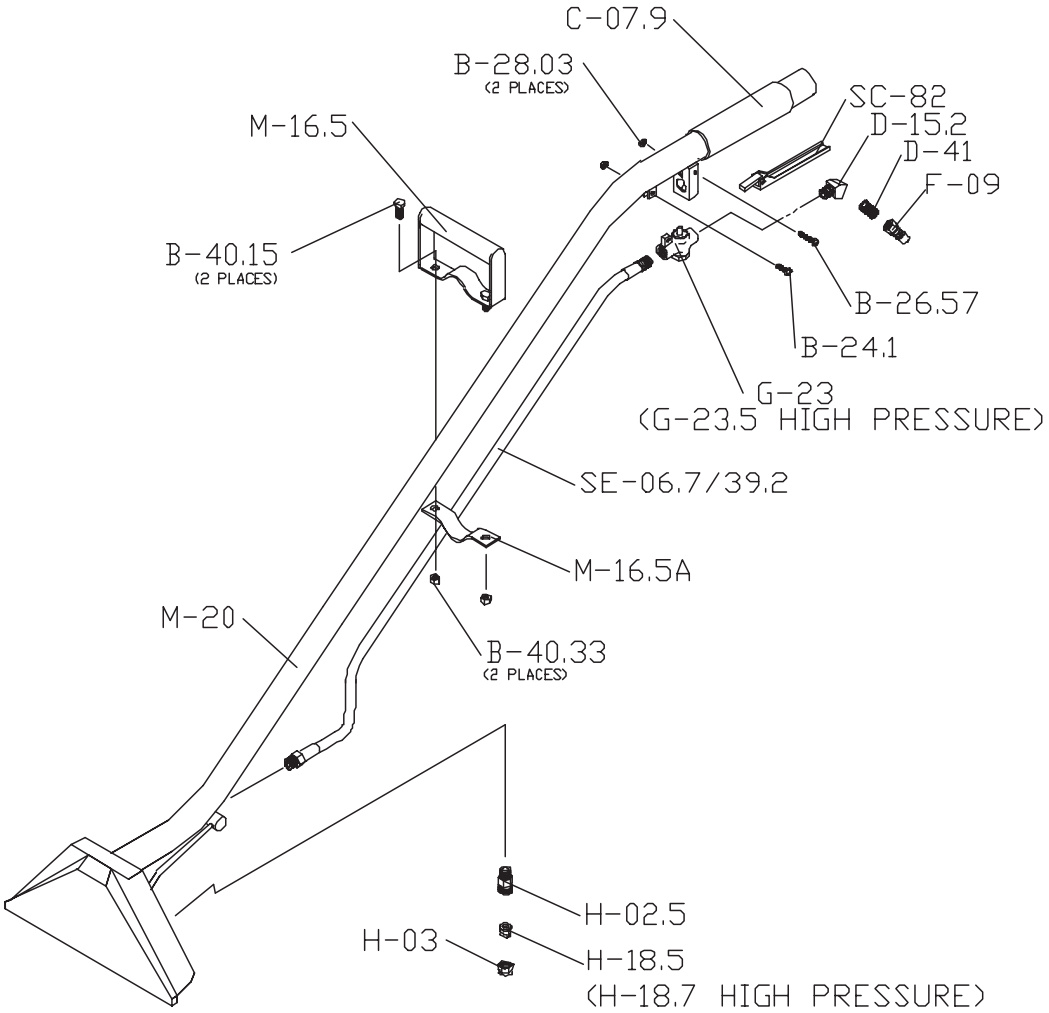
Figure 9-31 **Vacuum Relief Valve Assembly**
C-4237 Rev B



Vacuum Relief Valve Assembly Parts List

Item	Part Number	Description	Qty
1	000-015-182	Bracket, Vacuum Relief Valve	1
2	000-027-032	Cap, Vacuum Releif Valve	1
3	000-125-111	Pipe, Vacuum Relief Spring Guide	1
4	000-105-067	Plate, Vacuum Relief Valve Mounting	1
5	000-155-026	Spring, Vacuum Relief	1
6	000-143-198	Screw, 3/8"-16UNC x 4" Lg. Hex Head Full Thread	1
7	000-094-077	Nut, 3/8"-16UNC x 1.00" O.D. Knurled	2
8	000-094-101	Nut, 3/8"-16UNC Hex Jam	1

Figure 9-31 **Cleaning Wand Assembly**



PART #	DESCRIPTION	QTY.
B-24.1	10-32 X 3/4 PHXZINC	1
B-26.57	10-32 X 1 3/8 PHX ZINC	1
B-28.03	NUT, 10-32 NYLOK ZINK	2
B-40.15	5/16-18 X 3/4 HEX CP	2
B-40.33	NUT 5/16-18 NYLOCK, ZINC	2
C-07.9	GRIP, FLRTOOL 1 1/2 X 6	1
D-15.2	45 ST ELBOW 1/4 NPT	1
D-41	NIPPLE, 1/4 NPT CLOSE BR	1
F-09	Q/C 1/4" PLUG BR SHUT OFF	1
G-23	VALVE,KNGSTN STD "S" BEND	1

