



11015 47th Avenue W, Mukilteo, WA 98275

BOXXER™ 421

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Mukilteo, Washington

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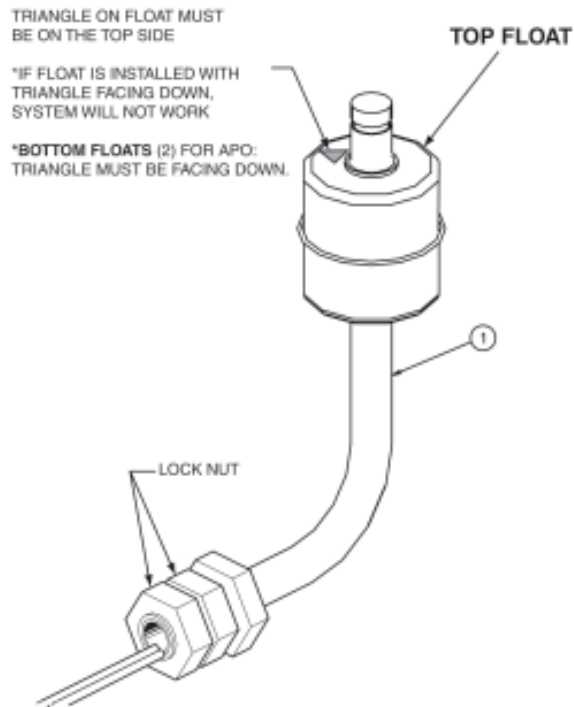
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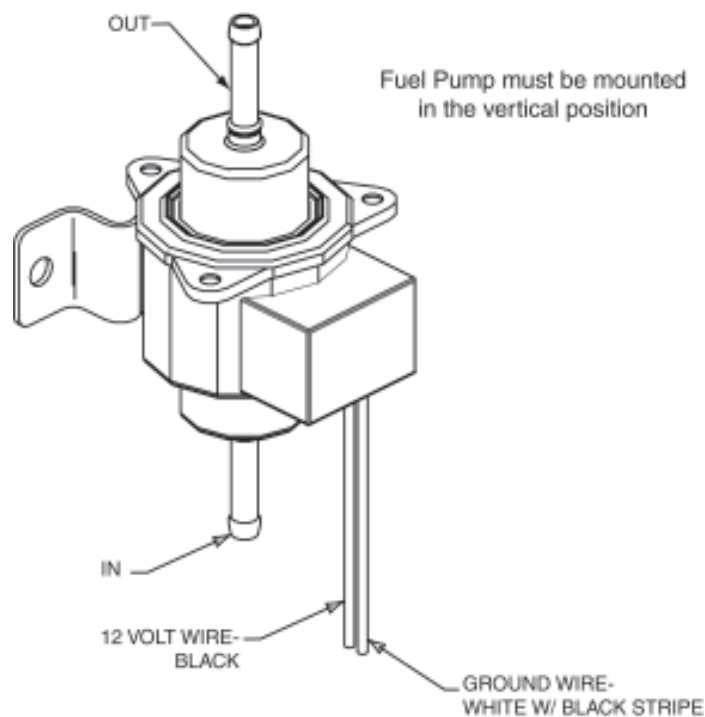
Recovery Tank Float Switch-Top Float Shown

B4624 Rev—



Fuel Pump Assembly

B4627 Rev—



General Information

This manual contains installation and operation instructions as well as information required for proper maintenance, adjustment and repair of this unit. Since the first and most important part of repair work is the correct diagnosis of the 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 where your only worry is “Does it start?”

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⚠ 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.

NOTICE

This symbol is used to warn of regulatory or legal issues.

<u>Hours</u>	<u>Telephone Numbers</u>
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.

▲ WARNING

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

▲ WARNING

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

▲ WARNING

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

▲ WARNING

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.

▲ WARNING

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

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⚠ WARNING

CARBON MONOXIDE: This unit generates toxic fumes. Position the vehicle so that the fumes will be directed *away* from the job site. *Do not park where exhaust fumes can enter a building through open doors, windows, air conditioning units or kitchen fans.*

⚠ 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 GAS TANK: Never operate this machine with a portable gas can inside the truck. Doing so increases the risk of a fire or explosion.

⚠ WARNING

PORTABLE PROPANE TANK: Do not use a portable tank inside of the truck or van. 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

THROUGH-FLOOR DRILLING: Be cautious when drilling holes through the van floor. Many vans have critical components mounted directly below the van floor that could be damaged by a misplaced drill bit. (See Product Support Bulletins 92102, 94062 and 94063 at the end of the manual.)

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

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

CAUTION

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.

CAUTION

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.

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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

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 Boxxer heat exchanger system is a highly engineered cleaning plant designed by HydraMaster Corporation. The system utilizes a dynamic heating system comprised 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 and it flows through the water conditioner 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. When equipped with an engine exhaust diverter, the diverter bypasses the heat from the exhaust heat exchanger and simultaneously releases water from the system and directs it to the recovery tank.

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
Weight:	370 lbs.
Engine:	Vanguard 21 HP Briggs and Stratton Pressurized Oil System Spin-on Filter, Oil Cooler and Oil PSI Protection Switch
Ignition:	Electronic, Keystart
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: 70 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
Boxxer™ Water Heating Package
Vacuum Recovery 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
HydraMaster Jacket

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
049-002	Filter, Fuel	1
049-008	Filter, S/S Vacuum Pump, 2½"	1
049-014	Filter, Vanguard Oil	2
049-016	Filter, ¼" Replacement Y	1
049-023	Screen, Garden Hose	1
049-012	Filter, Vanguard 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
106-016	Plug, Vanguard Spark	2
106-045	Plug, HD4 Coupling - 1" OD x $\frac{3}{16}$ " 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, 1 ½" 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

CAUTION

In Dodge vans the fuel tanks are located directly against the floor. Caution must be used when drilling any holes through the floor. (See Product Support Bulletin 94062 at the end of this manual.)

To purchase heavy duty 42 - 60 amp hour battery and have the battery 'slow' charge if new.

CAUTION

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**.*

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 supervising the correct installation of the unit in your vehicle and thoroughly training you in its operation, maintenance and precautions.

CORRECT INSTALLATION INCLUDES:

- Vehicle of proper load carrying capacity (recommendation: ½ ton).
- Installation of through-floor fittings for gasoline fuel lines.
- Placing the unit and recovery tank in your vehicle and securing them with bolts or tie down cleats.
- Connecting gasoline lines.
- Connecting the battery.
- Checking the pump, vacuum blower and engine oil levels prior to starting 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.

Vehicle Preparation

When selecting a truck, remember the preferable vehicle for a Boxxer 421 installation is a cargo van with a heavy-duty suspension package and a half ton capacity. If a fresh water tank is added, a three quarter ton or larger capacity van, with a 2,400 pound payload capacity, is required.

TRUCK PREPARATION

The manufacturer recommends the installation of a spray-on bed liner in the vehicle prior to installation of machine.

CAUTION

Be cautious when drilling any holes through the van floor. Many vans have critical components mounted directly below the van floor that could be damaged by a misplaced drill bit. (See Product Support Bulletins 92101, 94062, and 94063 at the end of this manual.)

This provides 'metal to cushion' mounting rather than 'metal to metal' and makes for an attractive van interior. It is highly recommended to install roof vents in vehicles operated in hot weather locations. Roof vent positions are shown in Figure 1-1.

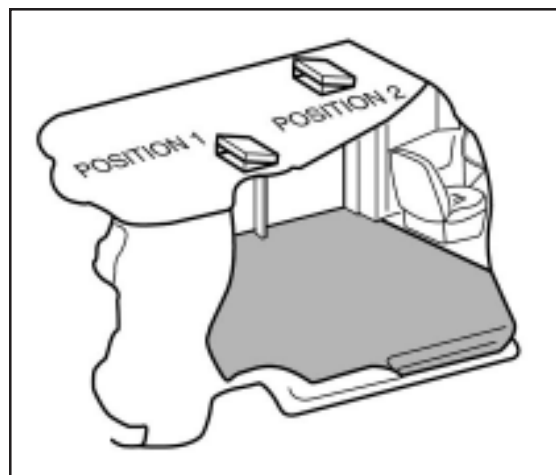


Figure 1-1 Roof Vent

PLACEMENT OF UNIT IN VEHICLE

There are two recommended unit placements:

SIDE DOOR:

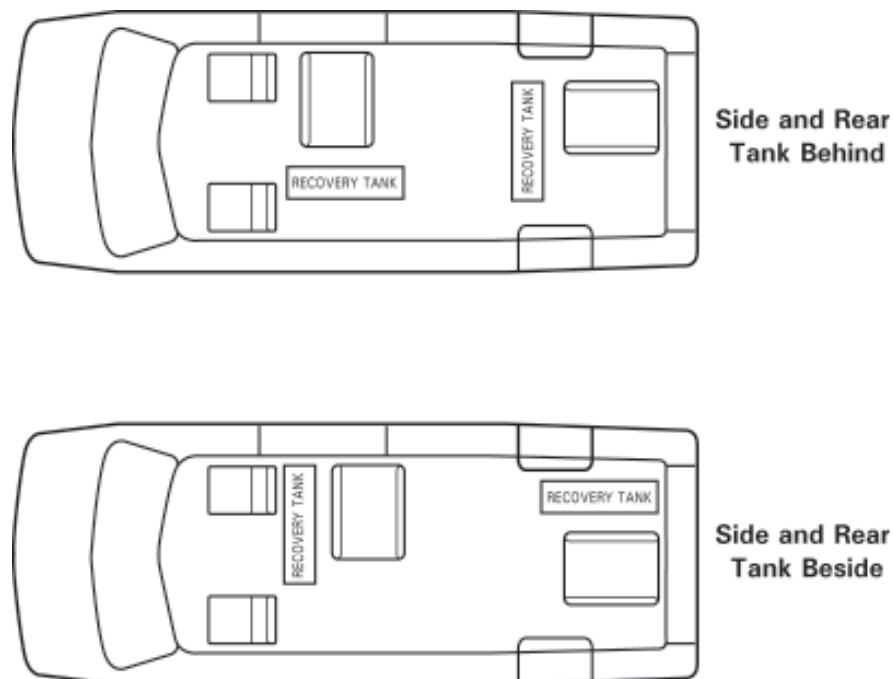
Most installations are side door. This provides rear access for accessories and hoses as well as unobstructed access to the component/working side of the machine, thus making it a bit easier to perform maintenance and/or repair without removing the unit from the truck.

REAR DOOR:

Although this location partly limits working access, it does direct the noise away from the cleaning site. Some cleaners in the colder areas prefer this location because it puts the weight over the rear wheels for better traction in ice and snow. Rear mounting requires the unit to be slid to the right side as far as possible.

This not only provides adequate working space on the component side of the unit but also improves weight distribution inside the van (engine and component weight line up over drive shaft). Also, it is physically easier to load the unit into the rear door due to the height of the van bed.

Figure 1-2 Recommended Placement

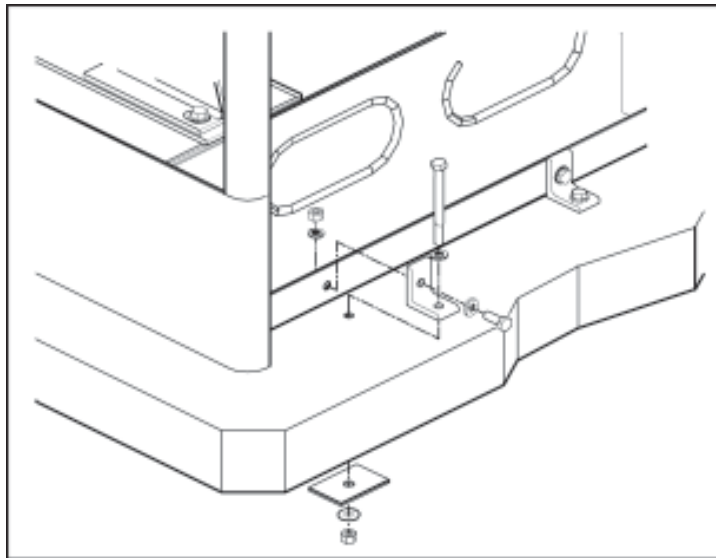


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Machine Tie Down Cleats

Secure the machine to the floor of the van with the four tie down cleats provided. This safety measure will ensure that the machine will not slide inside the van. See the following illustration for the correct installation.

Figure 1-3 Installation Using Tie-down Cleats



Ensure that the machine is well secured to the floor of the van with the hardware supplied. A sudden or crash stop will cause the machine to rocket forward. Protect yourself and the machine. **SECURE IT!**

▲ WARNING

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

The manufacturer also recommends the installation of aluminum vents in the truck roof to allow heat to escape.

▲ WARNING

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

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

⚠ WARNING

Do not use a portable propane tank inside of the truck or van. It is dangerous and illegal in most states.

⚠ WARNING

Transportation in a vehicle of any vented fuel container that presently holds or has ever held a flammable liquid is strictly forbidden by HydraMaster Corporation and by federal and state regulation.

⚠ WARNING

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

High Altitude Operation Preparation

To have your machine run at it's peak performance; you 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 carburetor jet. 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 jet sizes vary per engine and elevation. Consult HydraMaster to obtain proper jet size.

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.

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.

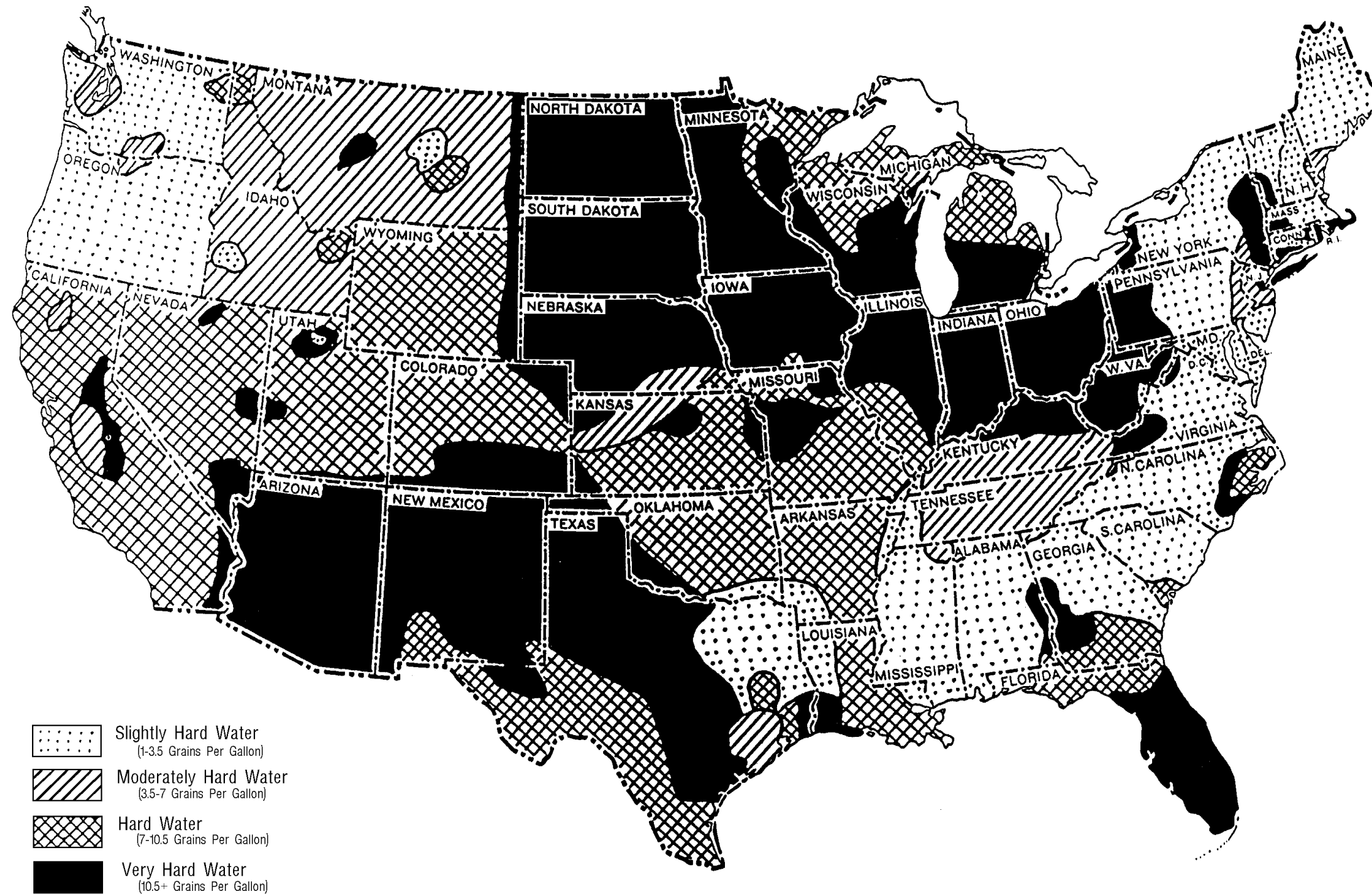
HydraMaster also recommends, in the strongest possible terms, that machines in all areas be fitted with a water softening system for improved operation and reliability.

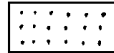



HydraMaster has included five hard water test strips with your machine. These can be used to test the water in your immediate and surrounding areas as they can vary greatly. Assume all water obtained from wells is hard.

CAUTION

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

Figure 1-4 Hard Water Map



-  Slightly Hard Water
(1-3.5 Grains Per Gallon)
-  Moderately Hard Water
(3.5-7 Grains Per Gallon)
-  Hard Water
(7-10.5 Grains Per Gallon)
-  Very Hard Water
(10.5+ Grains Per Gallon)

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

Cleaning and Chemicals

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.

CAUTION

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

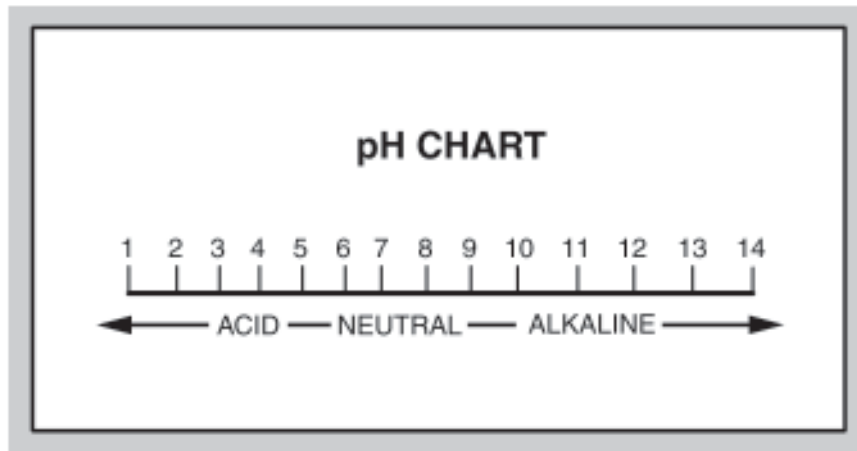
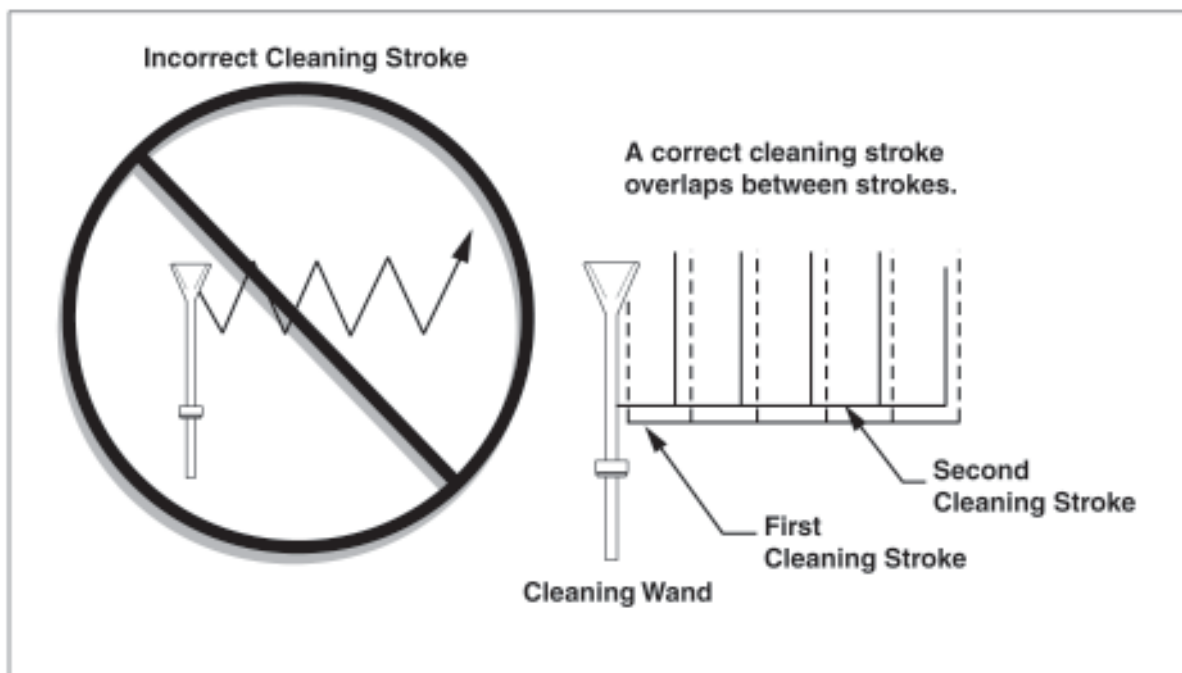


Figure 2-2: Cleaning Stroke Procedure



Operating Instructions

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.

Carpet or Hard Surface 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. Connect wand or tool.
4. Set THROTTLE to "HIGH".
5. If used, turn PUMP IN switch to "ON" (switch light will be illuminated).
6. Turn PUMP switch to "ON" (switch light will be illuminated).
7. Turn DIVERTER switch to "ON" (switch light will be illuminated).
8. Set temperature to desired level.
9. If used, turn PUMP OUT switch to "ON" (switch light will be illuminated).

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10. Set cleaning pressure at desired level.

Suggested Settings

Carpet Cleaning: 300 – 400 psi;

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

11. Turn the chemical selector valve to the "PRIME" position to purge any air from the system.
 - a. With the machine running at operating speed, block off the vacuum intake to the recovery tank. The vacuum gauge should read between 12"hg and 14"hg. This will assist in priming the chemical system.
 - b. When the chemical begins to flow through the flowmeter, with the flow indicator reading maximum flow for at least 30 seconds, turn the chemical selector to "ON". The restriction can now be removed from the vacuum inlet.
 - c. Then, while spraying solution from the cleaning tool, adjust the chemical flow by turning the chemical adjustment knob as necessary.
12. Commence cleaning.

Upholstery Cleaning

1. Start 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 the upholstery tool.
4. Set the THROTTLE to "LOW" or "HIGH".
5. If used, turn the PUMP IN switch to "ON" (switch light will be illuminated).
6. Turn the PUMP switch to "ON" (switch light will be illuminated).
7. Turn the DIVERTER switch to "ON" (switch light will be illuminated).
During upholstery cleaning if you desire a lower temperature you may want to leave the DIVERTER switch in the "OFF" position. The engine exhaust heat exchanger is bypassed, the heat will be obtained from the engine coolant and blower exhaust heat exchangers.
8. Set the temperature to desired level.

9. If used, turn PUMP OUT switch to **"ON"** (switch light will be illuminated).
10. Set cleaning pressure at desired level (300 –400 psi).
11. 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.
12. 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.

*Note: Make sure the diverter and pump switch are in the **"OFF"** position.*

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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**" position and the DIVERTER CONTROL switch to the "**OFF**" position while 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.

Exhaust Diverter System

The exhaust diverter system consists of two components; the diverter valve and the pump clutch. The diverter valve directs the flow of the exhaust through the coil heat exchanger or directly out of the machine via the diverter exhaust muffler. The pump clutch allows the pump to be turned on and off through a switch. This will enable the machine to be used for flood extraction without the need for an inlet garden hose connected to the machine. Thus preventing excessive filling of the recovery tank through the temperature control system.