PART #	DESCRIPTION	QTY.
G-23.5	VALVE,KNSTN HP "S" BEND	1
H-02.5	BODY, TEE JET 1/4 BRASS	2
H-03	CAP NUT, TEE JET BRASS	2
H-18.5	JET, 11003 TEE BRASS	2
H-18.7	JET, 110015 E TEE BRASS	2
M-16.5	HOE HANDLE,ECONO FLRTL	1
M-16.5 A	"U"CLAMP,SUPP HOE HNDL EC	1
M-20	WAND,"S"BND FLTL COM W/HD	1
SC-82	TRIGGER,COMP KNGSTN VALVE	1
SE-06.7/39.2	HOSE,1/4"SOL BLU X39.25DB	1

Vacuum System

CleanMaster 402
Section 10-1

The vacuum pump in this machine is commonly referred to as a 'positive displacement lobe' type blower. The performance and life of this unit is greatly dependent on the care and proper maintenance it receives.

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

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

⚠ CAUTION

Caution should be used when machine is being run for test purposes and the vacuum inlet on top of the machine is open.

To protect the vacuum blower from overloading and damaging itself, there is a vacuum relief system installed on the vacuum tank. When the vacuum tank inlet is completely sealed off, a maximum of 14 HG will be attained.

At the end of each day, an oil based lubricant should be sprayed into the blower lubrication port before shutting down the machine. Lubricate the vacuum blower *daily* to prevent rust deposits and moisture that will decrease the life of the vacuum blower.

⚠ CAUTION

Foam passing through the blower could lead to serious problems.
It is important to keep the vacuum tank foam free.

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

⚠ CAUTION

The vacuum tank is protected from overflowing by a vacuum tank float kill switch. The switch is not activated by foam, only by liquid.

VACUUM TANK FILTER BAGS

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

Vacuum System Troubleshooting

1.0. Weak vacuum at wand. Gauge reads normal (10" to 12" with hoses & wand attached)

1.1. **Clogged vacuum hoses or wand tube**. Disconnect hoses and check carefully for an obstruction.

1.2. **Excessive length of hoses connected to machine**. Make sure machine is rated for the conditions under which it is being operated.

2.0. Vacuum gauge will not come up to 12" hg

2.1. **There is an air leak somewhere in the vacuum system**. Check vacuum relief valve for proper adjustment. Carefully check all vacuum hoses for a cut or break. Check recovery tank lid gasket. Make sure recovery tank drain valve is fully closed.

2.2. **The vacuum gauge is defective**. Test gauge and replace as necessary.

2.3. **Vacuum blower is turning too slowly**. Check engine RPM. Adjust as necessary.

3.0. Vacuum gauge reads too high with no hoses attached

3.1. **Stainless steel filter in recovery tank is clogged**. Remove and clean or replace as necessary.

3.2. **Hose from vacuum blower to recovery tank is collapsed internally.** Inspect and replace as necessary.

4.0. Noisy vacuum blower

4.1. **Vacuum blower is low on oil**. Inspect oil level and replenish as necessary. Note: Running vacuum blower low on oil can cause severe mechanical damage. If this situation occurs, it should be inspected by a qualified service technician.

4.2. **Vacuum blower has internal damage**. Refer to qualified service technician.

5.0. Vacuum Blower is locked and will not turn

5.1. **The machine has been unused for a period on time and the blower was not properly lubricated when it was shut down, causing rust to build up on internal surfaces**. Spray penetrating oil into blower inlet and let sit for at least one hour. Then *very carefully* use pipe wrench on outer diameter of pulley on blower shaft and attempt to free up blower. *Do not use wrench directly on blower shaft.* If unable to free up blower in this manner, refer to qualified service technician.

5.2. **There is internal damage to the blower impellers or gears**. Refer to qualified service technician.

Miscellaneous Troubleshooting

1.0. Water from exhaust

1.1. **The recovery tank has been filled with foam or overfilled with water**. Remove recovery tank lid and inspect. If full, drain tank then inspect high-level shutoff switch for proper operation. Clean or replace switch as necessary.

1.1.1. If foam is observed in recovery tank, use defoamer on carpet being cleaned.

1.2. **Condensation**. This will be more pronounced in cool weather and humid climates. Observe how long this condition persists after starting machine. If it is only until the machine warms up, it is normal.

1.3. **A heat exchanger is leaking**. Test heat exchanger for leaks. Repair or replace as necessary.

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Engine Troubleshooting

CleanMaster 402
Section 11-1

1.0. Will not turn over

1.1. **There is a loose or corroded battery terminal**. Clean and tighten the battery terminal connections.

1.2. **The battery is dead**. Recharge or replace the battery. Test the charging system. Repair as necessary. *WARNING: Do not attempt to jump-start this machine from a running vehicle. The amperage output from an automobile will damage the charging system of the truckmount.*

1.3. **The 25 amp main power fuse in the electrical panel has blown**. Inspect the wiring thoroughly to locate shorted or damaged wires.

1.4. **The vacuum blower has seized**. Attempt to turn the engine by hand. If it will not turn, refer to Vacuum section.

1.5. **The ignition switch is defective**. Test to see if there is 12 volts to the switch. If there is, but there is not 12 volts coming from the switch, replace the switch.

1.6. **There is a problem with the starter solenoid**. If there is 12 volts at the battery connection and at the key switch connection with the key in the start position but there is not 12 volts on the starter connection of the solenoid, replace the solenoid.