The Boxxer 421 can run in two different modes:

Cleaning Mode

To run the machine in Cleaning mode:

- a) Turn the pump and diverter switch to the "ON" position.
- b) Adjust thermostat knob to desired temperature.

Flood Damage Mode

To run the machine in Flood Damage mode:

- a) Turn the pump and diverter switch to the "OFF" position.
- b) Drain waterbox completely.

CAUTION

HOT SURFACES: When the machine is being run or after it has been shut down, caution should be used around the muffler and the exhaust diverter surfaces as they become hot during operation.

⚠ WARNING

Do not use excessive force when engaging and disengaging the heat exchanger bypass lever. This may cause damage to the exhaust diverter.

⚠ WARNING

In order for the valve to operate properly, it should periodically be engaged and disengaged.

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Adjustment After Installation:

Machines that are equipped with a diverter valve may need adjustment after the machine has been installed.

Prior to running the machine, perform the following steps:

1. Locate the actuator connected to the diverter valve arm which is located between the blower and engine exhaust heat exchanger.
2. The actuator shaft is connected to the diverter valve arm. Pull the actuator shaft forward and listen to hear if the poppet seals against the seat in the diverter valve. Push the actuator shaft back and listen to see if the poppet seals against the seat in the diverter valve.

If the poppet **seats** in both directions, the diverter actuator is in proper adjustment.

If the poppet **does not** seat in one or both directions the valve is out of adjustment. Perform the following steps to adjust the diverter actuator shaft.

3. The end of the actuator shaft is threaded into the diverter arm and is secured into position with a backup nut. This nut must be loosened to allow adjustment.
4. Loosen the actuator backup nut. This will allow you to rotate the actuator shaft clockwise or counterclockwise. Rotate the actuator shaft one half turn at a time. Then pull the actuator shaft forward and back. Listen to hear if the poppet seals in the seat of the diverter valve. Repeat this step until the diverter poppet seals in both directions.
5. Apply red Loctite on the thread of the actuator shaft. Retighten the backup nut.
6. Recheck the adjustment. Move the actuator shaft forward and back. Listen to hear if the diverter poppet seals in both directions. The diverter is now properly adjusted.

Machine Maintenance

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.

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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.

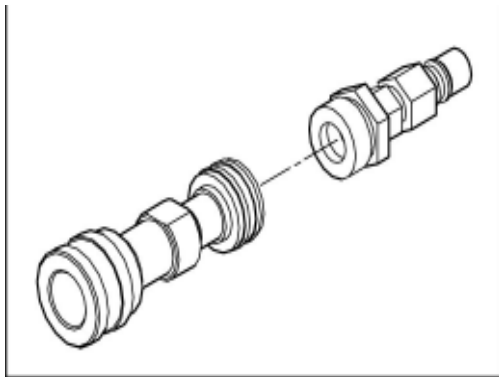


Figure 4-1 Recirculation Fitting

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.

Freeze Guard

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.

Attach the recirculation fitting provided in the kit to the garden hose quick connect (see Fig. 4-1) 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).

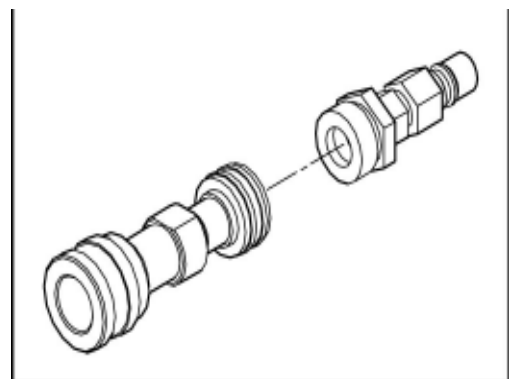


Figure 5-1 Recirculation Fitting

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.

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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 antifreeze 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.

High Pressure Pump -Maintenance

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.

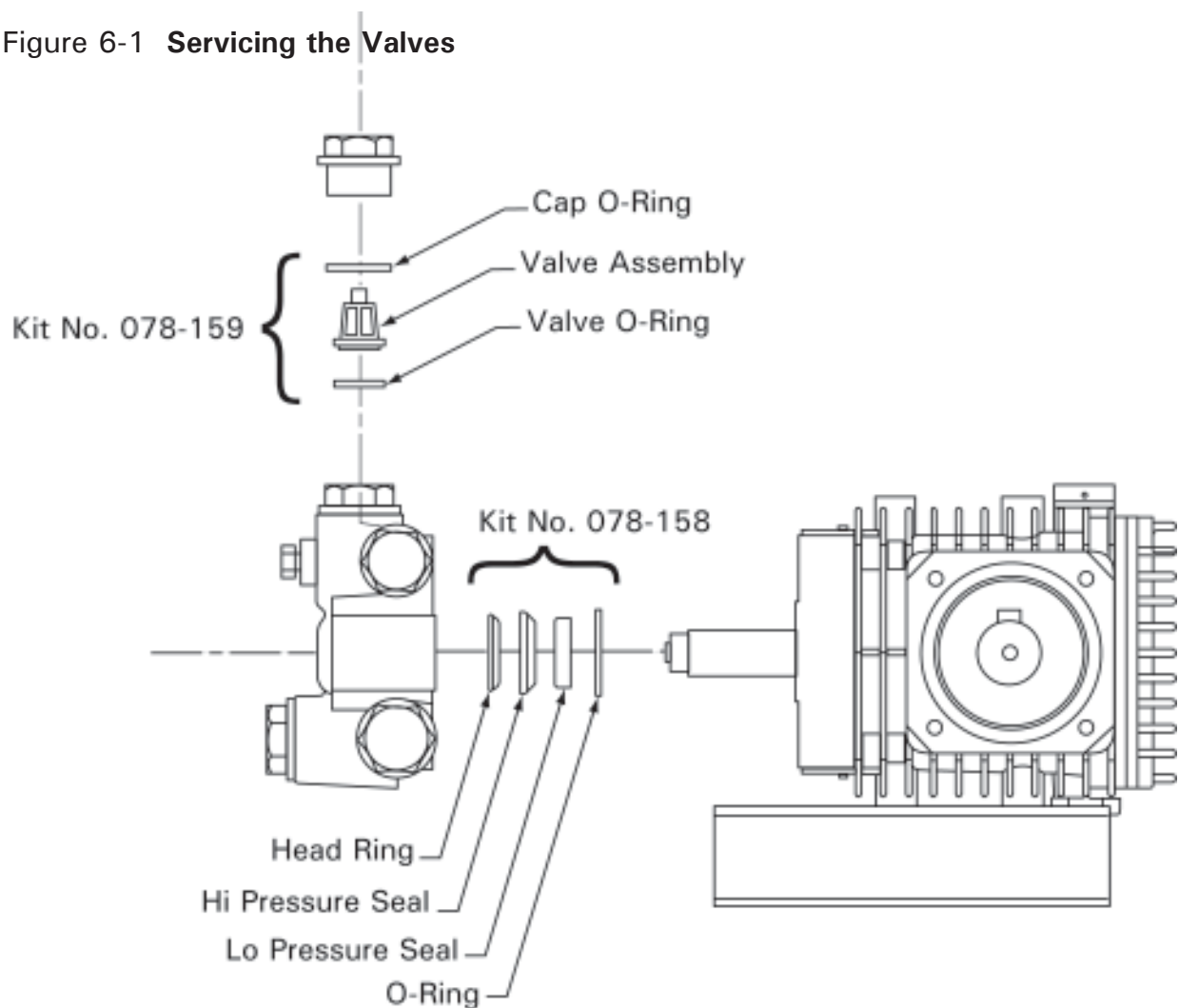
CAUTION

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 6-1 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.

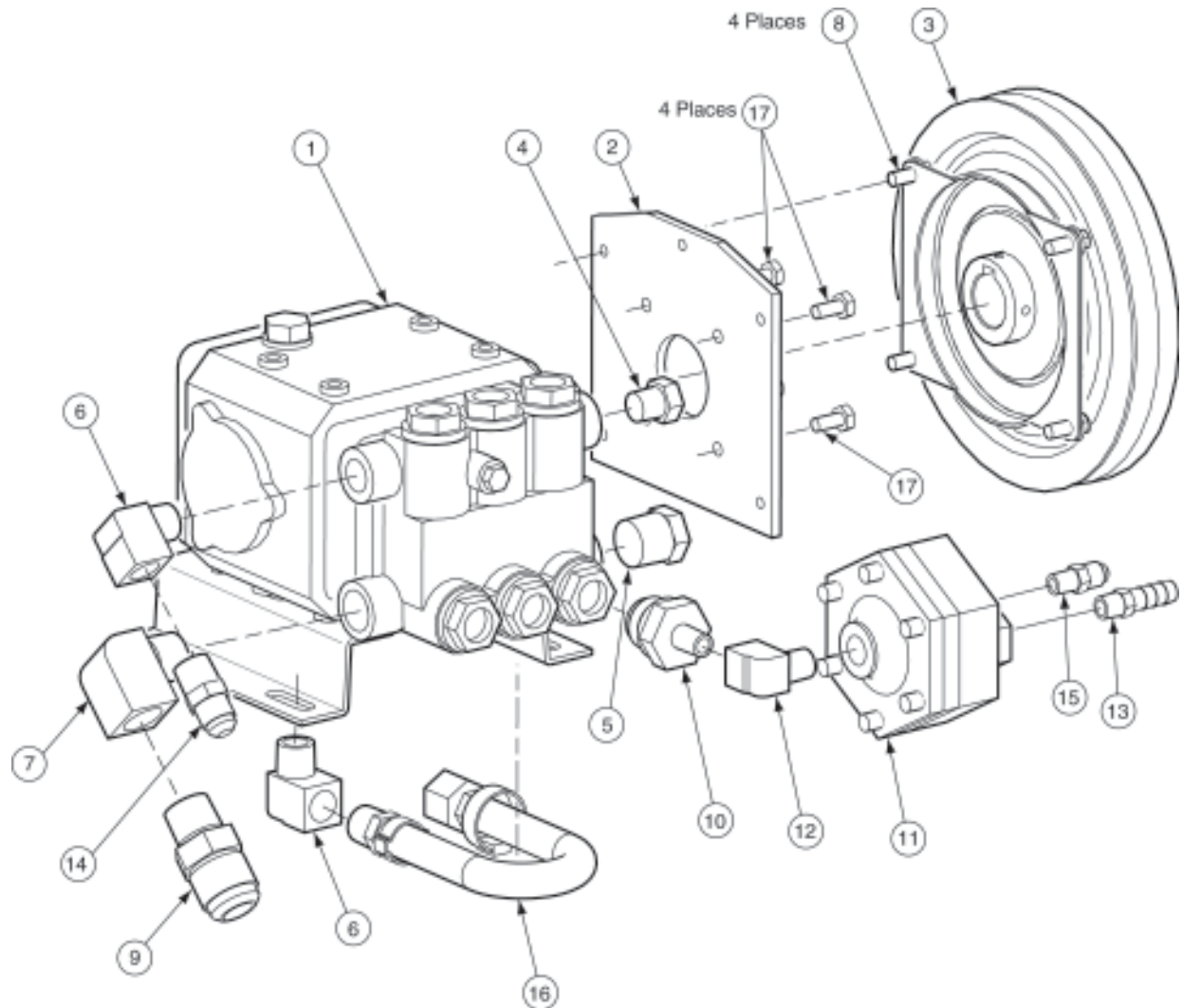
Servicing the Crankcase

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.

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Figure 6-2 **HydraPump II**

C5043, Rev—



Pump Assembly Parts List

ITEM	PART NO	DESCRIPTION	QTY
1	111-042	Pump, HydraPump II, Hi PSI, 3.5 GPM	1
2	105-148	Plate, Hydra Pump II Clutch Mounting	1
3	036-008	Clutch, Electrical Pump	1
4	106-003	Plug, 3/8" NPT Hex	1
5	106-004	Plug, 1/2" NPT Hex	1
6	052-086	Elbow, 1/2" NPT Street	2
7	052-087	Elbow, 1/2" NPT Street	1
8	143-141	Screw, 1/4—20UNC x 2" Lg. Whiz Lock	4
9	052-547	Nipple, 1/2" NPT x 3/4" SAE	1
10	001-096	Adapter, Chem. Pump to Comet Pump	1
11	— — — —	Chemical Pump Assembly	1
12	052-085	Elbow, 1/4" NPT Street	1
13	052-099	Insert, #28, 1/8" NPT x 3/8" Barb	1
14	052-128	Nipple, 3/8" NPT x 3/8" Male Propane	1
15	052-530	Nipple, 1/8" MNPT x 1/4" SAE	1
16	068-219	Hose, Pump Drain	1
17	143-221	Screw, 6mm-1 x 14mm Lg. Hex Head	4

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 if necessary.
 - 1.2. **Worn seals or valves in pump.** Test pump output volume directly from pump at normal running 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 to 3000 RPM. 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. **Pump switch is not turned on.** Turn on switch
- 2.2. **No water in water box.** Refer to section 5.0.
- 2.3. **Pump belt is broken.** Replace belt.
- 2.4. **Pump clutch is not activated. There *is no* water in water box.** Check system back to source to locate cause of interruption to water flow.
- 2.5. **Pump clutch is not activated. There *is* water in the water box.** Check for 12 volts at clutch. If 12 volts is present, replace clutch.
 - 2.5.1. If 12 volts is not present, check fuse that supplies power to the low-water relay. If fuse is good and there is 12 volts at the relay, check the low water switch in water box.
 - 2.5.2. If low water switch has no continuity when float is up, replace the switch. If switch is good, replace the low water relay.

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 afterburner 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 until the restriction is located.

4.0. Pressure pulsation

- 4.1. **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.
- 4.2. **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.
- 4.3. **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.

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.
- 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.

Vacuum System

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 12 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 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. **Vacuum blower is turning too slowly.** Check engine RPM. Adjust as necessary to 3000 RPM.
 - 2.3. **The vacuum gauge is defective.** Test gauge and replace as necessary.
-

3.0. Vacuum gauge reads too high with no hoses attached

- 3.1. **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.** Refer to qualified service technician.
-

Miscellaneous Troubleshooting

1.0. Water from exhaust

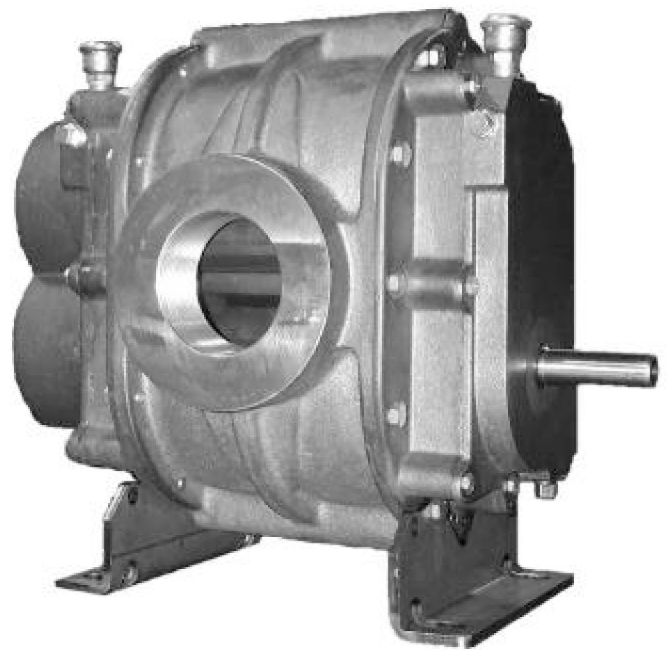
- 1.1. **The recovery tank has been filled with foam or overfilled with water.** Remove recovery tank lid and inspect. If full, drain tank then inspect high-level shutoff switch for proper operation. Clean or replace switch as necessary.
 - 1.1.1. If foam is observed in recovery tank, use defoamer on 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.** Change the diverter mode switch back and forth between Divert and Heat Exchange mode. Observe which condition causes water to be expelled from exhaust.
 - 1.3.1. If water is expelled while switch is in Heat Exchange mode, the engine exhaust after burner heat exchanger is leaking internally. Remove and test. Replace as necessary.
 - 1.3.2. If water is expelled while switch is in Divert mode, the blower exhaust heat exchanger is leaking. Remove and test. Replace as necessary.

Tuthill Vacuum & Blower Systems

Rotary Positive Displacement Air Blower

Models 3003 4005 4007

INSTALLATION
OPERATION
MAINTENANCE
REPAIR
MANUAL



WARNING
DO NOT OPERATE
WITHOUT READING MANUAL

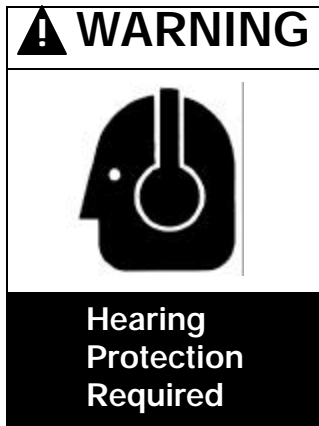


HydraMaster

REVISED SEPTEMBER 2006

SAFETY INSTRUCTIONS

1. Do not operate before reading the enclosed instruction manual.
2. Use adequate protection, warning and safety equipment necessary to protect against hazards involved in installation and



SAFETY WARNING

- Keep hands and clothing away from rotating machinery, inlet and discharge openings.
- Blower and drive mounting bolts must be secured.
- Drive belts and coupling guards must be in place.
- Noise level may require ear protection.
- Blower heat can cause burns if touched.

TUTHILL VACUUM & BLOWER SYSTEMS

Springfield, MO USA

NOTICE

The above safety instruction tags were attached to your unit prior to shipment. Do not remove, paint over or obscure in any manner.

Failure to heed these warnings could result in serious bodily injury to the personnel operating and maintaining this equipment.

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IMPORTANT

In order to assure you of the full benefits of our product warranty, please complete, tear out and return the warranty registration card located on the back cover of this manual, or you can register your product online at http://pneumatics.tuthill.com/product_registration

SAFETY PRECAUTIONS

For equipment covered specifically or indirectly in this instruction book, it is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should particularly be noted:

- Blower casing and associated piping or accessories may become hot enough to cause major skin burns on contact.
- Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting. Cover external moving parts with adequate guards.
- Disconnect power before doing any work, and avoid bypassing or rendering inoperative any safety or protective devices.
- If blower is operated with piping disconnected, place a strong, coarse screen over the inlet and avoid standing in discharge air stream.
- Avoid extended exposure in close proximity to machinery with high intensity noise levels.
- Use proper care and good procedures in handling, lifting, installing, operating, and maintaining the equipment.
- Other potential hazards to safety may also be associated with operation of this equipment. All personnel working in or passing through the area should be warned by signs and trained to exercise adequate general safety precautions.
- Hearing protection may be required depending on silencing capabilities.

INTRODUCTION

CONGRATULATIONS on your purchase of a new HydraMaster™ Rotary Positive Displacement Blower from Tuthill Vacuum & Blower Systems. Please examine the blower for shipping damage, and if any damage is found, report it immediately to the carrier. If the blower is to be installed at a later date make sure it is stored in a clean, dry location and rotated regularly. Make sure covers are kept on all openings. If blower is stored outdoors be sure to protect it from weather and corrosion.

HydraMaster blowers are built to exacting standards and if properly installed and maintained will provide many years of reliable service. We urge you to take time to read and follow every step of these instructions when installing and maintaining your blower. We have tried to make these instructions as straightforward as possible. We realize getting any new piece of equipment up and running in as little time as possible is imperative to production.

WARNING: Serious injury can result from operating or repairing this machine without first reading the service manual and taking adequate safety precautions.

IMPORTANT: Record the blower model and serial number in the OPERATING DATA form below. You will save time and expense by including this reference identification on any replacement part orders, or if you require service or

OPERATING DATA

It will be to the user's advantage to have the requested data filled in and available in the event a problem should develop in the booster or the system. This information is also helpful when ordering spare parts.

Model No. _____

Serial No. _____
(Recorded from nameplate on unit)

NOTES: _____

INSTALLATION

WARNING: Customers are cautioned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards involved in the installation and operation of this equipment in the system or facility.

Do not use air blowers on explosive or hazardous gases. Casing pressure must not exceed 25 PSIG (1.72 bar g). Each size blower has limits on pressure differential, running speed, and discharge temperature, which **must not** be exceeded. These limits are shown on the Specification Sheet "Maximum Operating Limits" on page 10.

WARNING: Keep hands, feet, foreign objects and loose clothes from inlet and outlet openings to avoid injury or damage if lobes are to be rotated at this point.

LUBRICATION

Do not start up the blower until you are positive that it has been properly and fully lubricated. (See Lubrication Section on page 6.)

WARNING: Do not operate equipment without adequate silencing devices since high noise level may cause hearing damage. (Reference OSHA Standards.)

LUBRICATION

Shaft bearings at the gear end of the blower are splash lubricated by one or both gears dipping into an oil reservoir formed in the gear end plate and cover. Shaft bearings at the drive end of the blower are lubricated by a slinger assembly dipping into an oil reservoir. Before starting the blower, fill oil sumps as shown below under "Filling Procedure." Tuthill approved mineral-based and synthetic lubricants are listed on page 11.

FILLING PROCEDURE

1. Remove fill plugs or breathers from both gear end and drive end plates.
2. SLOWLY pour oil through fill until oil appears in the oil sight glass. Bring oil level to center of sight glass. Except for the Competitor (3003), which requires grease in the drive end (see page 11 for Tuthill recommended grease).
3. Verify oil level is at proper level in BOTH gear end and drive end sight glasses.
4. Replace fill plugs or breathers that were removed in step 1.

CAUTION: Do not start the blower until you are sure oil has been put in the gear housing. Operation of the blower without proper lubrication will cause the blower to fail and void its warranty.

WARNING: NEVER ATTEMPT TO CHANGE OIL WHILE THE BLOWER IS IN OPERATION. Failure to heed this warning could result in damage to the equipment and/or serious personal injury. **Oil level must be checked while the blower is not running.**

APPROXIMATE OIL CAPACITIES

MODEL	Horizontal Air Flow		Vertical Air Flow	
	GEAR END	DRIVE END	GEAR END	DRIVE END
3003	3.4 ounces (100 mL)	Requires grease	6.0 ounces (180 mL)	Requires grease
4005, 4007	5.8 ounces (170 mL)	4.7 ounces (140 mL)	8.5 ounces (250 mL)	6.4 ounces (190 mL)

PneuLube™ synthetic oil is the best lubricant for your blower. Contact your local Tuthill Vacuum & Blower Systems Sales Professional for availability of this superior lubricant.

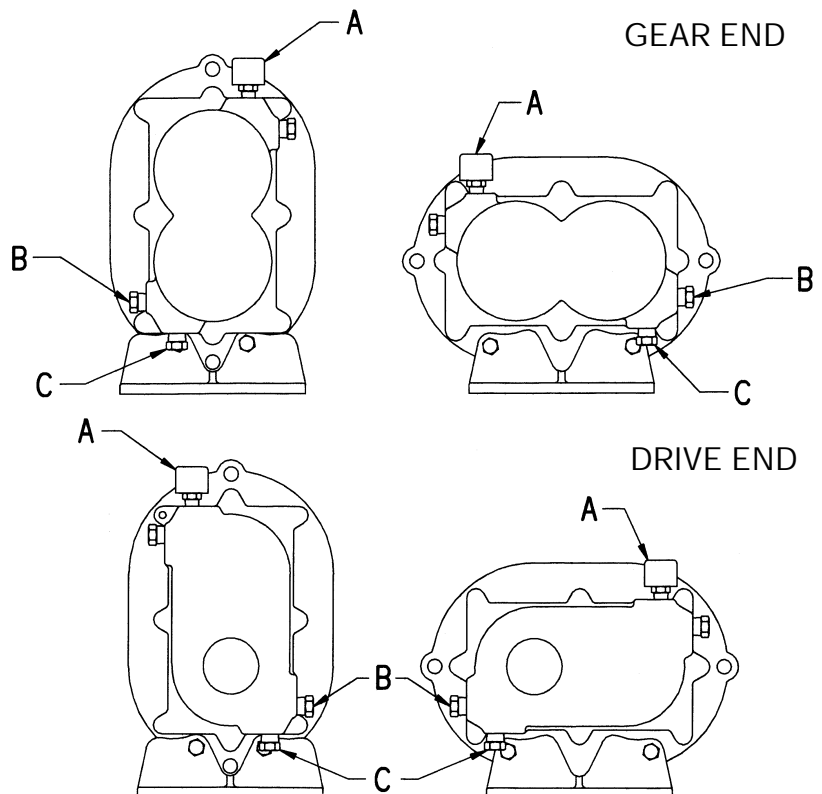
CAUTION!