1.7. **The starter motor is defective**. Check to see if the engine can be turned over by hand. If it can and if there is 12 volts from the starter solenoid to the starter, replace the starter.

1.8. **There is a mechanical problem with the engine**. If the engine can not be turned over by hand and the vacuum blower is not locked up, refer the engine to a qualified service technician to determine the cause of the problem.

2.0. Turns over but will not start. There *is no* spark

2.1. **The spark plugs are faulty.** Remove and inspect. Replace as necessary.

2.2. **The engine ignition system is malfunctioning**. Refer to a qualified engine service technician for inspection.

3.0. Turns over but will not start. There *is* spark

3.1. **Fuel is not reaching the carburetor inlet**. Check to make sure the propane tank valve is fully opened and the tank is full. Also make sure all propane quick-connectors are tight.

3.1.1. **The propane shutdown solenoid is faulty**. Check for 12 volts and a ground at the solenoid. If 12 volts and a ground are present and propane is not flowing through the solenoid while the engine is being cranked over, replace the solenoid.

3.1.2. If 12 volts is not present at the propane shutoff solenoid while the engine is being cranked over, inspect the wiring from the solenoid back to the ignition switch, including the diode. Repair or replace as necessary.

3.2. **The spark plugs are dirty or worn**. Inspect and replace as necessary.

3.3. **There is a mechanical problem with the engine**. Have engine inspected by a qualified engine service technician.

4.0. Starts then dies immediately

4.1. **One of the engine kill switches is activated**. Inspect the machine to determine if one of the following conditions exists:

4.1.1. Is the recovery tank full? Is the water box empty? Is the engine oil low? Has the machine overheated? If one of the above conditions is observed, correct the condition and re-start the machine.

4.1.2. **Note:** If the machine has shut down due to the high temperature switch being activated, thoroughly inspect the machine to determine the cause of the overheating. See section IV, Heating System.

4.1.3. **Note:** If the machine has shut down due to the engine low oil pressure switch being activated and the engine oil level appears to be normal, make sure the oil filter is an original equipment Kawasaki part. Some after-market oil filters, although they may fit on the engine, do not have the correct by-pass pressure internally and can cause the oil pressure to be too low.

4.2. **One of the engine kill switches is faulty**. Disconnect one of the wires from each kill switch and attempt to start the machine. If the machine starts after a wire is removed, test the switch. Re place as necessary.

4.3. **The Carbon Monoxide detector has activated the engine shutdown function**. Temporarily disconnect the orange wire from the CO detector to the engine shutdown relay. *If the engine starts and runs with this wire disconnected, this indicates that the CO detector has determined that the Carbon Monoxide level in the general area of the machine location is dangerously high.* ***Do not run the machine again until the area has been thoroughly ventilated and the problem has been corrected****. Refer to a qualified service technician for diagnosis and repair.*

5.0. Will not come up to operating speed

5.1. **Throttle linkage is out of adjustment**. Inspect for broken or loose linkage. Repair or replace as necessary and adjust to proper RPM. Note: It is important to use an accurate tachometer to adjust engine RPM. Too high or too low will cause severe damage to machine components.

5.2. **The propane flow to the carburetor or regulator is impeded**. Check to see that the propane tank valve is fully open and that the screw-on quick connects for the propane lines are tight.

5.3. **There is excessive load on the engine due to the blower-to-recovery tank hose becoming delaminated**. Remove and inspect the inside of the hose. Replace as necessary.

5.4. **There is excessive back-pressure on the engine or blower exhaust**. Check for clogged blower heat exchanger.

6.0. Runs rough at medium or high speed

6.1. **One or both spark plugs are defective**. Remove and inspect spark plugs. Replace as necessary.

6.2. **A spark plug wire is loose at the spark plug or has been damaged**. Inspect wire. Replace wire and coil as necessary.

6.3. **The propane regulator is out of adjustment**. Refer to qualified service technician for diagnosis and adjustment.

6.4. **Low compression on one or both cylinders**. Check compression. If low, check valve adjustment. If incorrect, adjust to proper specs.

6.4.1. If adjustment is okay, there is a possibility of burned valves, burned head gasket or worn cylinders. Refer to qualified engine service technician.

6.5. **Poor spark on one or both cylinders**. The engine ignition system is faulty. Refer to qualified engine service technician.

7.0. Engine overheats

7.1. **Low engine oil level.** Check oil level and replenish as necessary.

7.2. **Engine RPM too high**. Check RPM with an accurate tachometer. Adjust as necessary.

7.3. **Restricted engine or blower exhaust**. Disassemble exhaust components to locate restriction. Repair as necessary.

7.4. **Poor ventilation in vehicle.** All cargo area doors must be open for proper ventilation. Roof vents are strongly recommended for machines that are operated in hot climates. Any item that might restrict air flow to the machine such as other equipment or a solid divider between the cargo and passenger areas should be moved or modified to permit proper air flow.

Figure 12-1 **Electrical Schematic**
D-5298 Rev A

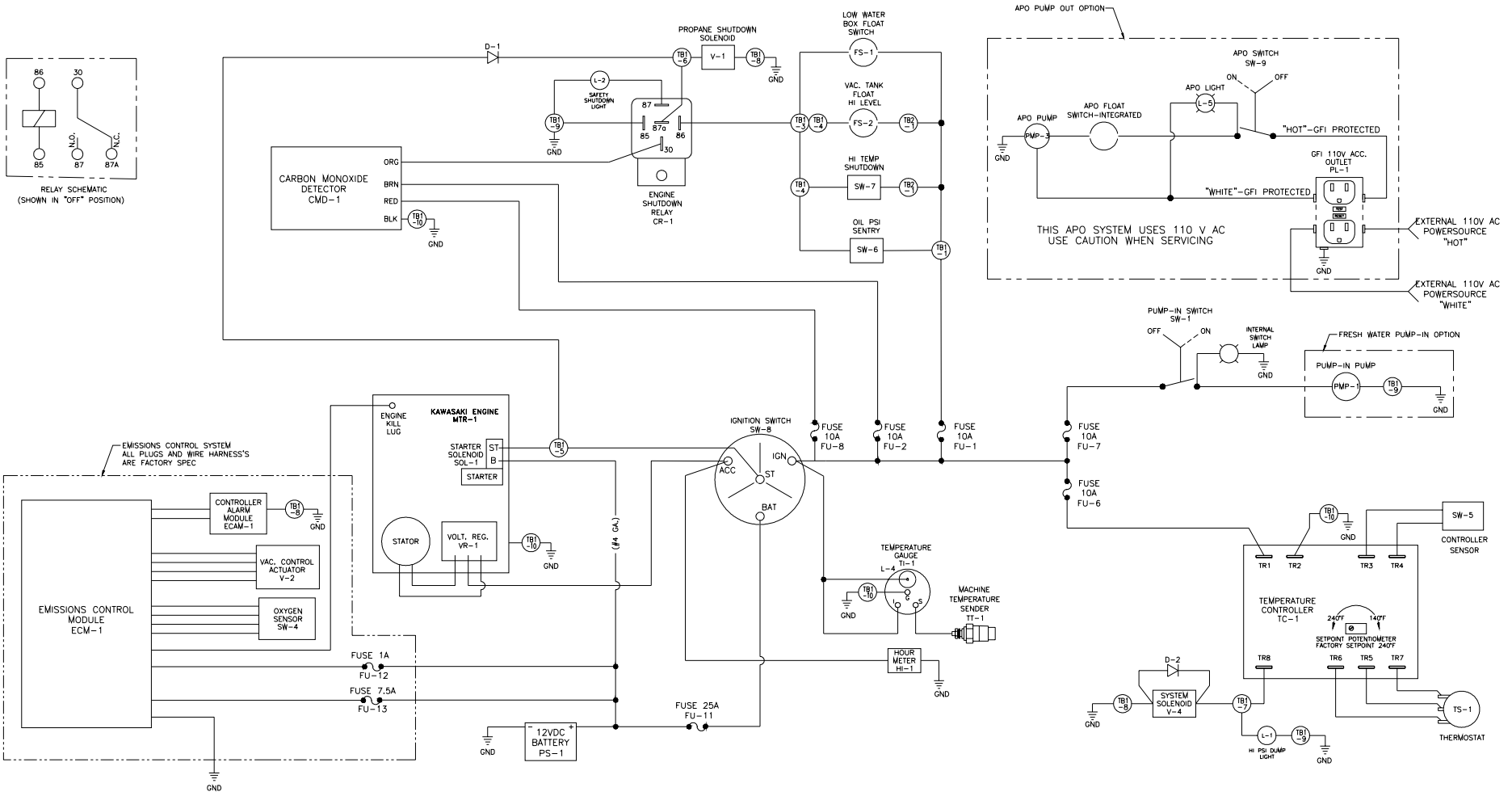


Figure 12-2 **Electrical Diagram**
D-5299 Rev A

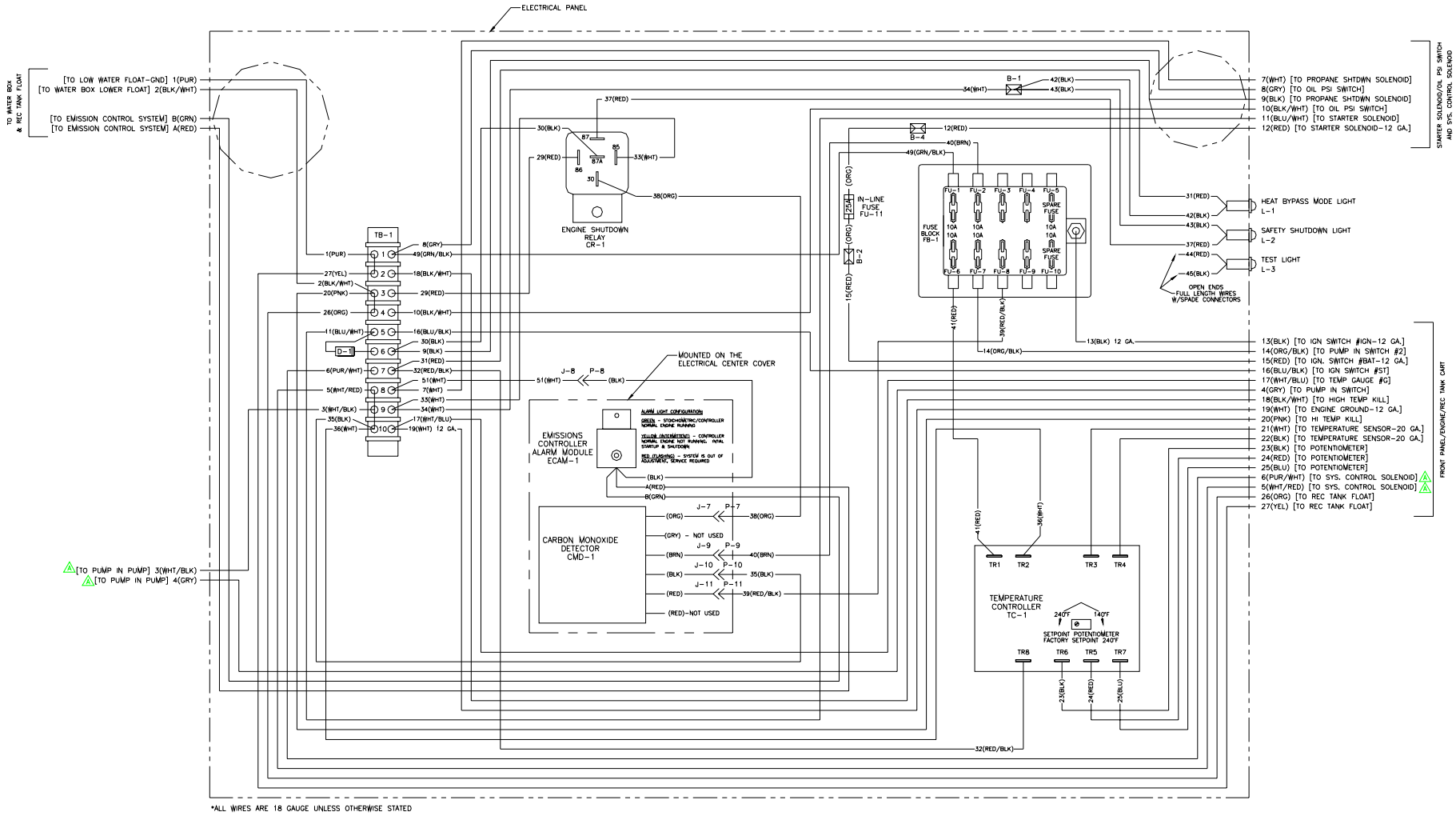


Figure 12-3 **Electrical Diagram**
D-5299 Rev A

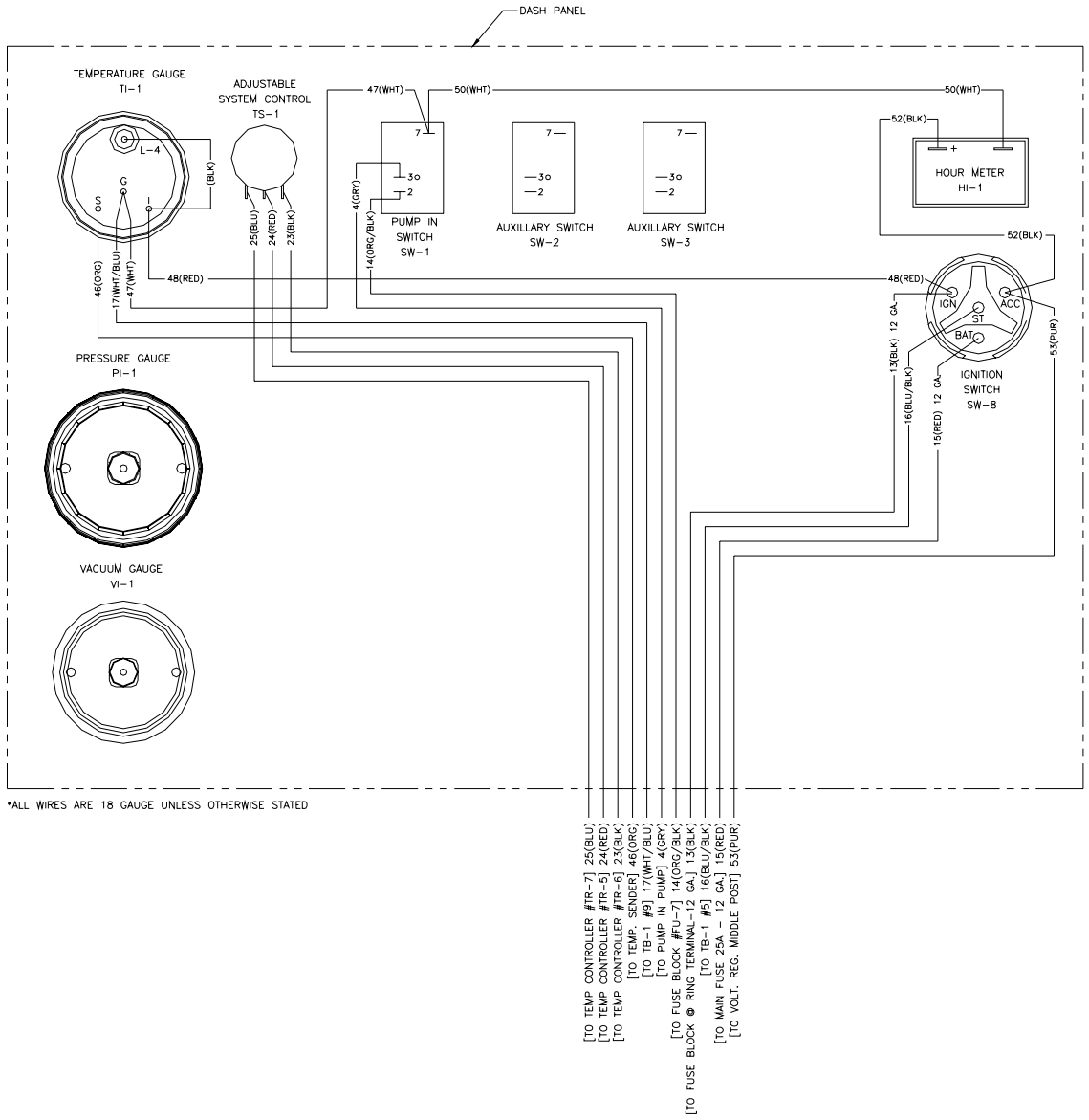