Most Hydra Master blowers are shipped from the factory in a left hand drive, vertical flow configuration.

If drive shaft location is changed, the oil level plugs, sight glasses and breathers must be relocated to proper positions, as shown to the right.

Failure to change plug location will result in blower failure and void the product warranty.

A = Breather
 B = Oil Level Sight Glass
 C = Magnetic Oil Drain Plug



PREVENTATIVE MAINTENANCE

A good maintenance program will add years of service to your blower.

A newly installed blower should be checked frequently during the first month of operation, especially lubrication. Check oil level in both the drive end and gear end of the blower and add oil as needed. See HydraMaster owners manual for recommended oil change intervals.

The following is recommended as a minimum maintenance program.

DAILY MAINTENANCE	WEEKLY MAINTENANCE	MONTHLY MAINTENANCE
1. Check and maintain oil level, and add oil as necessary.	1. Clean all air filters. A clogged air filter can seriously affect the efficiency of the blower and cause overheating and oil usage.	1. Inspect the entire system for leaks.
2. Check for unusual noise or vibration (See Troubleshooting on page 8)	2. Check relief valve to assure it is op-	2. Inspect condition of oil and change if necessary (see page 6)
		3. Check drive belt tension and tighten if necessary.

START-UP CHECKLIST

We recommend that these startup procedures be followed in sequence and checked (v) off in the boxes provided in any of the following cases:

- After maintenance work has been performed
- After blower has been removed and replaced

Date Checked

1. Check the unit for proper lubrication. Proper oil level cannot be over-emphasized. Refer to Lubrication Section.

2. Check Alignment.

For Direct Drive: Check coupling and shaft alignment.
For Belt Drive: Check for proper belt alignment and tension.

3. Turn the rotors by hand to be certain they do not bind.

4. "Bump" the unit with the motor a few times to check rotation and to be certain it turns freely and smoothly.

5. Start the unit and operate it for 30 minutes at no load. During this time, feel the cylinder for hot spots. If minor hot spots occur, refer to the Troubleshooting Section (page 8).

6. Apply the load and observe the operation of the unit for one hour. Check the unit frequently during the first day of operation.

7. If minor malfunctions occur, discontinue operation and refer to the Troubleshooting Section (page 8).

TROUBLESHOOTING

Although HydraMaster blowers are well designed and manufactured, problems may occur due to normal wear and the need for readjustment. The chart below lists symptoms that may occur along with probable causes and remedies.

SYMPTOM	PROBABLE CAUSE	REMEDIES
Loss of oil.	Gear housing not tightened properly. Lip seal failure. Insufficient sealant.	Tighten gear housing bolts. Disassemble and replace lip seal. Remove gear housing and replace sealant.
Excessive bearing or gear wear.	Improper lubrication. Excessive belt tension.	Correct oil level. Replace dirty oil. (See Lubrication section on page 6) Check belt manufacturer's specifications for tension and adjust accordingly.
Lack of volume.	Slipping belts. Worn lobe clearances. Speed too low.	Check belt manufacturer's specifications for tension and adjust accordingly. Check for proper clearances (See Assembly Clearances on page 10) Increase blower speed within limits.
Knocking.	Unit out of time. Distortion due to improper mounting or pipe strains. Excessive pressure differential.	Re-time. Check mounting alignment and relieve pipe strains. Reduce to manufacturer's recommended pressure.
Excessive blower temperature.	Too much or too little oil in gear reservoir. Too low operating speed. Clogged filter or silencer. Excessive pressure differential. Elevated inlet temperature. Worn lobe clearances.	Check oil level. (See Lubrication section on page 6) Increase blower speed within limits. Remove cause of obstruction. Reduce pressure differential across the blower. Reduce inlet temperature. Check for proper clearances (See Assembly Clearances on page 10)
Rotor end or tip drag.	Insufficient assembled clearances. Case or frame distortion. Excessive operating pressure.	Correct clearances. Check mounting and pipe strain. Reduce pressure differential. Reduce pressure differential or reduce inlet temperature.
Vibration.	Belt or coupling misalignment. Lobes rubbing. Worn bearings or gears. Unbalanced or rubbing lobes. Driver or blower loose. Piping resonance.	Check carefully, realign if necessary. Check cylinder for hot spots, then check for lobe contact at these points. Correct clearances (See Assembly Clearances on page 10) Check condition of gears and bearings; replace if necessary. Possible buildup on casing or lobes, or inside lobes. Remove buildup and restore clearances. Check mounting and tighten if necessary. Check pipe supports, check resonance of nearby equipment, check foundation

RECOMMENDED SHUTDOWN PROCEDURE TO MINIMIZE RISK OF FREEZING OR CORROSION

When high humidity or moisture is present in an air piping system, condensation of water can occur after the blower is shut down and the blower begins to cool. This creates an environment favorable to corrosion of the iron internal surfaces, or in cold weather, the formation of ice. Either of these conditions can close the operating clearances, causing the blower to fail upon future start-up.

The following shutdown procedure outlined below minimizes the risk of moisture condensation, corrosion and freezing. **Care must be taken so as not to overload or overheat the blower during this procedure.**

1. Isolate the blower from the moist system piping, allowing the blower to intake atmospheric air. Operate the blower under a slight load allowing the blower to heat within safe limits. The heat generated by the blower will quickly evaporate residual moisture.
2. For carpet cleaning applications, after the work is completed, simply allow the blower to run a few (3-5) minutes with the suction hose and wand attached. The suction hose and wand will provide enough load to the blower to evaporate the moisture quickly.
3. For extended shutdown, inject a small amount of a light lubricating oil such as 3-in-One® or a spray lubricant such as WD-40® into the inlet of the blower just prior to shutdown. The lubricant will provide an excellent protective coating on the internal surfaces. If using a spray lubricant, exercise care to prevent the applicator tube from getting sucked into the blower. The applicator tube will damage the blower, most likely to the point that repair would be required.

January, 2001

3-in-One and WD-40 are registered trademarks of WD-40 Company.

HydraMaster

Maintenance and Service Specifications Sheet

Assembly Clearances

Metric values (mm) are shown in parentheses ()
All other values are in inches

MODEL	LOBES TO END PLATES			INTERLOBE	LOBE TO CASING	
	DRIVE END	GEAR END	TOTAL		TIP-DOWEL	TIP-PORT
3003	.005" - .008" (.13 - .20)	.003" - .005" (.08 - .13)	.009" - .012" (.23 - .30)	.006" - .012" (.15 - .30)	.002" - .005" (.05 - .13)	.004" - .007" (.10 - .18)
4005-22L3-5837 4005-22L3-7964 4007-22R3-7963 4007-22R3-5874	Min. Drive Cl. .012" (.30)	Min. Driven Cl .015" (.38)				
	.012" (.30)	.015" (.38)				
	.010" (.25)	.017" (.43)				
	.010" (.25)	.017" (.43)				

Maximum Operating Limits			
MODEL	RPM	VACUUM in. Hg (mbar)	TEMPERATURE RISE F° (C°)
3003	3600	12 (510)	180 (82)
4005	3600	14 (540)	210 (117)
4007	3600	14 (510)	170 (94)

HydraMaster

MAINTENANCE AND SERVICE SPECIFICATIONS SHEET RECOMMENDED LUBRICANTS AND CAPACITIES

RECOMMENDED MINERAL BASED LUBRICANTS

AMBIENT	SHELL	CITGO	CHEVRON TEXACO	EXXONMOBIL
0° F (-18° C) to	TELLUS® PLUS 68	A/W 68	RANDO HD 68	DTE HEAVY MEDIUM
32° F (0° C) to	TELLUS® PLUS 100	A/W 100	RANDO HD 100	DTE HEAVY
90° F (32° C) to	TELLUS® PLUS 150	A/W 150	RANDO HD 150	DTE EXTRA HEAVY

RECOMMENDED SYNTHETIC BASED LUBRICANTS FOR M- D PNEUMATICS™ ROTARY BLOWERS

AMBIENT TEMPERATURE	TUTHILL	EXXONMOBIL	SHELL
0° F (-18° C) to 32° F (0° C)	PneuLube™ (ISO 100)	SHC 626 (ISO 68)	MADRELA® AS 68 (ISO 68)
32° F (0° C) to 90° F (32° C)		SHC 627 (ISO 100)	MADRELA® P 100 (ISO 100)
90° F (32° C) to 120° F (50° C)		SHC 629 (ISO 150)	MADRELA® P 150 (ISO 150)

NOTE: Tuthill Vacuum & Blower Systems cannot accept responsibility for damage to seals, O-rings and gaskets caused by use of synthetic lubricants not recommended by Tuthill Vacuum and Blower Systems.

Due to its superior viscosity index, Tuthill PneuLube™ provides the greatest ambient temperature flexibility. Contact your local Tuthill Vacuum & Blower Systems Sales Professional for availability of this superior lubricant.

* Oil capacities are based on filling from dry condition. Less oil may be needed depending on emptiness of oil reservoir (gear housing) after draining.

Always fill the gear housing until oil drips out of the oil level hole. Replace plugs in their respective holes. Following this procedure will insure proper oil level.

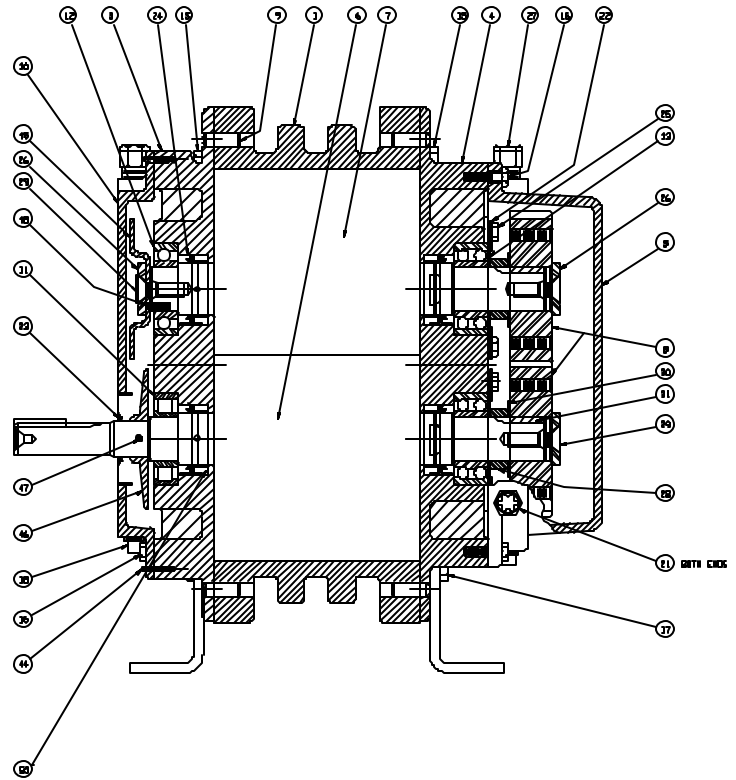
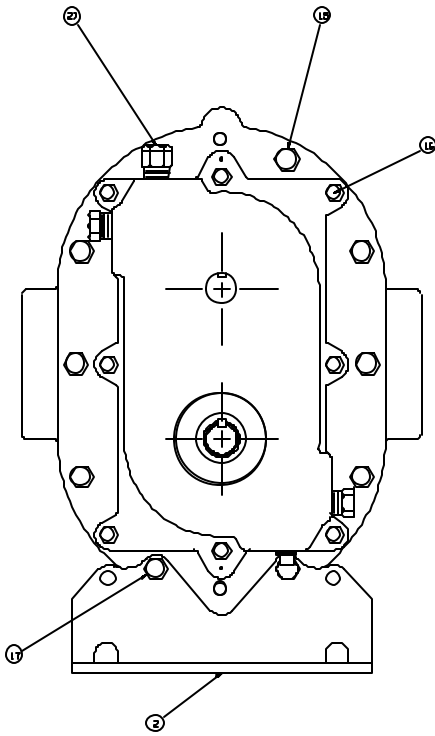
RECOMMENDED GREASE FOR DRIVE END:

For the Competitor (3003) only

Use NLGI #2 premium grade, petroleum base grease with high temperature resistance and good mechanical stability, such as PneuLube grease available from your Tuthill Pneumatics Sales Professional. Using a pressure gun, force new grease into each bearing until traces of clean grease come out of the relief fitting

HydraMaster

CUTAWAY VIEW AND PARTS LIST



ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Housing	1	21	Sight Gauge	2
2	Mounting foot	2	22	Bearing Retainer	2
3	Drive End Plate	1	23	Lip Seal	1
4	Gear End Plate	1	24	Lip Seal	4
5	Gear Cover	1	25	Screw, Hex Head	4
6	Drive Rotor	1	26	Washer	2
7	Driven Rotor	1	27	Breather	2
8	Timing Gear	2	28	Spacer	2
9	Dowel Pin	4	29	Screw, Socket Head	3
10	Drive Cover	1	30	Timing Shims	1
11	Roller Bearing	1	31	Timing Gear Key	2
12	Bearing	1	44	Dowel Pin	1
13	Bearing	2	45	Slinger	1
15	Screw, Hex Head	16	46	Slinger	1
16	Screw, Hex Head	16	47	Set Screw	2
17	Screw, Hex Head	4	48	Roll Pin	2
18	Drain Plug	2	50	Lab Seal	4
19	Pipe Plug	2			

When ordering parts, use the item number shown, plus your model and serial number.

HydraMaster Blower Warranty Definition

The warranty will be uncontested for a period up to two (2) years from the initial date of service on the original equipment. “Uncontested” means the blower will be warranted for all causes of failure on the first blower failure. An advanced replacement will be provided. After the first failure the Tuthill standard warranty will apply. The distributor is to document when the unit goes into service.

Tuthill Warranty

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, Tuthill Vacuum & Blower Systems (the seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period as stated in the table below. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation. (Non-standard materials are subject to a plus or minus 10% variation)

Product Type	Type of Application	
	Atmospheric Air or Process Air	Process Gases Other Than Air,
New	24 months from date of shipment, or 18 months after initial startup date, whichever occurs first	18 months from date of shipment, or 12 months after initial startup date, whichever occurs first
Repair	12 months from date of shipment, or remaining warranty period, whichever is greater	12 months from date of shipment, or remaining warranty period, whichever is greater

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's Ex-works point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original Ex-works point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up of material within the product supplied, nor those which are incompatible with the materials of construction. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit nor for problems due to incompatibility with the materials of construction.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an Officer of the Company is authorized to change this warranty in any way or grant any other warranty. Any such change by an Officer of the Company must be in writing.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on **CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE** and the **PATENTS** Clause hereof, the foregoing is **BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK.** In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occurred.

NOTES

Electrical System

The Boxxer electrical system, in keeping with the entire machine concept, has been kept to a minimum so as to keep any necessary troubleshooting as easy as possible.

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

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

The orange wire going from the engine starter solenoid to terminal #5 on the ignition switch is a fusible link and provides protection to the electrical system in case of failure.

Ignition Switch:

Terminal No.	Wire Color	Function
1	Not Used	
2	White	To Carburetor Solenoid (when used)
3	Black	To Stop Switch Terminal on Engine
4	Yellow	To Solenoid (tab terminal)
5	Orange	To Battery (battery terminal on solenoid)
6	Red	To Regulator / Rectifier

Switch Position	Continuity
1 Off	1 + 3 + 6
2 Run	2 + 5 + 6
3 Start	2 + 4 + 5

Figure 8-1 Wiring Schematic
D-5149 Rev. H

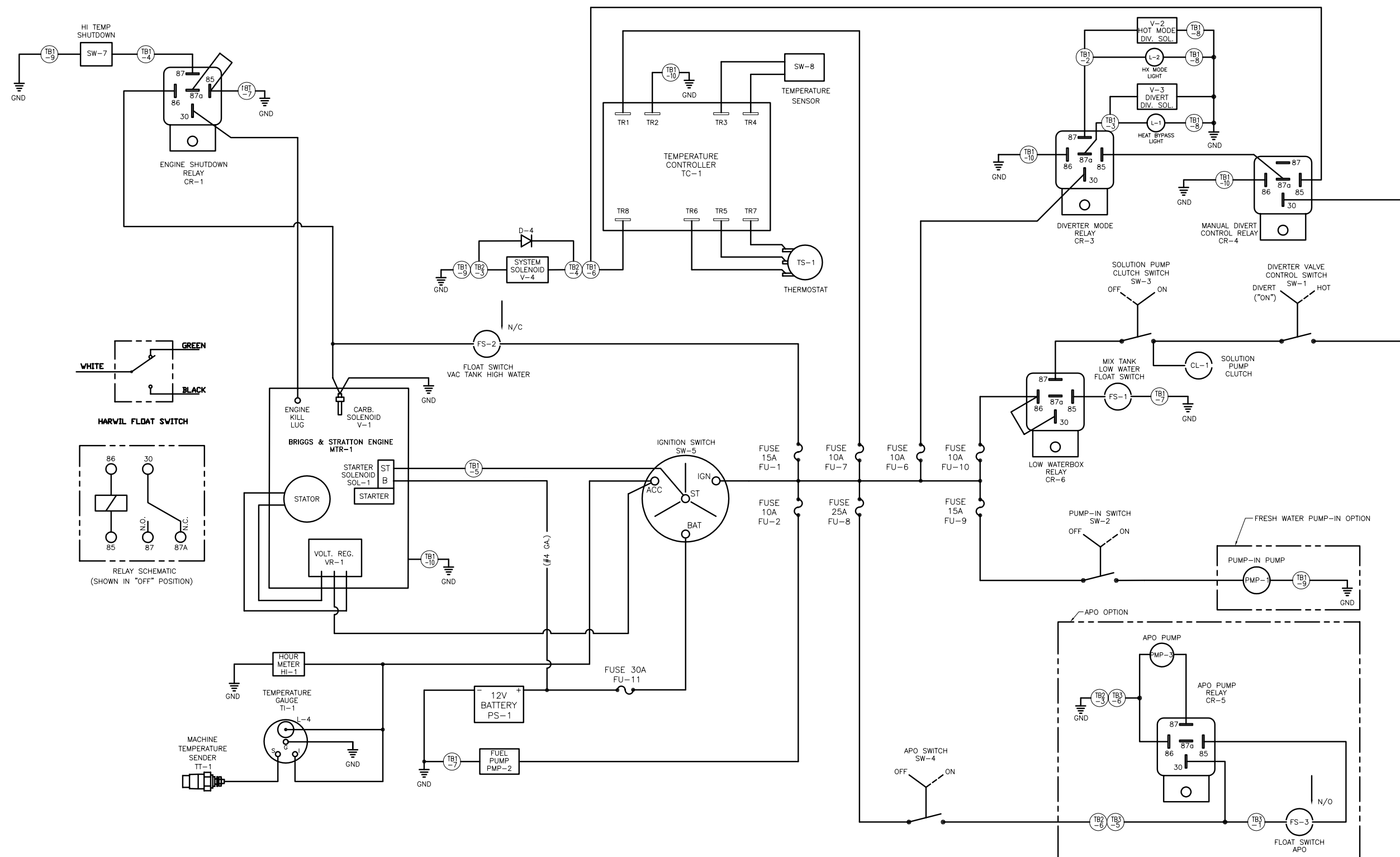


Figure 8-2 Wiring Schematic
D-5148 Rev. H (Sheet 2)

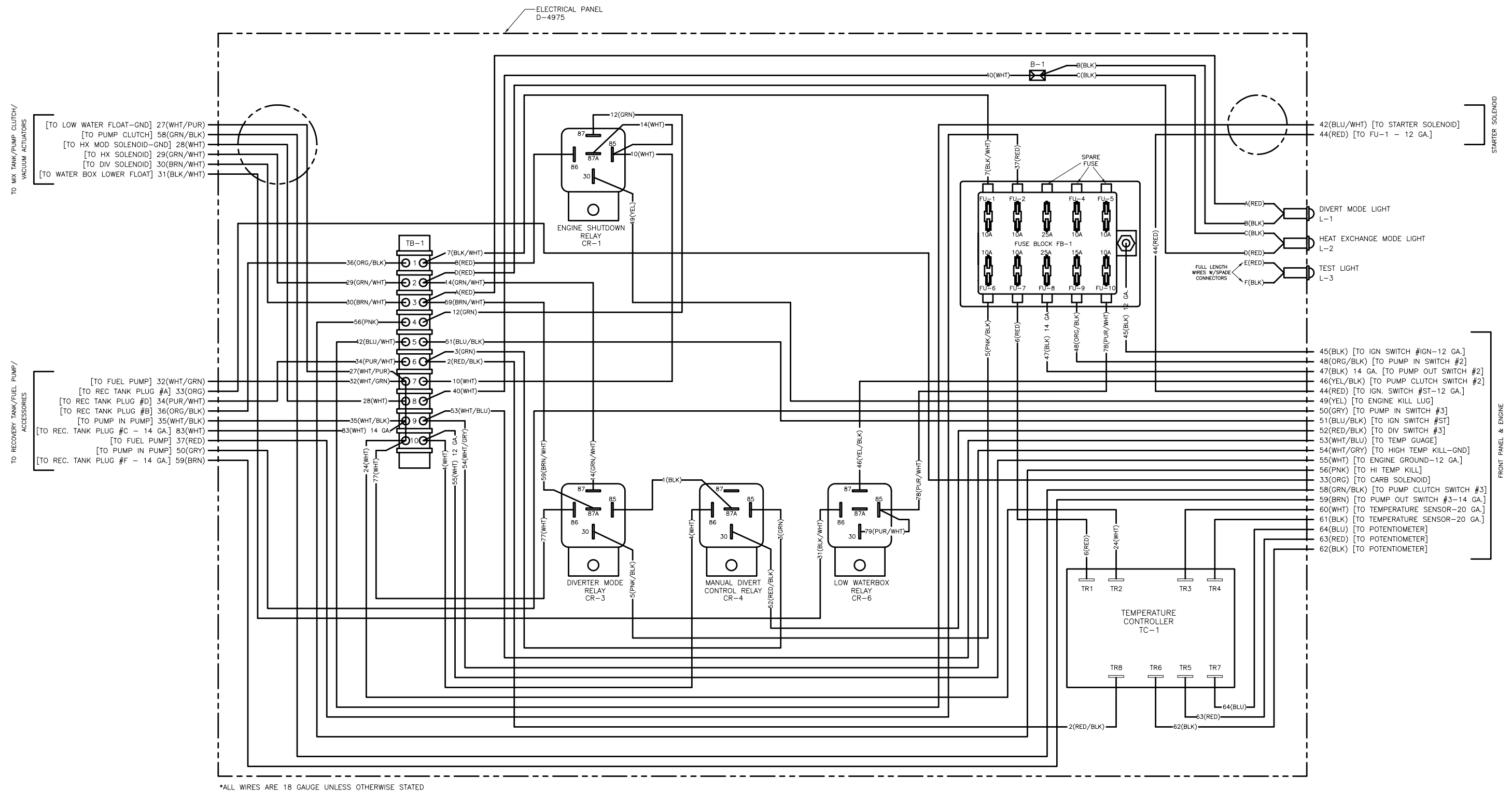


Figure 8-3 Wiring Schematic
D-5148 Rev. H (Sheet 3)