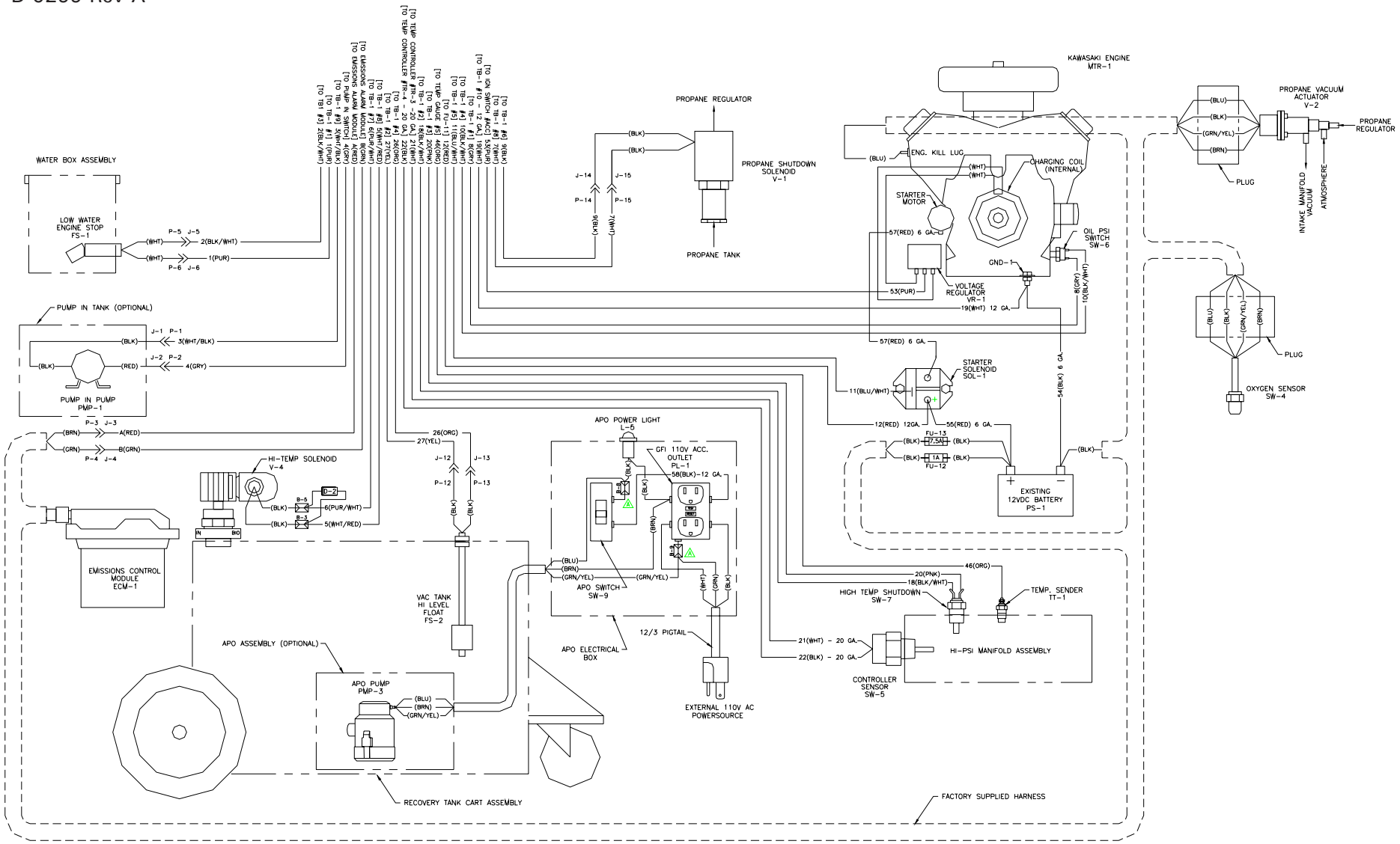


Figure 12-4 **Electrical Diagram**
D-5299 Rev A



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Machine Maintenance

CleanMaster 402

Section 13-1

To avoid costly repairs and down-time, it is imperative to develop and practice good maintenance procedures from the beginning. These procedures fall into daily, weekly, monthly and quarterly increments, and are outlined below. All recommended maintenance must be performed by competent service personnel.