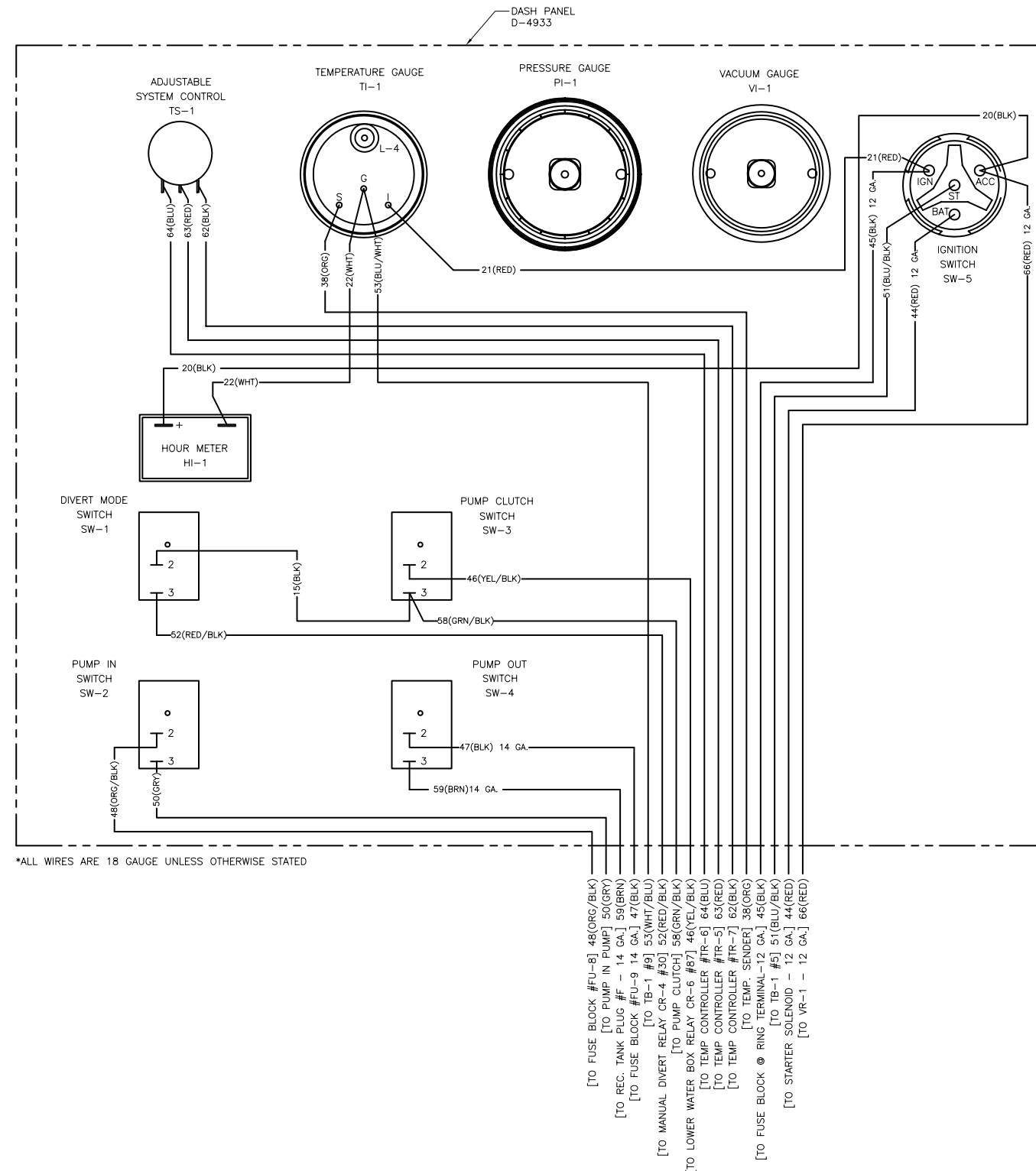
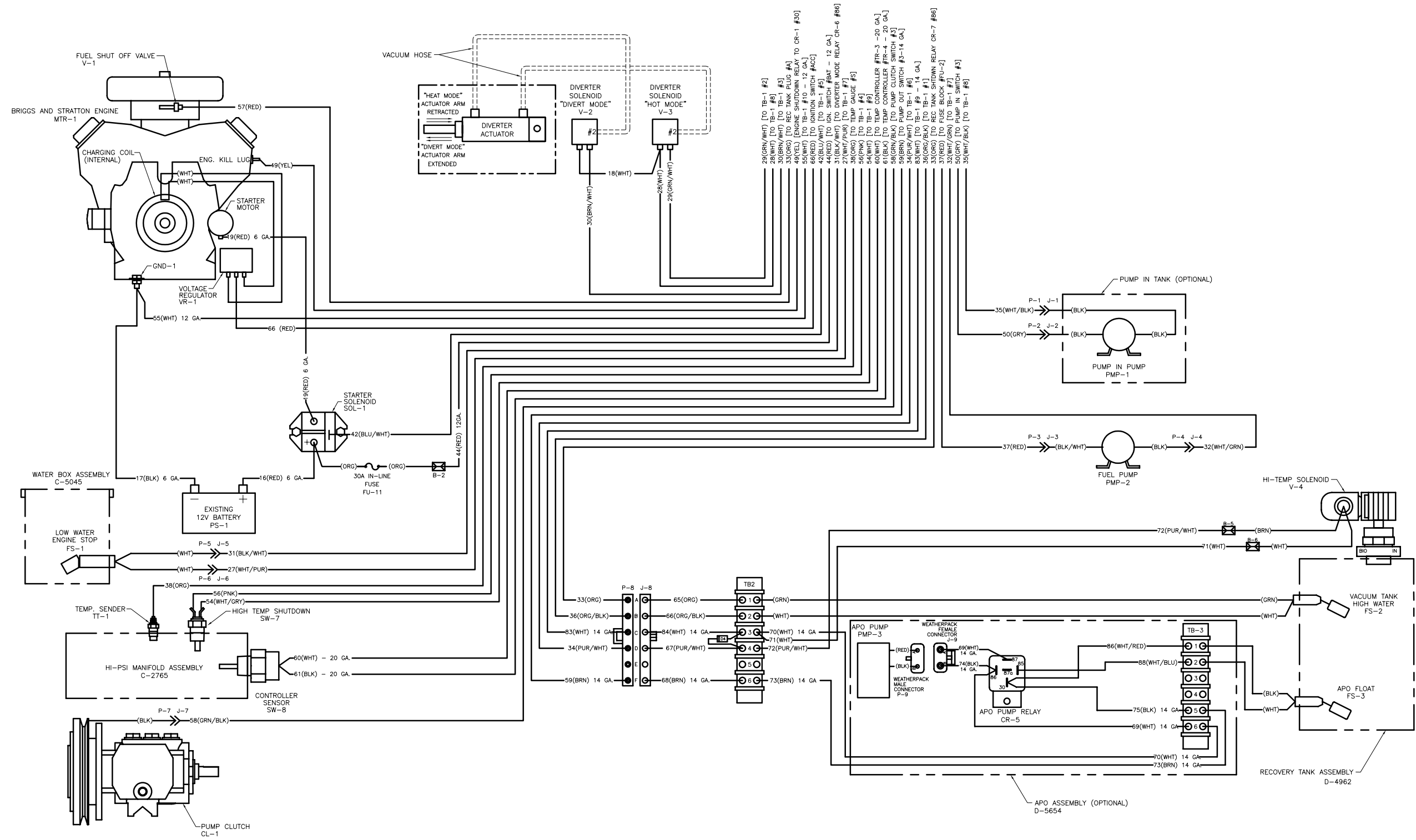


Figure 8-4 Wiring Schematic

D-5148 Rev. H (Sheet 4)



Electrical Troubleshooting

No.	Problem/Possible Cause	Solution
1.0	The engine is not charging the battery.	
1.1	The <i>regulator/rectifier</i> is bad.	Check the B+ voltage from the regulator/rectifier to ground. With the engine running at normal RPM the voltage should be 12.5 to 14.5 DC volts. If necessary, replace the regulator/rectifier.
1.2	The <i>stator winding</i> is bad.	Check for AC voltage at the regulator/rectifier. The stator should be producing an AC voltage of around 25 to 40 volts. Check your Owner's manual for the exact voltage. If necessary, replace the stator winding.

No.	Problem/Possible Cause	Solution
2.0	The fuse is blown.	
2.1	There is an <i>electrical short</i> in the system.	Check for a loose wire or a wire that has rubbed its insulation off and is shorting out to ground. Unscrew each individual wire (except the white wires) one at a time until the fuse does not trip. Then trace that circuit.

Water and Chemical System

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.):

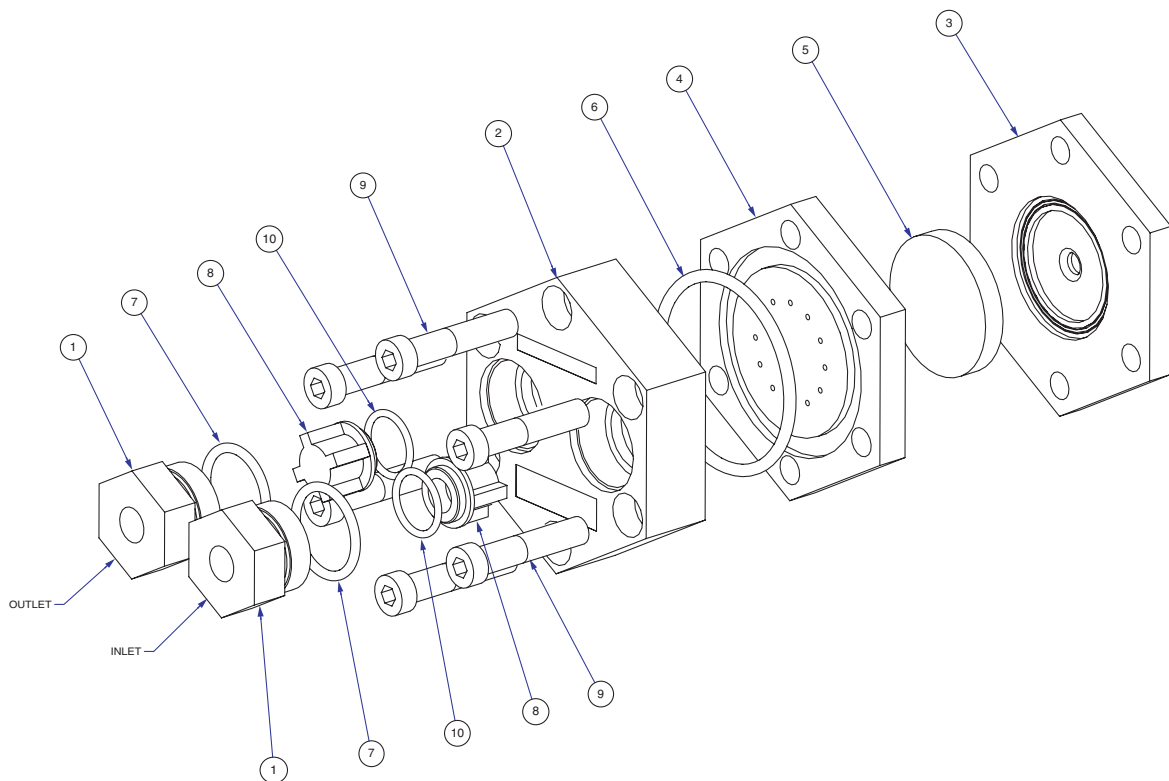
2. When the chemical begins to flow through the flowmeter, with the flow indicator indicating maximum flow and the PRIME line pulsing, turn the Chemical Selector Valve to "ON".
3. Place the Chemical PRIME Line back into the chemical container.
4. While spraying solution from the cleaning tool, adjust 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 9-1 Chemical Pump Assembly

C-4416 Rev. B



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 9-2 Wiring Schematic

D-5150 Rev. - (Sheet 1/3)

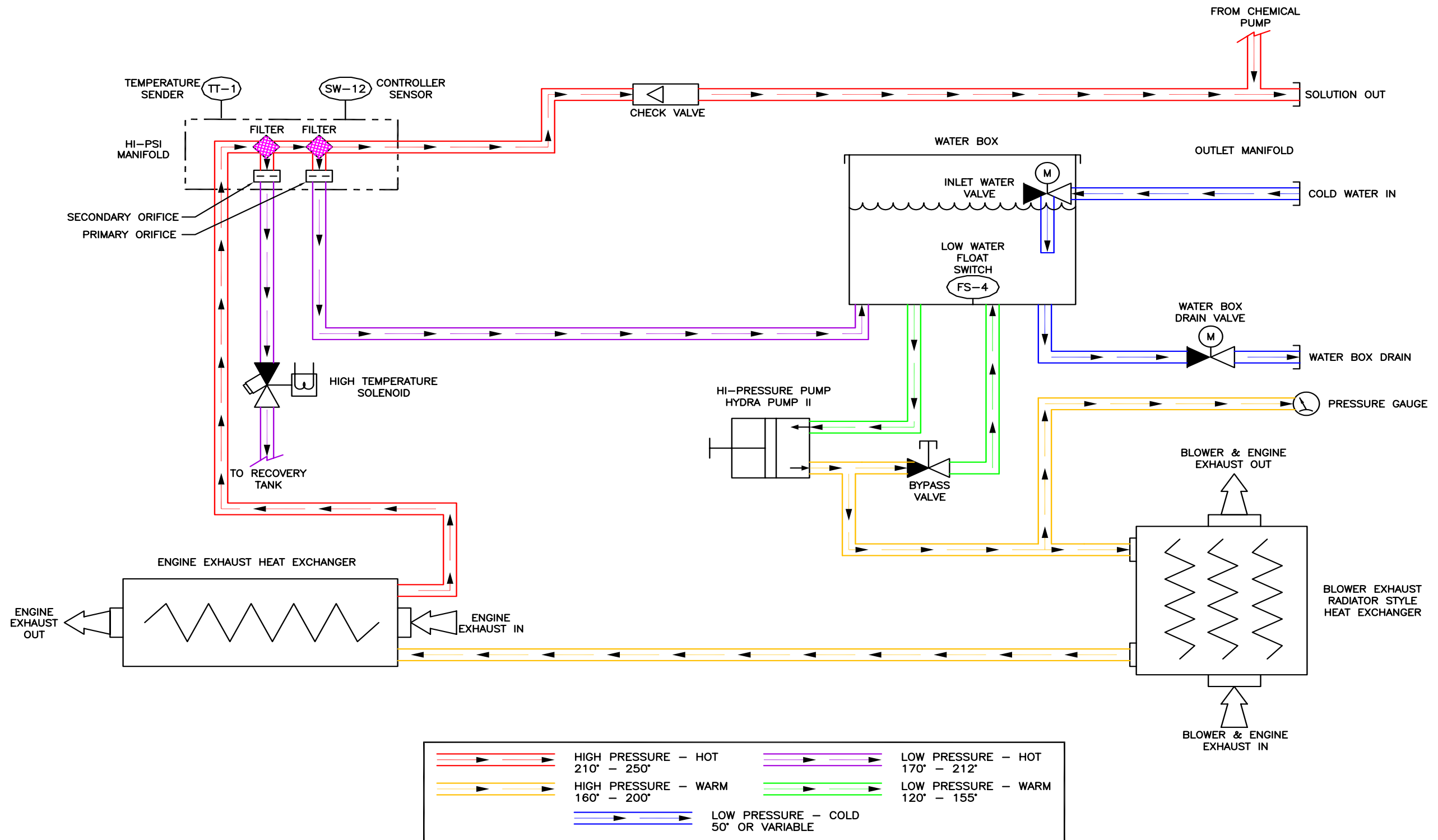


Figure 9-3 Wiring Schematic
D-5150 Rev. - (Sheet 2/3)

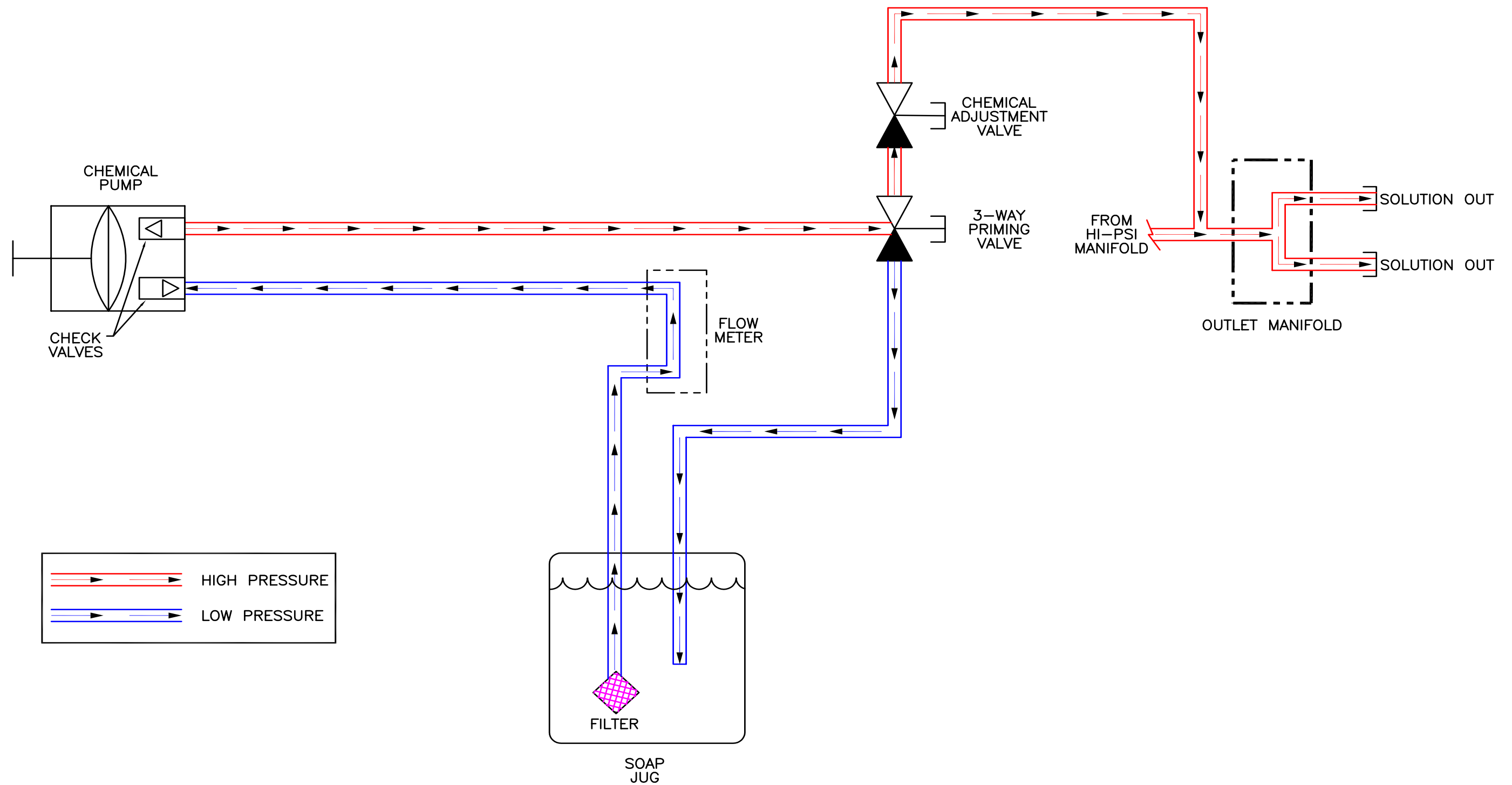
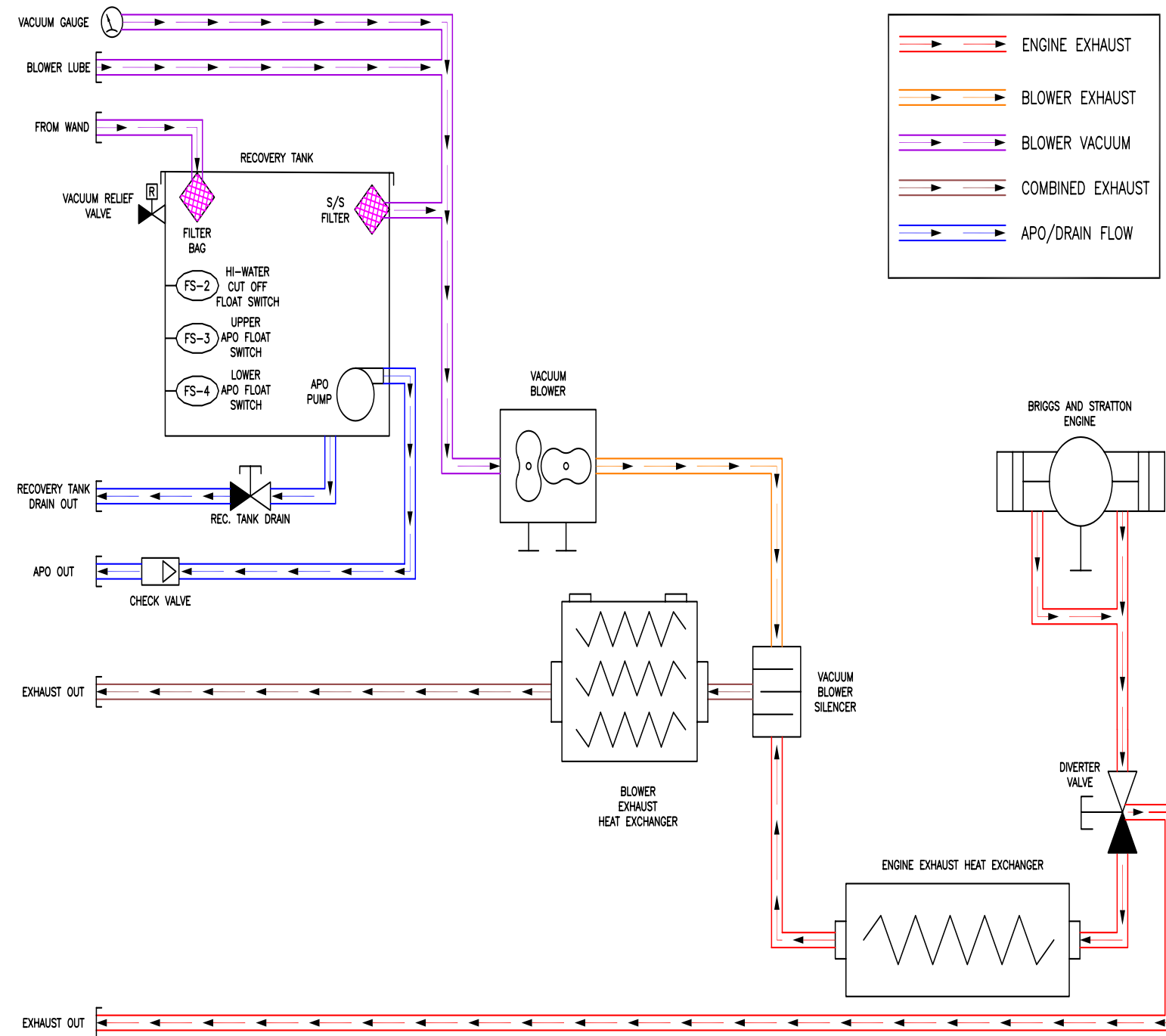


Figure 9-4 Wiring Schematic
 D-5150 Rev. - (Sheet 3/3)



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. **Diverter valve is stuck or out of adjustment.** Operate diverter valve manually (*make sure exhaust system is cool*) to determine if the movement of the valve is restricted. Repair or adjust as necessary.
 - 1.4. **Diverter valve and high-pressure dump solenoid are not functioning.** Check the fuses that provides power to the diverter mode relay and to the temperature controller.
 - 1.4.1. If a fuse is blown, inspect electrical system for worn and shorted wires. Repair or replace as necessary.
 - 1.4.2. If fuse is good, inspect diverter relay and diverter switch. If either is faulty, replace.
 - 1.4.3. If switch and relay are good, refer to qualified service technician to test temperature controller and RTD sensor.
 - 1.5. **Engine RPM is too high.** Check RPM with accurate tachometer and adjust as necessary to 3000 RPM.
-

2.0. Unable to achieve normal cleaning solution temperature

- 2.1. **System is in Divert mode or temperature control knob is turned down.** Inspect divert switch and temperature control. Change or adjust.
- 2.2. **Diverter valve is not closing completely.** Inspect diverter valve for proper operation. Adjust linkage as necessary.
- 2.3. **Diverter and hot water dump systems will not switch into “Cleaning” mode.** Refer to qualified service technician to test system.
- 2.4. **Engine RPM is too low.** Check RPM with accurate tachometer and adjust as necessary to 3000 RPM.
- 2.5. **Cleaning solution flow is too great.** Measure flow at cleaning tool.

- 2.5.1. Cleaning tool jet is too large or worn out. Inspect jet. Replace if necessary.
 - 2.5.2. Cleaning solution pressure is too high. Adjust pressure to normal. Inspect pressure gauge for accurate reading.
 - 2.6. **Heat exchangers have hard water scale build up internally.** Descale system.
-

Chemical System Troubleshooting

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, 2002 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 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.

Boxxer 421

- 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.** Check 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.

Engine Troubleshooting

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 if 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 II, 5.0.
- 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 going 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 be turned over by hand and the vacuum blower is not locked, 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

(Note: To check for spark, use the following procedure. Remove a spark plug from the engine. Attach the lead wire back onto the plug. Ground the threaded part of the spark plug to an unpainted engine surface. While holding the plug and wire assembly by the insulated wire, crank the engine over by turning the ignition switch to the "start" position. You should observe a blue spark between the two electrodes of the spark plug.)

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- 2.1. **Recovery tank is full.** Empty the tank.
- 2.2. **Recovery tank float is defective.** Disconnect float. If engine starts, replace the float.
- 2.3. **The oil pressure switch is preventing the engine from starting.** Check the engine oil level. If it is low, add oil to the proper level. If the engine still will not start, disconnect the oil pressure switch. If the engine starts with the oil pressure switch disconnected, replace the oil pressure switch.
 - 2.3.1 Note: It is important to use only Briggs oil filters. Even though an after-market filter may fit, the internal by-pass system may not be compatible with the Briggs engine resulting in low oil pressure.
- 2.4. **The high temperature switch has shut the engine down.** Observe the temperature gauge. If it is above the normal operating range (230° or above), allow the machine to cool down. If it will still not start, disconnect the high temp switch. If the machine then starts, replace the switch.
 - 2.4.1. If the machine starts after it has cooled down, refer to the Heating System section, 1.0.
- 2.5. **The spark plugs are faulty.** Remove and inspect. Replace as necessary.
- 2.6. **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 the fuel pump. If the pump is working, inspect the fuel lines between the fuel source and the carburetor. Repair or replace any faulty parts as necessary.
 - 3.1.1. If the pump *is not* working, check for 12 volts and a ground at the pump.
 - 3.1.2. If 12 volts *is not* present at the pump, check the wiring to the pump, including the fuse. Repair or replace as necessary. Note: If the fuse has blown, carefully inspect the wiring for a shorted or damaged wire. Repair immediately.
 - 3.1.3. If 12 volts *is* present at the pump and the ground is good, replace the pump.
- 3.2. **The carb solenoid is malfunctioning.** Test for 12 volts and proper ground at solenoid. If both test okay, replace the solenoid.
- 3.3. **The engine is flooded.** Wait for a few minutes and attempt to start with the choke open. Note: If the engine has been flooded, it may be necessary to remove and clean the spark plugs.
- 3.4. **The spark plugs are dirty or worn.** Inspect and replace as necessary.

3.5. **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. **The oil pressure switch is activated.** Check engine oil for proper level. If oil level is okay, disconnect switch. If the engine starts, replace the switch.

4.1.1. Note: It is important to use only Briggs oil filters. Even though an after-market filter may fit, the internal by-pass system may not be compatible with the Daihatsu engine resulting in low oil pressure.

5.0. Will not come up to normal operating RPM

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 speed to 3000 RPM while it is under a vacuum load of between 10"hg and 14"hg. Too high or too low will cause severe damage to machine components.

5.2. **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.

5.3. **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. **Low compression on one or both cylinders.** Check compression. If low, check valve adjustment. If incorrect, adjust to proper specs. This operation should be performed by a qualified service technician.

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

6.4. **Poor spark on one or both cylinders.** Refer to qualified engine service technician.

Boxxer 421

- 6.5. **Inadequate fuel supply to the carburetor.** Test the fuel volume at the carburetor by removing the fuel line from the carburetor inlet and placing the line in a metal container with a minimum of 16 oz capacity. Turn on the ignition switch to operate the fuel pump. The fuel flow volume should be 12 oz / minute. Check for clogged filter or obstructed fuel line. Also check to make sure the fuel pump is mounted vertically and is close to the fuel source. Repair as necessary.
-

7.0.Runs rich (Black smoke)

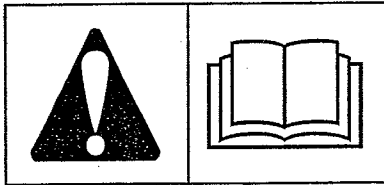
- 7.1. **Dirty air filter.** Inspect and replace as necessary.
- 7.2. **Choke is partially closed.** Inspect and adjust or repair as necessary.
- 7.3. **Excessive fuel to carburetor.** Insure that fuel pump is proper PSI rating. A fuel pump with a psi rating in excess of that of the pump supplied with the machine could overpower the inlet valve in the carburetor, causing excessive fuel to be supplied to the carburetor.
-

8.0.Engine overheats

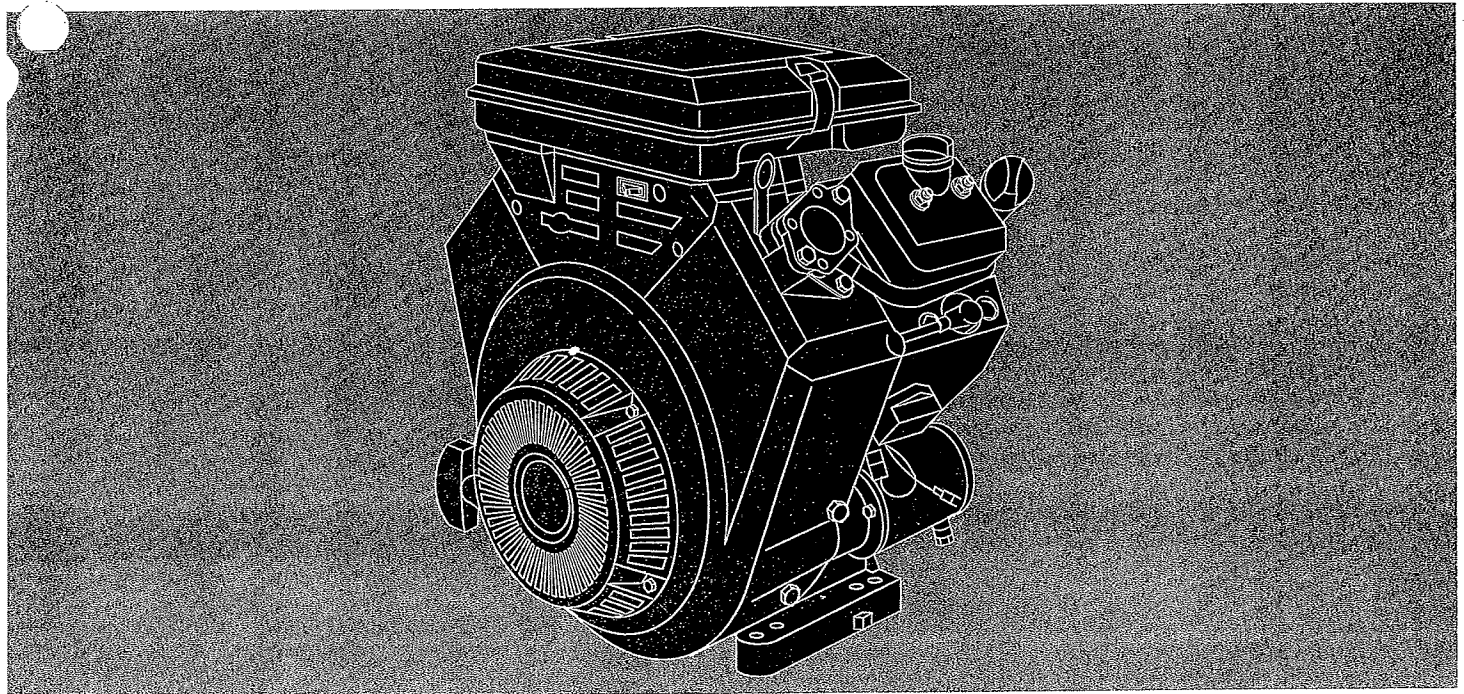
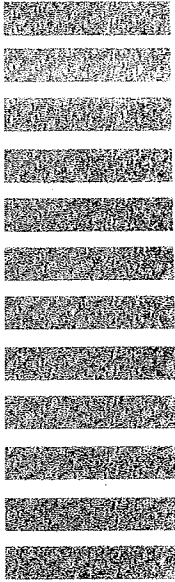
- 8.1. **Poor ventilation in vehicle.** All cargo area doors must be open for proper ventilation. Roof vents are strongly recommended for machines that are operated in hot climates. Any item that might restrict air flow to the machine such as other equipment or a solid divider should be moved or modified to permit proper air flow.
- 8.2. **Low engine oil level.** Check oil level and replenish as necessary.
- 8.3. **Engine RPM too high.** Check RPM with an accurate tachometer. Adjust as necessary to 3000 RPM.
- 8.4. **Restricted engine or blower exhaust.** Disassemble exhaust components to locate restriction. Repair as necessary.



290000, 300000, 350000, 380000



- ⓐ *Operating & Maintenance Instructions*
- ⓓ *Betriebsanleitung & Wartungsvorschriften*
- ⓓⓀ *Drifts- og vedligeholdelsesvejledning*
- ⓔ *Instrucciones de Mantenimiento & Operación*
- ⓕ *Instructions d'utilisation et de maintenance*
- ⓖⓔ *Οδηγίες Λειτουργίας & Συντήρησης*
- ⓔ *Istruzioni per l'uso e la manutenzione*
- ⓓ *Anvisninger for bruk og vedlikehold*
- ⓓⓁ *Gebruiksaanwijzing*
- ⓔ *Instruções de operação e de manutenção*
- ⓔ *Instruktionsbok*
- ⓕⓕ *Käyttö & Huolto-ohjeet*





Note: (This note applies only to engines used in the U.S.A.) Maintenance, replacement or repair of the emission control devices and systems may be performed by any nonroad engine repair establishment or individual. However, to obtain no charge repairs under the terms and provisions of the Briggs & Stratton warranty statement, any service or emission control part repair or replacement must be performed by a factory authorized dealer.

How To Use Manual Figures

- 1 - 9 refer to figures inside covers.
- 1 - 19 refer to engine components in figure 1.
- 1 - 9 refer to part/action in figures.

Record your engine Model, Type and Code numbers here for future use.

Record your date of purchase here for future use.

In the state of California, OHV Model Series 290000, 300000, 350000 and 380000 engines are certified by the California Air Resources Board to meet emissions standards for 250 hours. Such certification does not grant the purchaser, owner or operator of this engine any additional warranties with respect to the performance or operational life of this engine. This engine is warranted solely according to the product and emissions warranties stated elsewhere in this manual.

Engine Components (see fig. 1)

- 1 Oil fill cap
- 2 Dipstick
- 3 Fuel pump (if equipped)
- 4 Spark plug
- 5 Engine Model Type Code
xxxxxx xxxx xx xxxxxxxx
- 6 12V electric starter (if equipped)
- 7 Oil drain plug
- 8 Blower housing
- 9 Rope handle
- 10 Carburetor or LPG/NG Fuel mixer
- 11 Stop switch (if equipped)
- 12 Air cleaner (without fuel tank)
- 13 Fuel shut-off valve (if equipped)
- 14 Air cleaner (with fuel tank)
- 15 Fuel fill/fuel tank (if equipped)
- 16 Exhaust manifold
- 17 Oil filter (if equipped)

Safety Precautions

BEFORE OPERATING ENGINE...

- Read entire Operating & Maintenance Instructions AND the instructions for the equipment this engine powers.*
- Failure to follow instructions could result in serious injury or death.

* Briggs & Stratton does not necessarily know what equipment this engine will power. For that reason, you should carefully read and understand the operating instructions for the equipment on which your engine is placed.

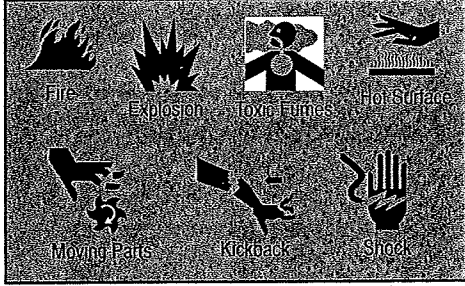
THE OPERATING & MAINTENANCE INSTRUCTIONS CONTAIN SAFETY INFORMATION TO

- Make you aware of hazards associated with engines
- Inform you of the risk of injury associated with those hazards, and
- Tell you how to avoid or reduce the risk of injury.

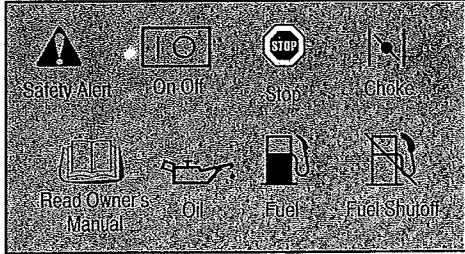
Technical Information

POWER RATINGS: The power ratings for an individual engine model are initially developed by starting with SAE (Society of Automotive Engineers) code J1940 (Engine Power & Torque Rating Procedure) (Revision 2002-05). Given both the wide array of products on which our engines are placed, and the variety of environmental issues applicable to operating the equipment, it may be that the engine you have purchased will not develop the rated horsepower when used in a piece of power equipment (actual "on-site" power). This difference is due to a variety of factors including, but not limited to, the following: differences in altitude, temperature, barometric pressure, humidity, fuel, engine lubrication, maximum governed engine speed, individual engine to engine variability, design of the particular piece of power equipment, the manner in which the engine is operated, engine run-in to reduce friction and clean out of combustion chambers, adjustments to the valves and carburetor, and other factors. The power ratings may also be adjusted based on comparisons to other similar engines utilized in similar applications, and will therefore not necessarily match the values derived using the foregoing codes.

Hazard Symbols and Meanings



International Symbols and Meanings



Warning Symbol: The safety alert symbol is used to identify safety information about hazards that can result in personal injury.

A signal word (DANGER, WARNING, or CAUTION) is used with the alert symbol to indicate the likelihood and the potential severity of injury. In addition, a hazard symbol may be used to represent the type of hazard.

DANGER indicates a hazard which, if not avoided, will result in death or serious injury.

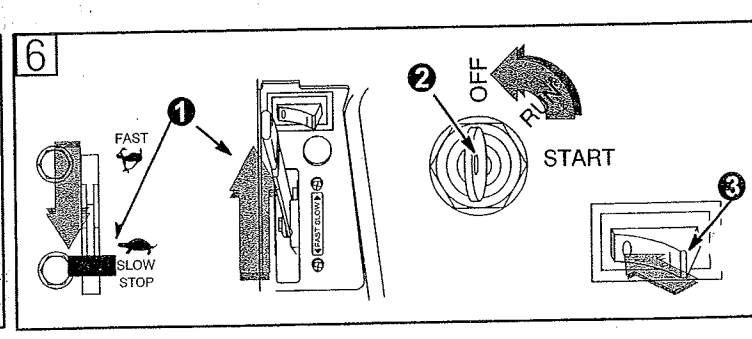
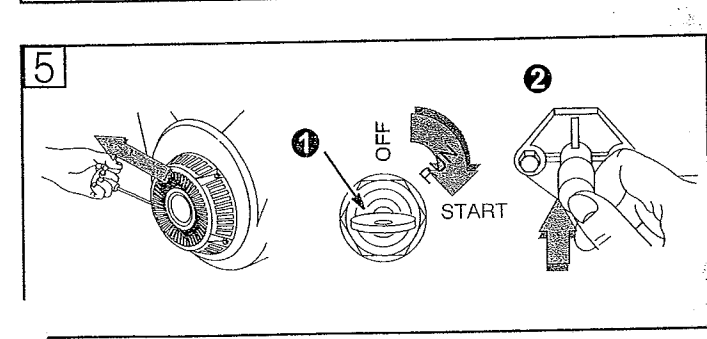
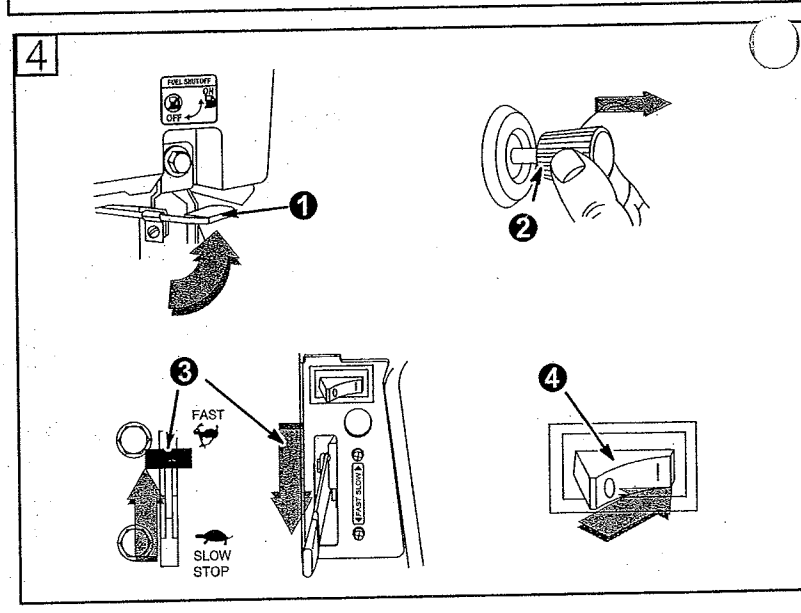
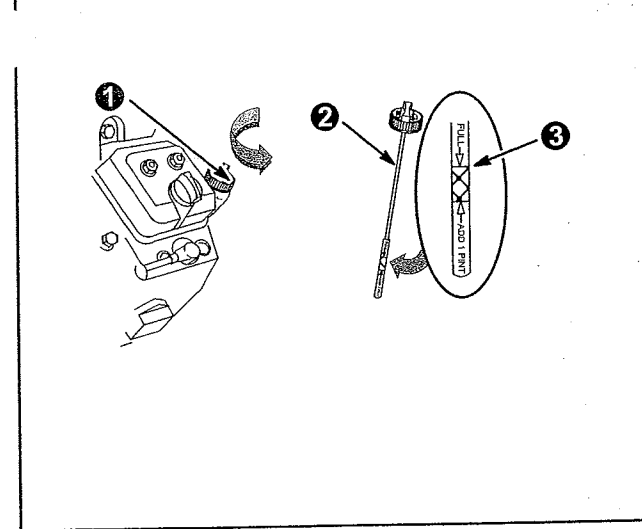
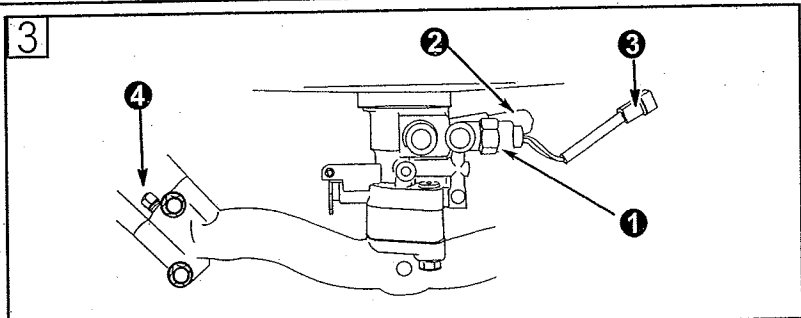
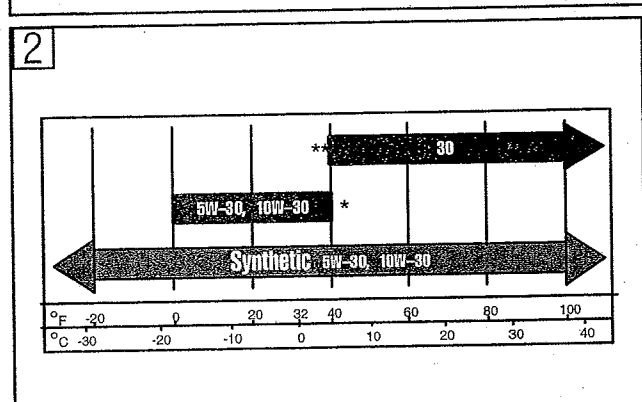
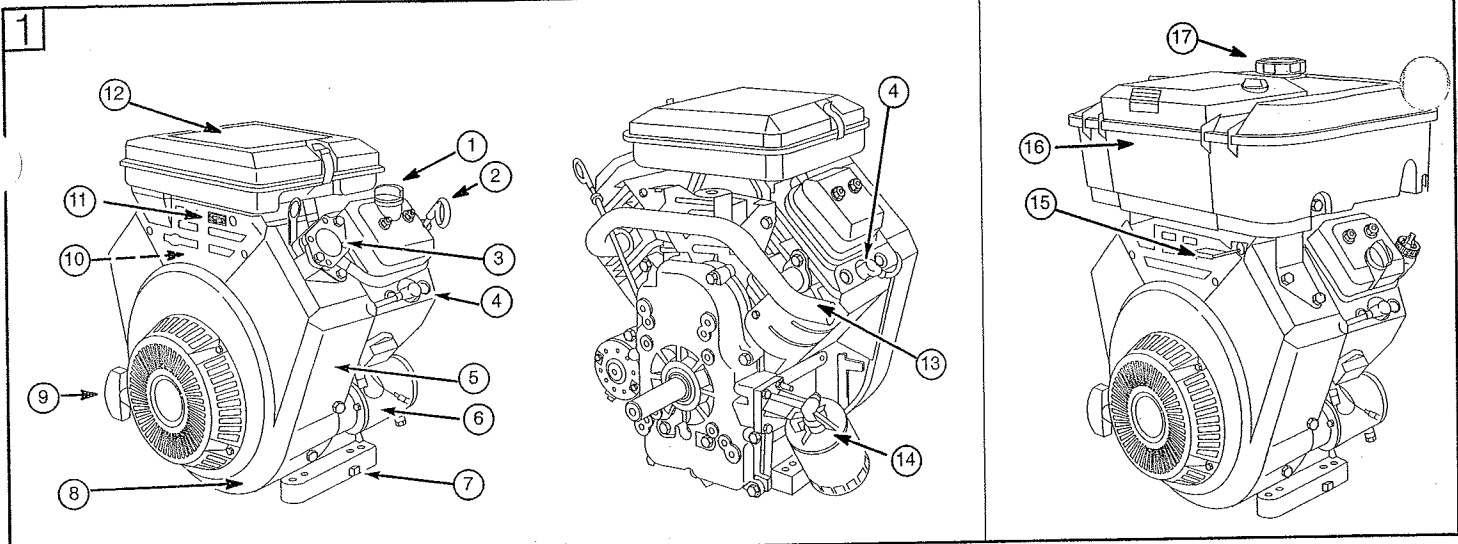
WARNING indicates a hazard which, if not avoided, could result in death or serious injury.


CAUTION indicates a hazard which, if not avoided, might result in minor or moderate injury.

CAUTION, when used without the alert symbol, indicates a situation that could result in damage to the engine.

WARNING

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



 **WARNING**



Gasoline and its vapors are extremely flammable and explosive.

Fire or explosion can cause severe burns or death.

WHEN FUELING

- Turn engine OFF and let engine cool at least 2 minutes before refueling engine.
- Fill fuel tank outdoors or in well-ventilated area.
- On **GASOLINE** operated engines, do not overfill fuel tank. Fill tank to approximately 1-1/2 inches below top of neck to allow for fuel expansion.
- Keep fuel away from sparks, open flames, pilot lights, heat, and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary.