Important: Record the date and machine hours on the maintenance log.

We have provided a maintenance log for your convenience at the end of this section. Records of maintenance must be kept and copies may be required to be furnished to HydraMaster before the warranty is honored. It is recommended that you affix a copy of the log on the vehicle door near your unit for convenience and to serve as a maintenance reminder.

OPERATIONAL MAINTENANCE

DAILY:

- Check engine oil level.
- Check high pressure pump oil. Add as necessary.
- Inspect garden hose screen. Clean as needed.
- Visually inspect machine for loose wires, oil leaks, water leaks, etc.
- Lubricate blower with an oil based lubricant through blower inlet.

WEEKLY:

- Inspect vacuum tank s/s filter and filter bag for tears, holes, etc. Clean, repair or replace as needed.
- One time change of oil and oil filter after first 20 hours of use.
- Check oil level in blower.
- Check drive system screws. Tighten as needed.
- Check pump drive belt for wear.

WEEKLY (cont.):

- Check pump pulleys.
- Check high pressure water lines for wear or chafing.
- Check all nuts and bolts. Tighten as needed.
- Inspect vacuum relief valve. Clean and lubricate as necessary.
- Clean vacuum tank thoroughly with high pressure washer.
- Check wiring for chafing.
- Flush water and chemical system with 50/50 white vinegar solution.
- Change engine oil (every 50 hrs.).

MONTHLY:

- Change oil filter (every other oil change).
- Check engine air cleaner filter. Clean as necessary.
- Remove pressure bypass valve piston plate. Grease plate. Reinstall.
- Check water level in battery. Clean connections as needed.

QUARTERLY:

- Check fuel lines.
- Clean and gap spark plugs.
- Check drive coupler for cracks or wear. Replace as necessary.
- Change oil in blower.
- Change pump oil.
- Grease blower bearing fittings.

500 HOURS:

- Replace plugs in the drive coupling, between the engine and the blower..

AS REQUIRED: DE-SCALING

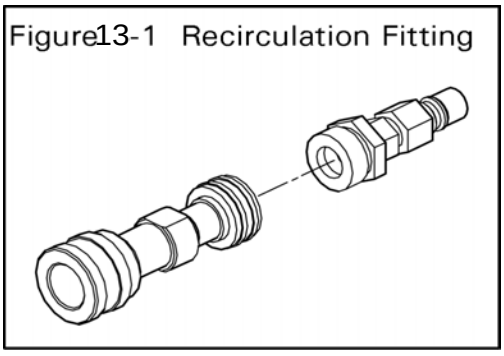
Scale deposits on the interior of the heating system can cause a noticeable loss in heating performance. Deposits of this kind result from hard water deposits, excessive chemical use, improper chemicals, etc. The frequency with which de-scaling procedures are required will vary. If your area has particularly hard water or you see evidence of deposits in the water system, you may have to de-scale monthly.

To de-scale your system, add an appropriate de-scaler chemical to your mix tank. Circulate it through the heating system. Let it stand. Flush and repeat as necessary. Clean all screens and strainers, and check them frequently following de-scaling.

NOTE: If you are using T.M. DeScaler through the flow meter, make sure to run clean water through the flow meter after this procedure.

To de-scale using the recirculation kit (part no. 078-058), start with an empty mix tank. Fill a third of the mix tank with T.M. DeScaler. Follow the recommendations on the T.M. DeScaler label for proportions. Verify that the upper float is not lying horizontal, but floats below.

Figure 13-1 Recirculation Fitting



Attach the recirculation fitting provided in the kit to the garden hose quick connect (see illustration) and this combination to the front of the machine.

Attach one section of female/female solution hose to the outgoing solution fitting on the front of the machine and the other end to the garden hose and recirculation fitting combination that is attached to the front of the machine (or as many sections as you want, if you wish to de-scale your hoses).

Start the machine and allow it to run for three to five minutes. Do not leave the T.M. DeScaler solution in the system. Flush the system with clean water and turn the machine OFF.

OVERALL MACHINE MAINTENANCE

Maintaining the original appearance of your unit is important for two reasons:

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

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

The following maintenance is recommended by the manufacturer at the frequency indicated.

AFTER EACH JOB

- Check recovery tank, s/s filter and filter bag as required.

DAILY

- Wipe machine down thoroughly with a damp cloth.
- Flush recovery tank out thoroughly.
- Empty filter bag and inspect for rips, tears, etc. Replace as needed.
- Remove, thoroughly clean and reinstall stainless steel filter screen in recovery tank.
- Inspect and clean vacuum slot on cleaning wand.
- Check wand head for sharp edges that could tear carpet. File down as needed.
- Clean wand to maintain original appearance.
- Wipe down vacuum and high pressure hoses as needed.
- Visually inspect hoses for cuts, etc.