WHEN STARTING ENGINE

- Make sure spark plug, muffler, fuel cap and air cleaner are in place.
- Do not crank engine with spark plug removed.
- If fuel spills, wait until it evaporates before starting engine.
- If **GASOLINE** engine floods, set choke to OPEN/RUN position, place throttle in FAST and crank until engine starts.

WHEN OPERATING EQUIPMENT WITH GASOLINE ENGINE


- Do not tip engine or equipment at angle which causes gasoline to spill.
- Do not choke carburetor to stop engine.

WHEN TRANSPORTING EQUIPMENT

- On gasoline engine, transport with fuel tank EMPTY or with fuel shut-off valve OFF.
- On **NATURAL / LIQUID PETROLEUM (LP) GAS** engine, transport with fuel cylinder empty, and valve closed, or tank disconnected.

WHEN STORING FUEL OR EQUIPMENT WITH FUEL IN TANK OR IN FUEL CYLINDER

- Store away from furnaces, stoves, water heaters or other appliances that have pilot light or other ignition source because they can ignite gasoline vapors.

 **WARNING**



Engines give off carbon monoxide, an odorless, colorless, poison gas.

Breathing carbon monoxide can cause nausea, fainting or death.

- Start and run engine outdoors.
- Do not start or run engine in enclosed area, even if doors or windows are open.

 **WARNING**



Gaseous fuels are extremely flammable and readily form explosive air-vapor mixtures at ambient temperatures.

IF YOU SMELL GAS:

- DO NOT start the engine.
- DO NOT actuate any electrical switches.
- DO NOT use the phone in the vicinity.
- Evacuate the area.
- Contact the gas supplier or fire department.

REMEMBER:

- LPG vapor is heavier than air and tends to collect in low areas. NG vapor is lighter than air and tends to collect in high areas. Both may travel to remote locations.
- Keep all flames, sparks, pilot lights, and other ignition sources away from the area where the engine is operated or repaired.
- DO NOT smoke when operating or repairing the engine.
- DO NOT store gasoline or other flammable vapors or liquids in the vicinity of the engine.
- **BEFORE** doing any service work to the engine, shut off the gas supply.
- After initial installation or servicing, check for gas leaks. DO NOT use an open flame. Apply very soapy water or leak test solution with a brush and look for bubbles.
- Keep the equipment and the area surrounding the engine free of debris.
- Install the fuel system according to applicable fuel/gas codes.


 **WARNING**



Wear eye protection when doing repair work.

Frostbite can result from skin/eye contact with leaking LP liquid.

- Installation, adjustment and repair work should be done by a qualified technician.
- Flexible supply lines should be checked regularly to make sure they are in good condition. Replace damaged or leaking components.

 **WARNING**



Unintentional sparking can result in fire or electric shock.


Unintentional start-up can result in entanglement, traumatic amputation, or laceration.

BEFORE PERFORMING ADJUSTMENTS OR REPAIRS

- Disconnect spark plug wire and keep it away from spark plug.
- Disconnect battery at negative terminal (only engines with electric start).

WHEN TESTING FOR SPARK

- Use approved spark plug tester.
- Do not check for spark with spark plug removed.

 **WARNING**



Starting engine creates sparking. Sparking can ignite nearby flammable gases. Explosion and fire could result.

- If there is natural or LP gas leakage in area, do not start engine.
- Do not use pressurized starting fluids because vapors are flammable.

 **WARNING**



Running engines produce heat. Engine parts, especially muffler, become extremely hot.

Severe thermal burns can occur on contact.

Combustible debris, such as leaves, grass, brush, etc. can catch fire.

- Allow muffler, engine cylinder and fins to cool before touching.
- Remove accumulated combustibles from muffler area and cylinder area.
- Install and maintain in working order a spark arrester before using equipment on forest-covered, grass-covered, brush-covered unimproved land. The state of California requires this (Section 4442 of the California Public Resources Code). Other states may have similar laws. Federal laws apply on federal land.

 **WARNING**



Rotating parts can contact or entangle hands, feet, hair, clothing, or accessories.

Traumatic amputation or severe laceration can result.

- Operate equipment with guards in place.
- Keep hands and feet away from rotating parts.
- Tie up long hair and remove jewelry.
- Do not wear loose-fitting clothing, dangling drawstrings or items that could become caught.

 **WARNING**



Rapid retraction of starter cord (kickback) will pull hand and arm toward engine faster than you can let go.

Broken bones, fractures, bruises or sprains could result.

- When starting engine, pull cord slowly until resistance is felt, then pull rapidly.
- Remove all external equipment/engine loads before starting engine.
- Direct coupled equipment components such as, but not limited to, blades, impellers, pulleys, sprockets, etc., must be securely attached.

Oil Recommendations (see fig. [2])

Engine shipped from Briggs & Stratton without oil. Before starting engine, fill with oil. Do not over-fill.

Use a high quality detergent oil classified "For Service SF, SG, SH, SJ" or higher such as Briggs & Stratton 30W, Part Number 100005 (20 oz.) or 100028 (48 oz.). Use no special additives with recommended oils. Do not mix oil with gasoline.

Choose the SAE viscosity grade of oil from this chart that matches the starting temperature anticipated before the next oil change. (see fig. [2])



Note: Synthetic oil meeting ILSAC GF-2, API certification mark and API service symbol (shown at left) with "SJ/CF ENERGY CONSERVING" or higher, is an acceptable oil at all temperatures. Use of synthetic oil does not alter required oil change intervals.

* Air cooled engines run hotter than automotive engines. The use of non-synthetic multi-viscosity oils (5W-30, 10W-30, etc.) in temperatures above 40° F (4° C) will result in higher than normal oil consumption. When using a multi-viscosity oil, check oil level more frequently. SAE 30 oil, if used below 40° F (4° C), will result in hard starting and possible engine bore damage due to inadequate lubrication.

Check oil level (see fig. [2])

Oil capacity: approximately 1-1/2 quarts (48 ounces or 1.6 liters) when changing oil and filter. (Oil capacity will be greater if engine is equipped with remote oil filter.)

Oil filling procedure: first add 1 quart (32 ounces or 1 liter). Start and run engine at idle for 30 seconds. Shut engine off and wait 30 seconds. Then add more oil slowly to bring level to Full mark on dipstick. Check for oil leaks. Tighten dipstick firmly before starting engine.

Oil checking procedure: before starting engine, place engine level and clean around oil fill ❶. Remove dipstick ❷, wipe with clean cloth, insert and tighten down again. Remove dipstick and check oil level. Oil should be at FULL mark ❸. If oil is required, add slowly. Tighten dipstick firmly before starting engine.

Fuel Recommendations

Gasoline Powered Engines

Use clean, fresh, lead-free gasoline with a minimum of 85 octane. Leaded gasoline may be used if it is commercially available and if unleaded is unavailable. Purchase fuel in quantity that can be used within 30 days.

Do not use gasoline which contains Methanol. Do not mix oil with gasoline. In U.S.A. leaded gasoline may not be used.

This engine is certified to operate on gasoline. Exhaust Emission Control System: EM (Engine Modifications).

For engine protection, we recommend using Briggs & Stratton Fuel Stabilizer available from an Authorized Briggs & Stratton Service Dealer.

Natural (NG) / Liquid Propane (LPG) Gas Powered Engines

Use clean, dry fuel, free of moisture or any particulate material. Using fuels outside the following recommended values may cause performance problems.

In engines set up to run on LPG, commercial grade HD5 LPG is recommended. Recommended fuel composition is fuel with a minimum fuel energy of 2500 BTU's/ft³ with maximum propylene content of 5% and butane and heavier gas content of 2.5% and minimum propane content of 90%.

NG or LPG engines are certified to operate on natural or liquid propane gas.



The equipment on which this engine is mounted is equipped with an automatic safety gas "fuel lock-off" valve. DO

NOT operate the equipment if the "fuel lock-off" valve is missing or inoperative.

Adding Fuel - Gasoline



Before refueling, allow engine to cool 2 minutes.

Clean around fuel fill before removing cap to refuel. Remove cap. Fill tank to approximately 1-1/2 inches below top of neck to allow for fuel expansion. Be careful not to overfill.

Adding Fuel - Natural (NG) / Liquid Propane (LPG)

Read the operating instructions supplied by the equipment manufacturer for information on refueling natural or LP gas engine.

Starting (see figs. [3] [4])



ALWAYS KEEP HANDS AND FEET CLEAR OF EQUIPMENT MOVING PARTS.



Do not use a pressurized starting fluid. Vapors are flammable.

Start, store and fuel equipment in level position.

Check oil level.

Open fuel shut-off valve, if equipped.

BEFORE STARTING - LPG / NG Engines

(see fig. [3])

The LPG / NG mixer is equipped with solenoid ❶, fuel inlet ❷, 12 volt connector ❸, and equipped for a fuel lock-off valve ❹.

CAUTION:

All LPG / NG fuel mixers are equipped with a solenoid. ❶ When operating on LPG fuel, 12 volts **MUST** be supplied to connector ❷.

When operating on NG fuel, 12 volts **MUST NOT** be supplied to connector ❸.

1. Move throttle control to FAST position.
2. Push rocker switch to I position.

BEFORE STARTING - Gasoline Engines

(see fig. [4])

If engine runs low on oil, an oil pressure switch (if engine is equipped) will either activate a warning device or stop the engine. (Read the operating instructions supplied by the equipment manufacturer to determine which way your engine is equipped.) See Oil pressure on next page.

1. Open fuel shut-off valve ❶, if equipped.
2. Move choke control ❷ to CHOKE position.

Note: If engine does not start, remove air cleaner to check choke. Choke must fully close. If not, see **Adjustments**.

3. Move throttle control ❸ to FAST position.
4. Push rocker switch ❹ to I position.

Rewind starter, if equipped (see fig. [5])



Grasp rope handle and pull slowly until resistance is felt. Then pull cord rapidly to overcome compression, prevent kickback and start engine. Repeat if necessary with choke in RUN position throttle in FAST. When engine starts, operate in FAST.

Electric starter (see fig. [5])

On engines equipped with 12 volt starting systems, turn key to START position ❶ or press button ❷. Repeat if necessary with choke off and throttle control in FAST position. Operate engine with choke off and throttle in FAST position.

Note: If equipment manufacturer has supplied battery, charge it before trying to start engine, as equipment manufacturer recommends. Use short starting cycles (15 secs. per min.) to prolong starter life. Extended cranking can damage starter motor.

CAUTION: If engine is equipped with battery for electric starter, do not operate engine with battery disconnected.

Stopping (see fig. [6])

Do not move choke control to CHOKE to stop engine. Backfire or engine damage may occur. Move throttle control ❶ to IDLE or SLOW position, then to STOP or turn key to OFF ❷ or push rocker switch ❸ to 0 position.

Always remove key from switch when equipment is not in use or left unattended.



When engine or equipment is transported, close fuel shut-off valve, if equipped, to prevent fuel leakage.

Maintenance Schedule

Follow the hourly or calendar intervals, whichever occur first. More frequent service is required when operating in adverse conditions noted below.

First 8 Hours

- Change oil

Every 8 hours or daily

- Check oil level
- Clean around muffler, linkage and springs

Every 25 hours or every season

- Change oil if operating under heavy load or high ambient temperature
- Service air cleaner pre-cleaner*

Every 50 hours or every season

- Change oil
- Clean and inspect spark arrester, if equipped

Every 100 hours or every season

- Service air cleaner cartridge*
- Replace oil filter, if equipped
- Clean oil cooler, if equipped*
- Clean cooling system*
- Check valve clearance - NG / LPG engines

Every season

- Replace spark plugs
- Replace in-line fuel filter
- Check valve clearance

* Clean more often under dusty conditions, or when airborne debris is present or after prolonged operation cutting tall, dry grass.

Maintenance (see figs. 8 9 10)

See any Authorized Briggs & Stratton Dealer for correct replacement parts.



To prevent accidental starting, remove spark plug wire ① and ground it before servicing, and disconnect battery at negative terminal, if equipped.

Oil service (see fig. 8)

Check oil level regularly.

Be sure correct oil level is maintained. Check every 8 hours or daily, before starting engine. See oil filling procedure, *Oil Recommendations*.

Change oil.

Change oil after first 8 hours of operation. Change oil while engine is warm. Refill with new oil of recommended SAE viscosity grade. (see fig. 2)

Change oil filter ②, if equipped. (see fig. 8)

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

Oil pressure

If oil pressure drops below 1-4 psi (.1-.2 kg/cm²), an oil pressure switch (if engine is equipped) will either activate a warning device or stop the engine. Check oil level with dipstick. If oil level is between **ADD** and **FULL** mark on dipstick, **do not try to restart engine**. Contact an Authorized Briggs & Stratton Service Dealer. **Do not operate engine until oil pressure is corrected.**

If oil level is below **ADD** mark on dipstick, add oil to bring level to **FULL** mark. Restart engine and check oil pressure. If pressure is normal, continue to operate engine.

Note: Oil pressure gauge, if engine is equipped, is supplied by manufacturer of equipment.

Maintenance Cont'd

Air cleaner, dual element (see fig. 9)

1. Remove cover.
2. Carefully slide pre-cleaner ② off cartridge ③.
3. Remove knob and plate. Carefully remove cartridge to prevent debris from entering carburetor.

Replace pre-cleaner, if equipped, or cartridge if very dirty or damaged.

To service cartridge, clean by tapping gently on a flat surface. Do not use petroleum solvents, e.g., kerosene, which will cause cartridge to deteriorate. Do not use pressurized air, which can damage cartridge. Do not oil cartridge.

4. Reinstall cartridge, plate and knob.

Note: Top side of air cleaner plate ④ is marked "UP" (only on engines equipped with integral fuel tank).

5. Install pre-cleaner on cartridge and replace cover.

Spark plug service (see fig. 10)



DO NOT check for spark with spark plugs removed. Use only Briggs & Stratton Spark Tester ②, to check for spark.

DO NOT crank engine with spark plug removed. If engine is flooded, place throttle in FAST and crank until engine starts.

Spark plug gap ⑤ should be .76 mm or 0.030 in.

Replace spark plugs every season. Spark tester and spark plug wrench are available from any Authorized Briggs & Stratton Service Dealer.

Note: In some areas, local law requires using a resistor spark plug to suppress ignition signals. If this engine was originally equipped with resistor spark plug, use same type of spark plug for replacement.

Keep engine clean (see fig. 10)

Periodically remove chaff/debris buildup from engine. Do not spray engine with water because water could contaminate fuel. Use a brush or compressed air.



Accumulation of chaff/debris around exhaust manifold/muffler ④ could cause a fire. Inspect and clean before every use.

Keep linkage, springs and controls ④ free of debris.

If muffler is equipped with spark arrester screen ⑤, remove spark arrester screen for cleaning and inspection every 50 hours or every season. Replace if damaged.



Replace in-line fuel filter ⑥ every season. Drain fuel tank or close fuel shut-off valve before replacing filter.

Clean oil cooler ⑦ every 100 hours or every season, if equipped.

Chaff or debris may clog engine's air cooling system, especially after prolonged service. Every 100 hours or every season, clean internal cooling fins and surfaces to prevent overheating and engine damage. Remove blower housing to clean areas shown ⑧.

Check Valve Clearance

Gasoline Engines -

Check valve clearance yearly (intake and exhaust .10-.15 mm).

NG / LPG Engines -

Valve clearance must be checked after every 100 hours of operation. Adjust if necessary.

Adjustments (see fig. 7)



To prevent accidental starting, remove spark plug wire ① and ground it before adjusting, and disconnect battery at negative terminal, if equipped.

connect battery at negative terminal, if equipped.

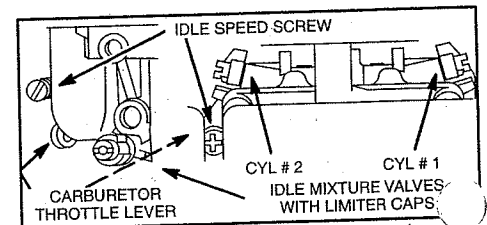
Carburetor adjustments



The manufacturer of the equipment on which this engine is installed specifies top speed at which the engine will be operated. DO NOT EXCEED this speed.

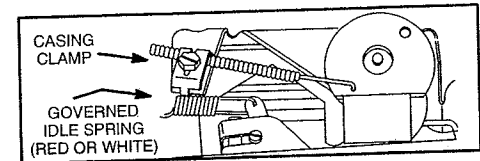
See an Authorized Briggs & Stratton Dealer for carburetor adjustment.

Start engine and warm up approximately 5 minutes before adjusting. With engine running, place throttle control in SLOW position. Rotate carburetor throttle lever against the idle speed screw and hold it. Turn idle speed screw to obtain 1400 rpm (1200 rpm on twin barrel carburetor). While still holding carburetor throttle lever against idle speed screw, turn idle mixture valve with limiter cap screw midway between limits. DO NOT remove limiter cap. DO NOT force beyond limit. On two barrel carburetor, set cylinder #1 idle mixture valve midway between limits. Then set cylinder #2 idle mixture valve midway between limits while holding carburetor throttle lever against idle speed screw.



Single barrel carburetor Two barrel carburetor

Readjust the idle speed to 1200 rpm, if governed idle spring is red, or 900 rpm, if governed idle spring is white as illustrated below. Release carburetor throttle lever. Move throttle control to FAST position.



Note: Engines operated at approximately 3000 to 5000 feet above sea level may require a high altitude carburetor main jet. See a Briggs & Stratton Dealer.

ON NG / LPG Powered Engines Adjusting Fuel Mixer

If adjustment is needed, see a Briggs & Stratton Authorized Service Dealer who has been licensed by the state or local municipality (if required) in which the service is performed. Mixer adjustment requires special equipment and a qualified technician. DO NOT remove limiter caps. DO NOT force beyond limits.

Adjustments Cont'd (see fig. 7)

Choke control adjustments

Remove air cleaner. Move choke control to CHOKE position. Carburetor choke valve ② should be completely closed. If not, loosen casing clamp screw ③ and pull casing and wire ④ in direction of arrow to end of travel. Tighten casing clamp screw. Replace air cleaner.

Throttle control adjustments ⑤

Remove air cleaner. Move throttle control to FAST position. Swivel ⑤ should be against throttle stop ⑥. If not, loosen casing clamp screw ⑦. Move casing and wire ⑧ in direction shown by arrow until swivel is against throttle stop. Tighten casing clamp screw. Check operation of controls. Readjust if necessary. Replace air cleaner.

Adjustable Governor Control

This control ⑨ was set according to requirements of manufacturer of the equipment on which this engine is installed. If adjustment is required, consult any Briggs & Stratton Authorized Service Dealer.

Storage

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

For engine protection, we recommend use of Briggs & Stratton Fuel Stabilizer available from an Authorized Briggs & Stratton Service Dealer. Mix stabilizer with fuel in fuel tank or storage container. Run engine for a short time to circulate stabilizer through carburetor. Engine and fuel can be stored up to 24 months.

Note: If stabilizer is not used or if engine is operating on gasoline containing alcohol, e.g. gasohol, remove all fuel from tank and run engine until it stops from lack of fuel.

1. Change oil. See Oil service. (see figs. 2, 7)
2. Remove spark plugs and pour about 30 ml (1 oz) of engine oil into cylinders. Replace spark plugs and crank slowly to distribute oil.
3. Clean chaff or debris from cylinders and cylinder head fins and behind muffler.
4. Store in a clean and dry area, but NOT near a stove, furnace or water heater which uses a pilot light or any device that can create a spark.

Service

See an Authorized Briggs & Stratton Service Dealer. Each one carries a stock of Genuine Briggs & Stratton Parts and is equipped with special service tools. Trained mechanics assure expert repair service on all Briggs & Stratton engines. Only dealers advertising as "Authorized Briggs & Stratton" are required to meet Briggs & Stratton standards.

When you purchase equipment powered by a Briggs & Stratton engine, you are assured of highly skilled, reliable service at more than 30,000 Authorized Service Dealers worldwide, including more than 5,000 Master Service Technicians. Look for these signs wherever Briggs & Stratton service is offered.



You may locate your nearest Authorized Briggs & Stratton Service Dealer in our dealer locator map on our web site www.briggsandstratton.com or in the "Yellow

Pages™" directory under "Engines, Gasoline" or "Gasoline Engines," or "Lawn Mowers" or similar category.



Note: Walking fingers logo and "Yellow Pages" are registered trademarks in various jurisdictions.

An illustrated shop manual includes "Theories of Operation," common specifications and detailed information covering adjustment, tune-up and repair of Briggs & Stratton V-Twin cylinder OHV, 4 cycle engines. Order P/N 272144 from an Authorized Briggs & Stratton Service Dealer.

Insist on Genuine Briggs & Stratton replacement parts with our logo on the box and/or part. Non-original parts may not perform as well and may void your warranty.

Partial List of Genuine Briggs & Stratton Parts

Briggs & Stratton (or equivalent)

Part	Part No.
Oil (20 oz.)	100005
Oil (48 oz.)	100028
Oil filter (6 cm long)	492932 (5049)
Oil filter (9 cm long)	491056
Oil pump kit (uses standard electric drill to remove oil from engine quickly)	5056
Fuel stabilizer (1 oz., 30 ml single use pouch)	992030
Fuel stabilizer (4.2 oz., 125 ml bottle)	999005E (5041)
Fuel filter (without fuel pump)	298090 (5018)
Fuel filter (with fuel pump)	493629
Fuel filter (with 9 qt. fuel tank on engine)	808116
Air cleaner cartridge (with 9 qt. fuel tank on engine)	393957
Air cleaner pre-cleaner (with 9 qt. fuel tank on engine)	271794
Air cleaner cartridge (all other models except model 380000)	394018
Air cleaner pre-cleaner (all other models except model 380000)	272490
Air cleaner (cartridge and pre-cleaner kit) (all other models except model 380000)	5050
Air cleaner cartridge (model 380000)	692519
Air cleaner pre-cleaner (model 380000)	692520
Resistor spark plug	491055 or 496018
Long life platinum spark plug (used on most OHV engines)	5066
Spark tester	19368
Spark plug wrench	19374
Spark arrester	392390
Resistor spark plug	491055 or 496018

BRIGGS & STRATTON ENGINE OWNER WARRANTY POLICY

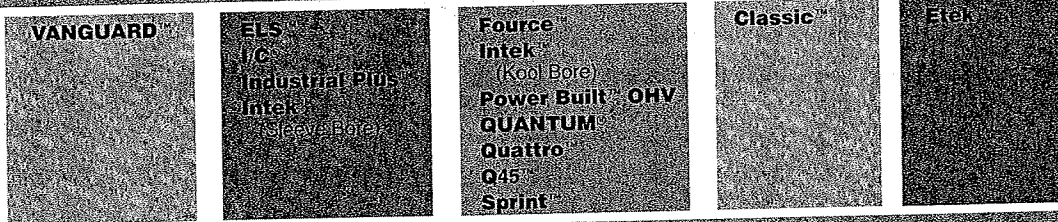
Effective January 1, 2003 replaces all undated Warranties and all Warranties dated before January 1, 2003

LIMITED WARRANTY

Briggs & Stratton Corporation will repair or replace, free of charge, any part(s) of the engine that is defective in material or workmanship or both. Transportation charges on parts submitted for repair or replacement under this warranty must be borne by purchaser. This warranty is effective for the time periods and subject to the conditions stated below. For warranty service, find the nearest Authorized Service Dealer in our dealer locator map at www.briggsandstratton.com, or by calling 1-800-233-3723, or as listed in the "Yellow Pages"™.

THERE IS NO OTHER EXPRESS WARRANTY. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE YEAR FROM PURCHASE, OR TO THE EXTENT PERMITTED BY LAW ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES ARE EXCLUDED TO THE EXTENT EXCLUSION IS PERMITTED BY LAW. Some states or countries do not allow limitations on how long an implied warranty lasts, and some states or countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state and country to country.

OUR PRODUCT



WARRANTY PERIOD*

Consumer Use	2 years	2 years	2 years	1 year	1 year
Commercial Use	2 years	2 years	90 days	90 days	90 days

* Note the following special warranty periods: 2 years for Classic™ engines in the European Union and Eastern European countries, for all consumer products in the European Union, and for emission control systems on engines certified by EPA and CARB. 5 years for consumer use, 90 days for commercial use of Touch-N-Mow® starter on Quantum® and Intek™ engines. Engines used in competitive racing or on commercial or rental tracks are not warrantied.

The warranty period begins on the date of purchase by the first retail consumer or commercial end user, and continues for the period of time stated in the table above. "Consumer use" means personal residential household use by a retail consumer. "Commercial use" means all other uses, including use for commercial, income producing or rental purposes. Or if an engine has experienced commercial use, it shall thereafter be considered as a commercial use engine for purposes of this warranty.

NO WARRANTY REGISTRATION IS NECESSARY TO OBTAIN WARRANTY ON BRIGGS & STRATTON PRODUCTS. SAVE YOUR PROOF OF PURCHASE RECEIPT. YOU DO NOT PROVIDE PROOF OF THE INITIAL PURCHASE DATE AT THE TIME WARRANTY SERVICE IS REQUESTED, THE MANUFACTURING DATE OF PRODUCT WILL BE USED TO DETERMINE THE WARRANTY PERIOD.

ABOUT YOUR ENGINE WARRANTY

Briggs & Stratton welcomes warranty repair and apologizes to you for being inconvenienced. Any Authorized Service Dealer may perform warranty repairs. Most warranty repairs are handled routinely, but sometimes requests for warranty service may not be appropriate. For example, warranty would not apply if engine damage occurred because of misuse, lack of routine maintenance, shipping, handling, warehousing or improper installation. Similarly, warranty is void if the serial number of the engine has been removed or the engine has been altered or modified.

If a customer differs with the decision of the Service Dealer, an investigation will be made to determine whether the warranty applies. Ask the Service Dealer to submit all supporting facts to his Distributor or the Factory for review. If the Distributor or the Factory decides that the claim is justified, the customer will be fully reimbursed for those items that are defective. To avoid misunderstanding which might occur between the customer and the Dealer, listed below are some of the causes of engine failure that the warranty does not cover.

Normal wear:

Engines, like all mechanical devices, need periodic parts service and replacement to perform well. Warranty will not cover repair when normal use has exhausted the life of a part or an engine.

Improper maintenance:

The life of an engine depends upon the conditions under which it operates, and the care it receives. Some applications, such as tillers, pumps and rotary mowers, are very often used in dusty or dirty conditions, which can cause what appears to be premature wear. Such wear, when caused by dirt, dust, spark plug cleaning

grit, or other abrasive material that has entered the engine because of improper maintenance, is not covered by warranty.

This warranty covers engine related defective material and/or workmanship only, and not replacement or refund of the equipment to which the engine may be mounted. Nor does the warranty extend to repairs required because of:

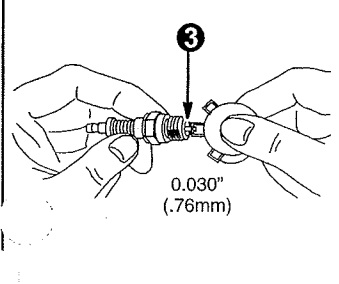
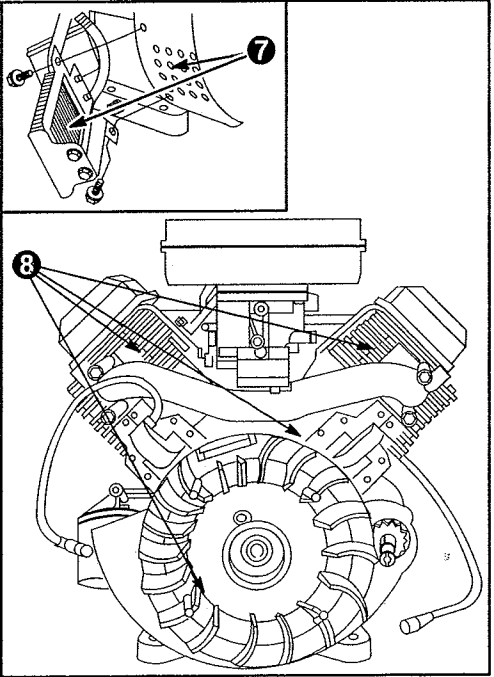
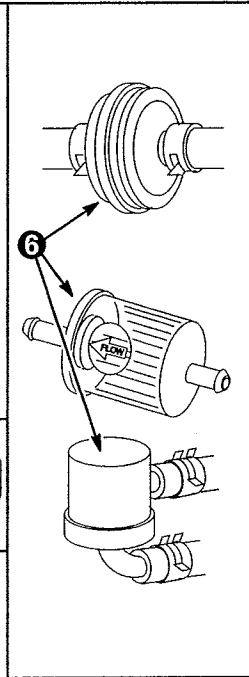
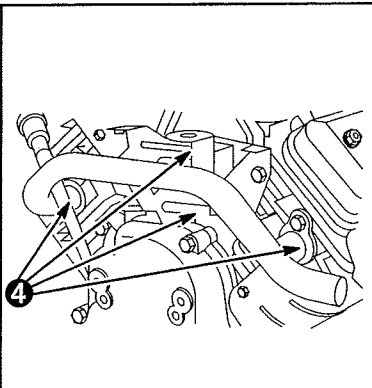
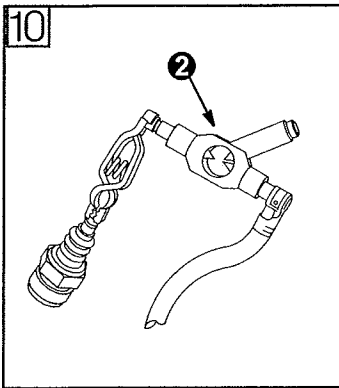
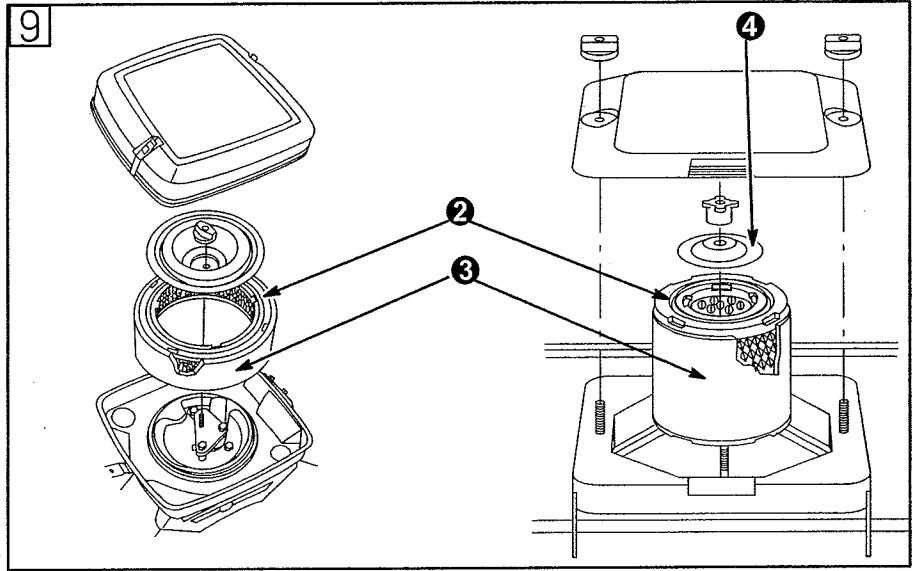
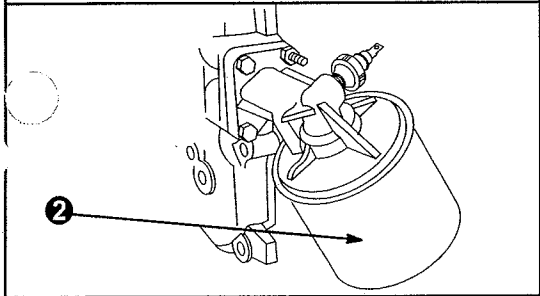
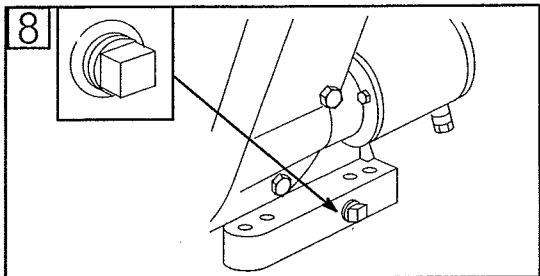
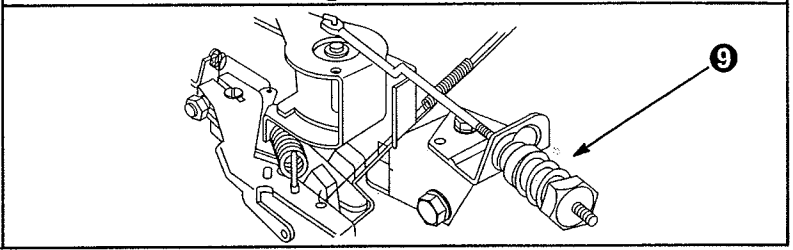
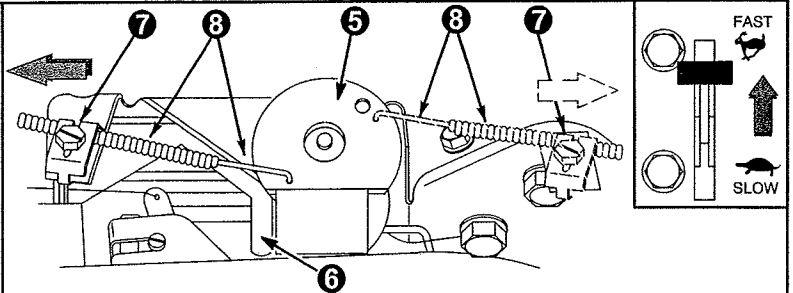
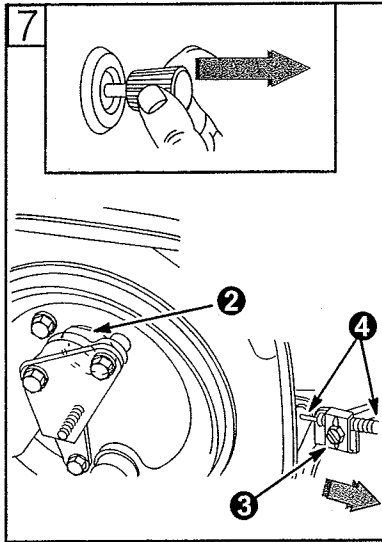
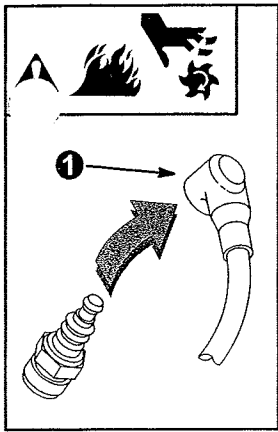
1. PROBLEMS CAUSED BY PARTS THAT ARE NOT ORIGINAL BRIGGS & STRATTON PARTS.
2. Equipment controls or installations that prevent starting, cause unsatisfactory engine performance, or shorten engine life. (Contact equipment manufacturer.)
3. Leaking carburetors, clogged fuel pipes, sticking valves, or other damage, caused by using contaminated or stale fuel. (Use clean, fresh, lead-free gasoline and Briggs & Stratton Fuel Stabilizer, Part No. 5041.)
4. Parts which are scored or broken because an engine was operated with insufficient or contaminated lubricating oil, or an incorrect grade of lubricating oil (check oil level daily or after every 8 hours of operation. Refill when necessary and change at recommended intervals.) OIL GARD® may not shut down running engine. Engine damage may occur if oil level is not properly maintained. Read Operating & Maintenance Instructions.
5. Repair or adjustment of associated parts or assemblies such as clutches, transmissions, remote controls, etc., which are not manufactured by Briggs & Stratton.
6. Damage or wear to parts caused by dirt, which entered the engine because of improper air cleaner maintenance, re-assembly, or use of a non-original air cleaner element or cartridge. (At recommended intervals, clean and re-oil

the Oil-Foam® element or the foam pre-cleaner, and replace the cartridge.) Read Operating & Maintenance Instructions.

7. Parts damaged by over-speeding, or overheating caused by grass, debris, or dirt, which plugs or clogs the cooling fins, or flywheel area, or damage caused by operating the engine in a confined area without sufficient ventilation. (Clean fins on the cylinder, cylinder head and flywheel at recommended intervals.) Read Operating & Maintenance Instructions.
8. Engine or equipment parts broken by excessive vibration caused by a loose engine mounting, loose cutter blades, unbalanced blades or loose or unbalanced impellers, improper attachment of equipment to engine crankshaft, over-speeding or other abuse in operation.
9. A bent or broken crankshaft, caused by striking a solid object with the cutter blade of a rotary lawn mower, or excessive v-belt tightness.
10. Routine tune-up or adjustment of the engine.
11. Engine or engine component failure, i.e., combustion chamber, valves, valve seats, valve guides, or burned starter motor windings, caused by the use of alternate fuels such as, liquified petroleum, natural gas, altered gasolines, etc.

Warranty is available only through service dealers which have been authorized by Briggs & Stratton Corporation. your nearest Authorized Service Dealer is listed in the "Yellow Pages"™ of your telephone directory under "Engines, Gasoline" or "Gasoline Engines," "Lawn Mowers," or similar category.

Briggs & Stratton Engines Are Made Under One Or More Of The Following Patents: Design D-247,177 (Other Patents Pending)										
6,325,036	6,077,063	5,819,513	5,606,948	5,497,679	5,235,943	5,138,996	4,996,956	4,633,556	4,430,984	DES. 308
6,284,123	6,064,027	5,813,384	5,606,851	5,320,795	5,197,425	5,086,890	4,977,879	4,630,498		DES. 308, L
6,260,529	6,014,808	5,765,713	5,548,955	5,271,363	5,197,422	5,070,829	4,971,219	4,522,080		DES. 309, 4*
6,230,678	5,894,715	5,645,025	5,546,901	5,269,713	5,191,864	5,058,544	4,895,119	4,520,288		DES. 356,!
6,202,616	5,852,951	5,642,701	5,503,125	5,265,700	5,188,069	5,040,644	4,819,593	4,512,499		DES. 361, 7.
6,116,212	5,823,153	5,619,845	5,501,203	5,243,878	5,186,142	5,009,208	4,719,682	4,453,507		DES. 375, 963



**Briggs & Stratton Corporation (B&S), the California Air Resources Board (CARB) and the United States Environmental Protection Agency (U.S. EPA)
Emission Control System Warranty Statement (Owner's Defect Warranty Rights and Obligations)**

EMISSION CONTROL WARRANTY COVERAGE IS APPLICABLE TO CERTIFIED ENGINES PURCHASED IN CALIFORNIA IN 1995 AND THEREAFTER, WHICH ARE USED IN CALIFORNIA, AND

TO CERTIFIED MODEL YEAR 1997 AND LATER ENGINES WHICH ARE PURCHASED AND USED ELSEWHERE IN THE UNITED STATES (AND AFTER JANUARY 1, 2001 IN CANADA).

California, United States and Canada Emission Control Defects Warranty Statement

The California Air Resources Board (CARB), U.S. EPA and B&S are pleased to explain the Emission Control System Warranty on your model year 2000 and later small off-road engine (SORE). In California, new small off-road engines must be designed, built and equipped to meet the State's stringent anti-smog standards. Elsewhere in the United States, new non-road, spark-ignition engines certified for model year 1997 and later, must meet similar standards set forth by the U.S. EPA. B&S must warrant the emission control system on your engine for the periods of time listed below, provided there has been

no abuse, neglect or improper maintenance of your small off-road engine. Your emission control system includes parts such as the carburetor, air cleaner, ignition system, muffler and catalytic converter. Also included may be connectors and other emission related assemblies.

Where a warrantable condition exists, B&S will repair your small off-road engine at no cost to you including diagnosis, parts and labor.

Briggs & Stratton Emission Control Defects Warranty Coverage

Small off-road engines are warranted relative to emission control parts defects for a period of two years, subject to provisions set forth below. If any covered part on your engine is defective, the part will be repaired or replaced by B&S.

Owner's Warranty Responsibilities

As the small off-road engine owner, you are responsible for the performance of the required maintenance listed in your Operating and Maintenance Instructions. B&S recommends that you retain all your receipts covering maintenance on your small off-road engine, but B&S cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

You are responsible for presenting your small off-road engine to an Authorized B&S Service Dealer as soon as a problem exists. The undisputed warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

If you have any questions regarding your warranty rights and responsibilities, you should contact a B&S Service Representative at 1-414-259-5262.

The emission warranty is a defects warranty. Defects are judged on normal engine performance. The warranty is not related to an in-use emission test.

Briggs & Stratton Emission Control Defects Warranty Provisions

The following are specific provisions relative to your Emission Control Defects Warranty Coverage. It is in addition to the B&S engine warranty for non-regulated engines found in the Operating and Maintenance Instructions.

1. Warranted Parts

Coverage under this warranty extends only to the parts listed below (the emission control systems parts) to the extent these parts were present on the engine purchased.

a. Fuel Metering System

- Cold start enrichment system (soft choke)
- Carburetor and internal parts
- Fuel Pump

b. Air Induction System

- Air cleaner
- Intake manifold

c. Ignition System

- Spark plug(s)
- Magneto ignition system

d. Catalyst System

- Catalytic converter
- Exhaust manifold
- Air injection system or pulse valve

e. Miscellaneous Items Used in Above Systems

- Vacuum, temperature, position, time sensitive valves and switches
- Connectors and assemblies

2. Length of Coverage

B&S warrants to the initial owner and each subsequent purchaser that the Warranted Parts shall be free from defects in materials and workmanship which caused the failure of the Warranted Parts for a period of two years from the date the engine is delivered to a retail purchaser.

3. No Charge

Repair or replacement of any Warranted Part will be performed at no charge to the owner, including diagnostic labor which leads to the determination that a Warranted Part is defective, if the diagnostic work is performed at an Authorized B&S Service Dealer. For emissions warranty service contact your nearest Authorized B&S Service Dealer as listed in the "Yellow Pages" under "Engines, Gasoline," "Gasoline Engines," "Lawn Mowers," or similar category.

4. Claims and Coverage Exclusions

Warranty claims shall be filed in accordance with the provisions of the B&S Engine Warranty Policy. Warranty coverage shall be excluded for failures of Warranted Parts which are not B&S parts or because of abuse, neglect or improper maintenance as set forth in the Engine Warranty Policy. B&S is not liable to cover failures of Warranted Parts caused by use of add-on, non-original, or modified parts.

5. Maintenance

Any Warranted Part which is not scheduled for replacement as required maintenance or which is scheduled only for regular inspection to the effect of "repair or replace as necessary" shall be warranted as to defects for the warranty period. Any Warranted Part which is scheduled for replacement as required maintenance shall be warranted as to defects only for the period of time up to the first scheduled replacement for that part. Any replacement part that is equivalent in performance and durability may be used in the performance of any maintenance or repairs. The owner is responsible for the performance of all required maintenance, as defined in the B&S Operating and Maintenance Instructions.

6. Consequential Coverage

Coverage hereunder shall extend to the failure of any engine components caused by the failure of any Warranted Part still under warranty.

Look For Relevant Emission Durability Period and Air Index Information On Your Engine Emission Label

Engines that are certified to meet the California Air Resources Board (CARB) Tier 2 Emission Standards must display information regarding the Emissions Durability Period and the Air Index. Briggs & Stratton makes this information available to the consumer on our emission labels. The engine label will indicate certification information.

The **Emission Durability Period** describes the number of hours of actual running time for which the engine is certified to be emission compliant, assuming proper maintenance in accordance with the Operating & Maintenance Instructions. The following categories are used:

Moderate: Engine is certified to be emission compliant for 125 hours of actual engine running time.

Intermediate: Engine is certified to be emission compliant for 250 hours of actual engine running time.

Extended: Engine is certified to be emission compliant for 500 hours of actual engine running time.

For example, a typical walk-behind lawn mower is used 20 to 25 hours per year. Therefore, the **Emission Durability Period** of an engine with an **intermediate** rating would equate to 10 to 12 years.

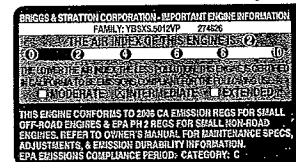
The **Air Index** is a calculated number describing the relative level of emission for a specific engine family. The lower the **Air Index**, the cleaner the engine. This information is displayed in graphical form on the emission label.

After July 1, 2000, Look For Emissions Compliance Period On Engine Emissions Compliance Label

After July 1, 2000 certain Briggs & Stratton engines will be certified to meet the United States Environmental Protection Agency (USEPA) Phase 2 emission standards. For Phase 2 certified engines, the Emissions Compliance Period referred to on the Emissions Compliance label indicates the number of operating hours for which the engine has been shown to meet Federal emission requirements. For engines less than 225 cc displacement, Category C = 125 hours, B = 250 hours and A = 500 hours. For engines of 225 cc or more, Category C = 250 hours, B = 500 hours and A = 1000 hours.

The displacement of Model Series 290000 and 300000 engines is 480 cc. The displacement of Model Series 350000 engines is 570 cc. The displacement of Model Series 380000 engines is 627 cc.

This is a generic representation of the emission label typically found on a certified engine.