WEEKLY

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

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CM402LP MAINTENANCE LOG

MAX HRS	DAILY SERVICE	OIL RECOMMENDATIONS	
8	ENGINE OIL - check	BLOWER	40 weight non-detergent
8	PUMP OIL - check	PUMP	40 weight non-detergent
8	GARDEN HOSE SCREEN - clean	ENGINE	30 weight motor oil
8	MACHINE - general inspection		NOTE: Overhead valve engines can use multi-viscosity oil, but will experience increased oil consumption
8	VACUUM TANK FILTER BAG - clean		
8	BLOWER INLET - spray with lubricant		

	WEEKLY SERVICE	DATE & HOURS						
20	OIL - change with filter		Break-in. One time only.					
25	BLOWER - check oil level							
25	DRIVE SYSTEM - tighten screws							
25	BELTS & PULLEYS - check for wear							
25	HIGH PRESSURE LINES - check for chafing							
25	NUTS & BOLTS - check tightness							
25	"Y" FILTER - check and clean							
25	ORIFICE - inspect							
25	VAC. RELIEF VALVE - inspect, clean, lube							
25	VACUUM TANK - clean							
25	WIRING - check for chafing							
25	CHEMICAL SYSTEM - flush with vinegar							
50	ENGINE OIL - change							

	MONTHLY SERVICE							
100	OIL FILTER - change							
100	ENGINE AIR CLEANER - clean							
100	BYPASS VALVE - grease piston and o-rings							
100	BATTERY WATER LEVELS - check							

	QUARTERLY SERVICE (3 MONTHS)							
300	FUEL LINES - check							
300	SPARK PLUGS - clean and gap							
300	DRIVE COUPLER - check for wear							
400	BLOWER - change							
400	BLOWER - grease bearing							
400	PUMP OIL - change							
1000	OXYGEN SENSOR - replace							

How to Order Parts

CleanMaster 402
Section 14-1

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

WARRANTY PARTS ORDERS

1. Call the local distributor where you purchased your equipment and ask for the Service Department.

2. Have the following information ready:
   A. Equipment Model
   B. Date of Purchase
   C. Hours on the Unit
   D. Unit Serial Number
   E. Description of Malfunction

3. Once it has been determined which parts are needed to correct the problem with your machine, make arrangements with your distributor to either perform the repairs or ship the parts to you.

PARTS ORDERS

Call your local distributor. In most instances, they either stock or have access to parts through a regional service center.

EMERGENCIES

If, for any reason, your distributor is unable to supply you with the necessary parts, they may call us and arrange for expedited shipping.

HydraMaster sells parts only through authorized distributors and service centers.

ONE FINAL NOTE

Any questions you have regarding the warranty program should be directed to the:

HydraMaster Customer Service Department
(425) 775-7275,
8 a.m. to 5 p.m.
Monday through Friday (PST).

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

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

Warranty Information

CleanMaster 402
Section 14-3

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

BLOWER:

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

HIGH PRESSURE WATER PUMP:

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

VACUUM TANK:

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

CHEMICAL SYSTEM:

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

CONTROL PANEL:

- Failure to protect flowmeter and water pressure gauge against freezing.

VACUUM AND SOLUTION HOSES:

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

CLEANING WAND:

- Failure to protect against freezing.
- Obvious physical abuse of wand.

WATER HEATING SYSTEM:

- Over-pressurization of the system (recommended maximum working pressure-1,000 PSI).
- Failure to protect against freezing.

HARD WATER DEPOSITS:

- Failure to use or maintain a water softening system or a properly installed magnetic-type de-scaler, whichever might be necessary, with machines operating in designated "Hard Water Areas" (3.5 grains or more per gallon).

WARRANTY

HydraMaster will warrant all fuel system parts for a period of 2 years. The engine is covered by Kawasaki for a period of 2 years with this exception, "warranty does not apply to engine adjustment or repair required due to failure of the combustion chamber valves, valve seats, valve guides or burned starter motor windings which occur when operating an engine with LPG or NG". All other parts are covered by the standard HydraMaster "Golden Guarantee." Warranty repairs may be performed as usual with the exception of fuel system adjustments. The fuel system adjustments are set at the factory and any tampering with them will void the warranty.

WARRANTY PROCEDURE

Warranty coverage is available to you through *your local Distributor.*

If you have moved to a new area or have purchased a used machine and need information regarding your local distributor, call HydraMaster at (425) 775-7272 or email us at custsvc@hydramaster.com. When calling your distributor, be sure to have the machine's information; model and serial number, ready for the service representative.

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

FOR YOUR REFERENCE:

Model No. _____

Serial No. _____

Date of Purchase: _____

Purchased From (Distributor): _____

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Accessories

CleanMaster 402

Section 15-1

Genuine HydraMaster Accessories & Detergents

This section of your Owners Manual is devoted to Accessories and Detergents which we have found to be helpful and useful. These products can enhance your cleaning and reduce your labor costs!

HydraMaster Machine accessories are the most innovative collection available in the cleaning industry. Our patented **RX-20 Rotary Extractors** have changed the shape of steam cleaning. Our hoses and tanks are of the finest quality construction.

SafeClean Detergents have been specially prepared, not only to give you exceptional cleaning, but also to optimize your truckmount's operation and reliability. Most detergents don't work well under the high heat, high pressure conditions of truckmount use. SafeClean will maintain your machines's water pump and water heating systems at peak efficiency and help ensure fewer breakdowns.

For more information, or to order

Genuine HydraMaster Accessories and Detergents

Call your nearest authorized HydraMaster Distributor.