*Machine Assemblies
and Parts Lists*

Boxxer 421

Figure 11-7 Frame Assembly - Front View

D-5057 Rev I

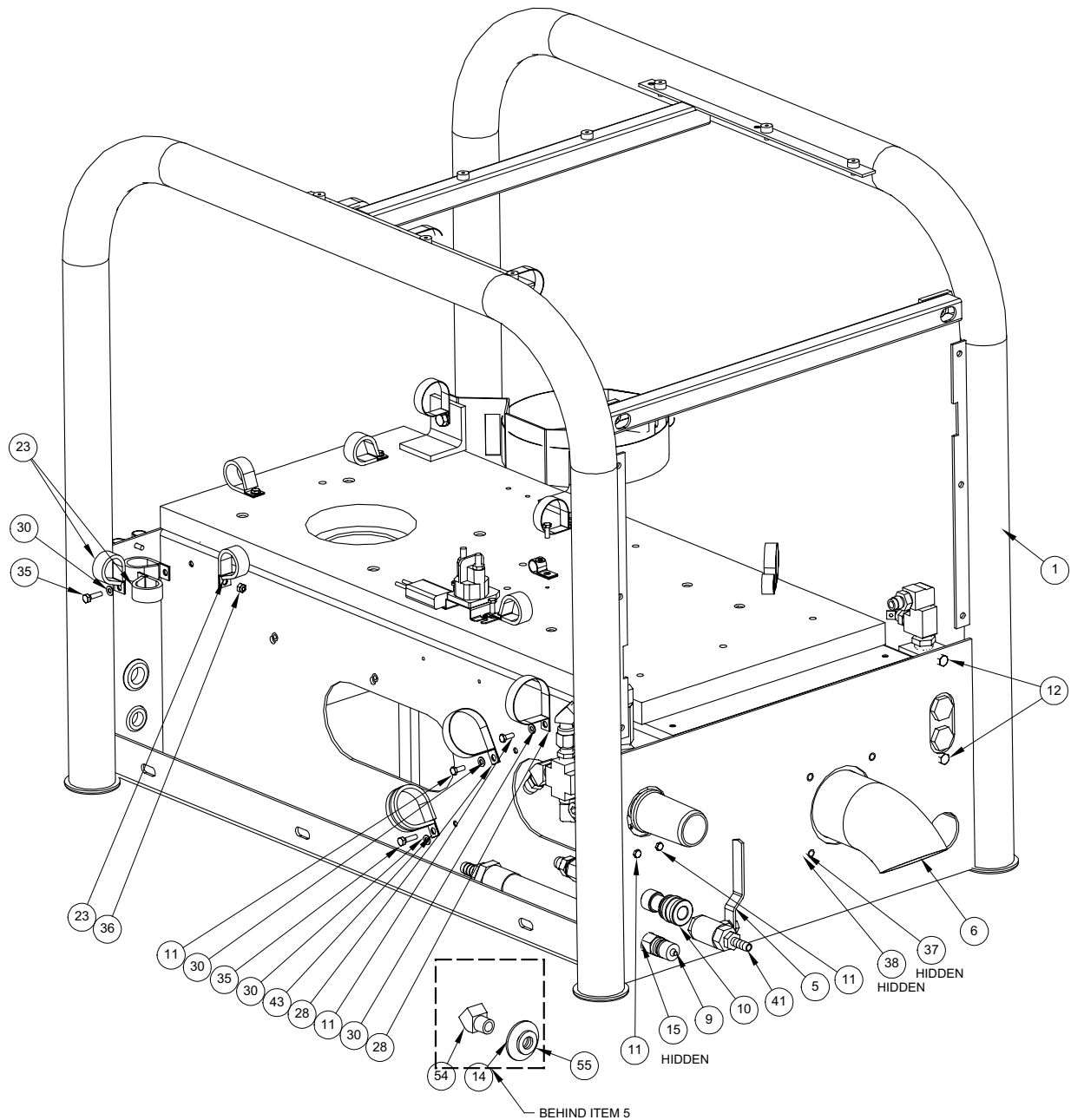
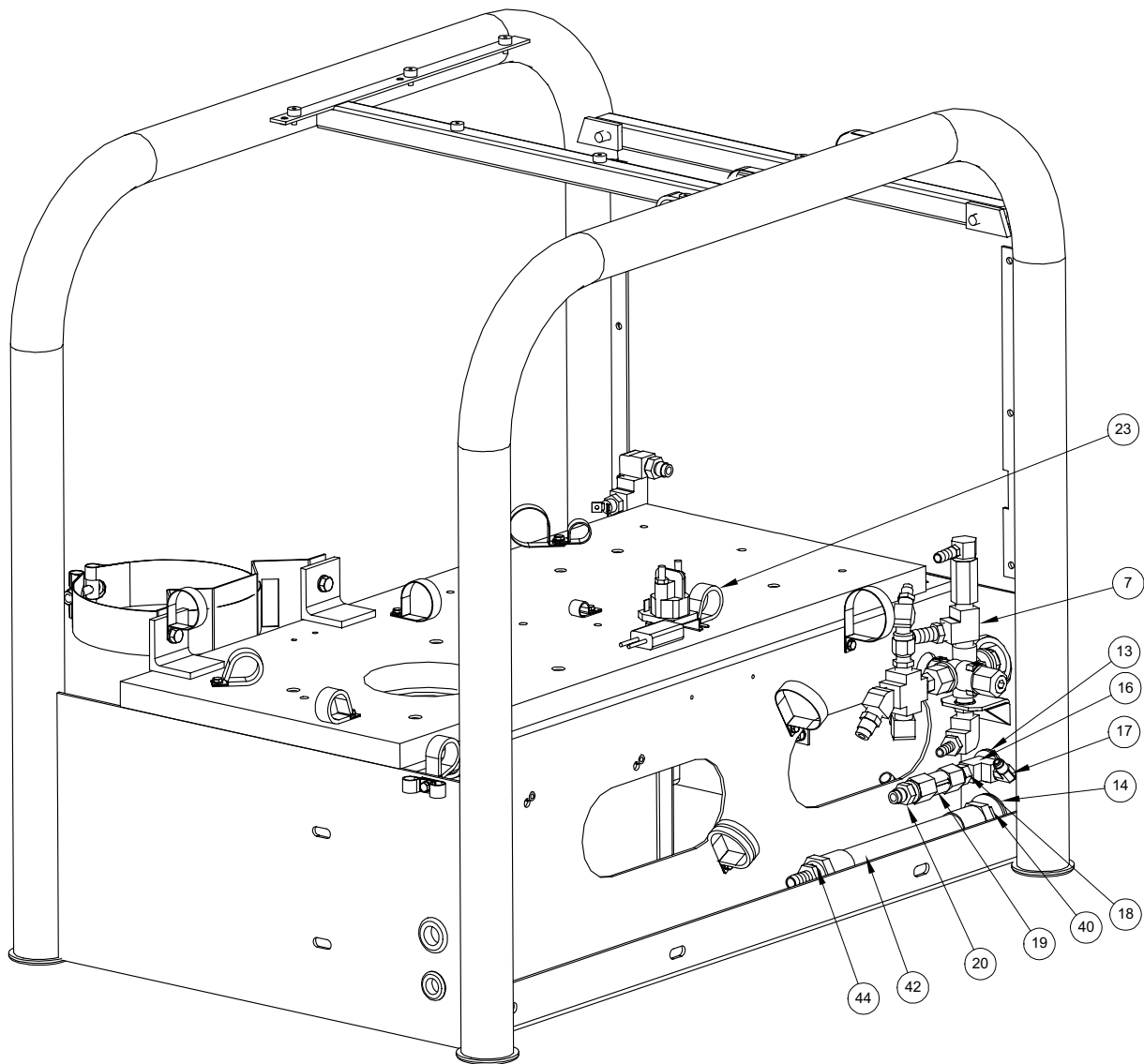


Figure 11-8 Frame Assembly - Rear View - Left Side

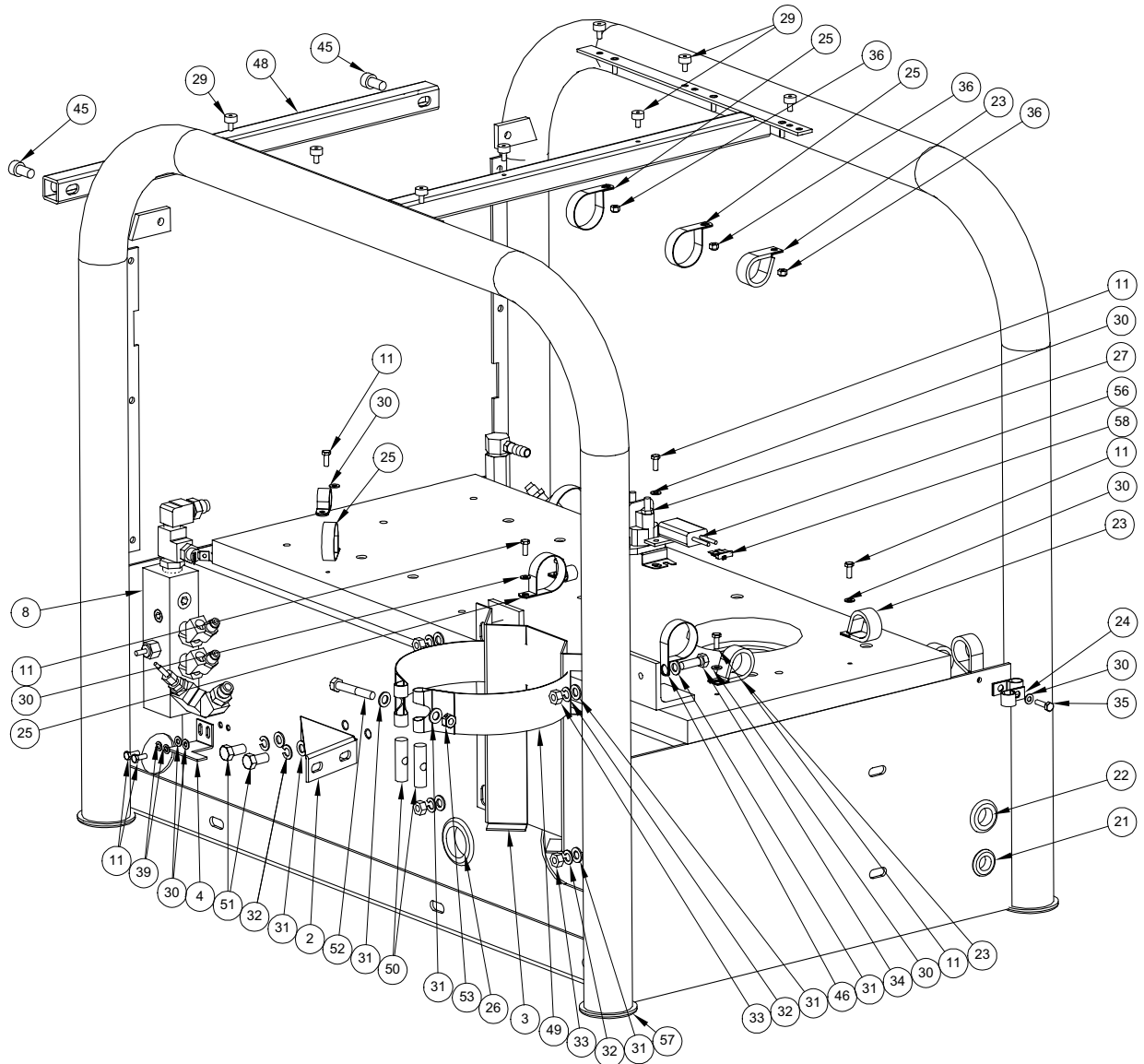
D-5057 Rev I



Boxxer 421

Figure 11-9 Frame Assembly - Rear View - Right Side

D-5057 Rev I



Frame Assembly Parts List

Item	Part Number	Description	Qty
1	000-055-149	Frame, Weldment - Boxxer 421	1
2	000-015-752	Bracket, Muffler Mounting	1
3	000-015-745	Bracket, Coil Heat Exchanger Saddle - Boxxer 421	1
4	000-015-758	Bracket, Exhaust Support	1
5	000-169-064	Valve, 3/8" NPT Full Port Ball	1
6	000-001-098	Adapter, Exhaust Turndown - Weldment	1
7	Fig. 11-24	Assembly, By-Pass Valve - Boxxer 421	1
8	Fig. 11-23	Assembly, Hi-PSI Manifold - Boxxer 421	1
9	000-052-052	Quick Connect, 660 Male w/ Viton Standard	1
10	000-052-051	Quick Connect, 440 Female w/ EPDM O-Ring	1
11	000-143-126	Screw, #10-24UNC x 0.50" Lg. Hex Head	13
12	000-143-542	Screw, 1/4"-28UNF x 0.50" Lg.	2
13	000-174-007	Washer, 1/2" Flat	2
14	000-174-008	Washer, 5/8" Flat	3
15	000-174-030	Washer, 5/8" I.D. x 7/8" O.D. x 0.010" Thk.	1
16	000-052-090	Tee, 1/4" NPT Branch M-F-F	1
17	000-052-532	Elbow, 1/4" SAE x 1/4" JIC x 90°	1
18	000-052-073	Nipple, 3/8" NPT x 1/4" NPT Hex	1
19	000-169-177	Valve, 3/8" FPT Check 65 PSI	1
20	000-052-528	Nipple, 3/8" M JIC x 3/8" NPT	1
21	000-060-002	Grommet, Large Wiring	1
22	000-060-013	Grommet, 3/4" Id x w/ 1/8" Groove	1
23	000-033-057	Clamp, 1" Cushion Loop	8
24	000-033-046	Clamp, 1/2 Wide x 1/2 Tube	3
25	000-033-053	Clamp, 1-1/2" Cushion Loop	4
26	000-060-010	Grommet, 1-5/16" I.D.	1
27	000-157-012	Switch, Starter Solenoid 14 HP B&S	1
28	000-033-067	Clamp, 2" Cushion Loop	2
29	000-108-115	Protector, 5/8" Bumper	8
30	000-174-001	Washer, #10 Flat	14

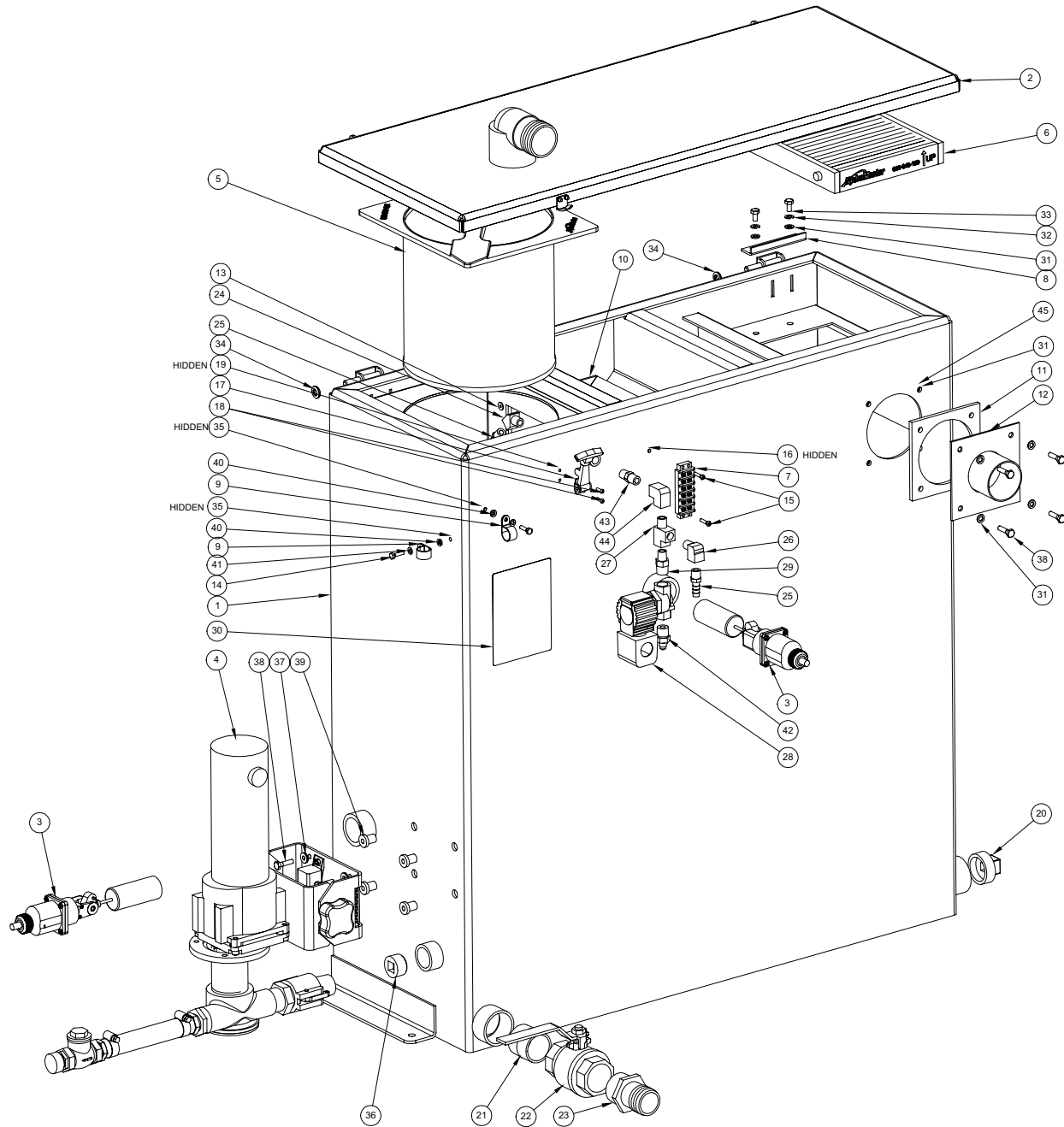
Boxxer 421

Frame Assembly Parts List

Item	Part Number	Description	Qty
31	000-174-049	Washer, 5/16" Flat	10
32	000-174-018	Washer, 5/16" Lock	6
33	000-094-012	Nut, 5/16-18"UNC Hex	4
34	000-143-143	Screw, 5/16"-18UNC x 1.00" Lg. Hex Head	2
35	000-143-132	Screw, #10-24UNC x 0.75" Lg. Hex Head	3
36	000-094-034	Nut, #10-24UNC Nylock	4
37	000-174-003	Washer, 1/4" Flat	4
38	000-094-009	Nut, 1/4"-20UNC Hex Nylock	4
39	000-174-014	Washer, #10 Lock	2
40	000-052-075	Nipple, 3/8" NPT x 1/2" NPT	1
41	000-052-104	Insert, #66 (3/8" NPT x 3/8" Barb)	1
42	000-163-056	Magnaclean, Hard Water Protector - Complete	1
43	000-033-050	Clamp, 1-3/4" Cushion Loop	1
44	000-052-107	Insert, #88 (1/2" NPT x 1/2" Barb)	1
45	000-143-094-1	Screw, 3/8"-16UNC x 0.75" Lg. Socket Head	2
46	000-033-116	Clamp, 1-1/2" Cushion Loop w/ 7/16" Mounting Hole	1
47	000-033-023	Clamp, 3/4" Nylon Hose	1
48	000-154-125	Spacer, Frame Tube Removable - Boxxer 421	1
49	000-033-123	Clamp, After Burner Mount - Boxxer 421	1
50	000-141-033	Rod, Heat Exchanger Strap - Retainer	2
51	000-143-017	Screw, 3/8"-16UNC x 3/4" Lg. Hex Head	2
52	000-143-316	Screw, 5/16"-18UNC x 2.00" Lg. Hex Head	1
53	000-094-081	Nut, 5/16"-18UNC Hex 2-Way Locking	1
54	000-052-083	Elbow, 3/8" NPT Street x 45°	1
55	000-057-055	Gasket, Garden Hose	1
56	000-056-006	Fuse Holder, Inline Weather Proof	1
57	000-106-040	Plug, Frame End	4
58	000-056-011	Fuse, 30 AMP Plug In	1
59	000-052-105	Insert, #68 (3/8" NPT x 1/2" Barb)	1

Figure 11-10 70 Gallon Universal Recovery Tank Assembly

D-6861 Rev B



Boxxer 421

70 Gallon Universal Recovery Tank Assembly Parts List

Item	Part Number	Description	Qty
1	000-159-128	Tank, 70 Gallon Universal Recovery - Weldment	1
2	Fig. 11-11	Assembly, Cover - Single Vac. - 70 Gallon Universal Tank	1
3	000-157-090	Float, Lever Switch	2
4	000-079-091	Kit, Dura-Flow APO - Production (Fig. 11-27)	1
5	000-049-152	Filter, Recovery Tank Basket	1
6	000-049-153	Filter, Flat - Recovery Tank	1
7	000-012-002	Block, 6 Post Terminal	1
8	000-015-932	Bracket, Flat Filter Securing - Universal Recovery Tank	1
9	000-033-023	Clamp, 3/4" Nylon Hose	2
10	000-049-154	Deflector, Air - Universal Recovery Tank	1
11	000-057-206	Gasket, Adapter - Universal Recovery Tank	1
12	000-001-131	Adapter, Tank To Ø2.5" Blower Hose - Universal Recovery T	1
13	000-140-023	Rivet, AB8-6A Aluminum Pop	6
14	000-143-132	Screw, #10-24UNC x 0.75" Lg. Hex Head	2
15	000-143-051	Screw, #8-32UNC x 0.75" Lg. Binder Head Phillips	2
16	000-094-059	Nut, #8-32UNF Nylock	2
17	000-086-008	Latch, Bungie	1
18	000-143-539	Screw, #6-32UNC x 0.50" Lg. Button Head Allen	2
19	000-094-063	Nut, #6-32UNC Nylock	2
20	000-106-019	Plug, 1-1/2" NPT	1
21	000-052-763	Nipple, 1-1/2" IPS Close s/s	1
22	000-169-022	Valve, 1-1/2" Full Port Ball	1
23	000-052-226	Insert, 1-1/2" NPT x 1-1/2" Barb (Grey)	1
24	000-052-082	Elbow, 1/4" NPT Street x 45°	1
25	000-052-102	Insert, #46 (1/4" NPT x 3/8" Barb)	2
26	000-052-085	Elbow, 1/4" NPT Street	1
27	000-052-090	Tee, 1/4" NPT Branch M-F-F	1
28	000-169-082	Valve, 12 Volt Solenoid 1200 PSI	1
29	000-052-073	Nipple, 3/8" NPT x 1/4" NPT Hex	1
30	000-081-220	Label, Maintenance & Lubrication Schedule	1

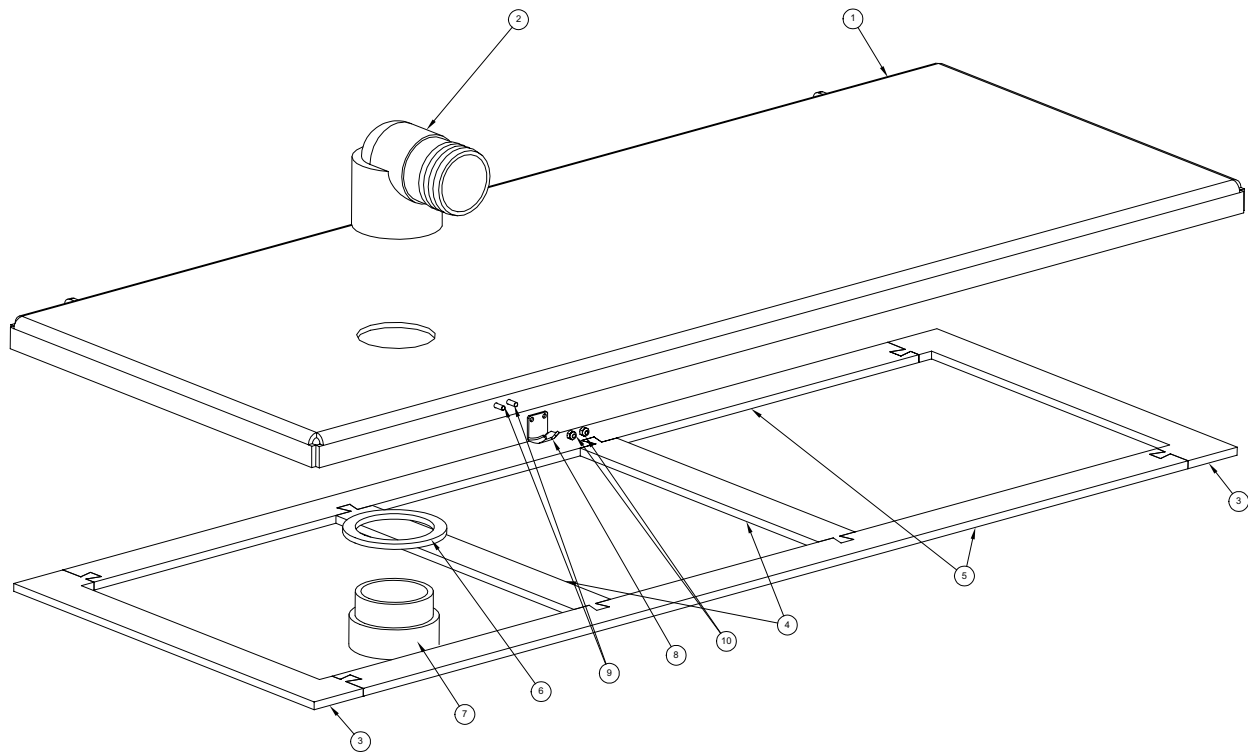
70 Gallon Universal Recovery Tank Assembly Parts List

Item	Part Number	Description	Qty
31	000-174-003	Washer, 1/4" Flat	10
32	000-174-019	Washer, 1/4" Lock	2
33	000-143-333	Screw, 1/4"-20UNC x 0.50" Lg. Hex Head	2
34	000-174-029	Washer, 3/8" Rubber Back	2
35	000-094-034	Nut, #10-24UNC Nylock	2
36	000-106-049	Plug, 1" NPT Allen Head	1
37	000-174-060	Washer, 1/4" Flat Rubber Backed	4
38	000-143-002	Screw, 1/4"-20UNC x 1.00" Lg. Hex Head	8
39	000-094-113	Nut, 1/4"-20UNC Neoprene Wellnut	4
40	000-174-036	Washer, #10 Flat Rubber Backed	2
41	000-174-001	Washer, #10 Flat	2
42	000-052-662	Nipple, 3/8" NPT x 1/4" M SAE	1
43	000-052-071	Nipple, 1/4" NPT Hex	1
44	000-052-088	Elbow, 1/4" FPT x FPT	1
45	000-094-009	Nut, 1/4"-20UNC Hex Nylock	4

Boxxer 421

Figure 11-11 70 Gallon Universal Recovery Tank Cover Assembly

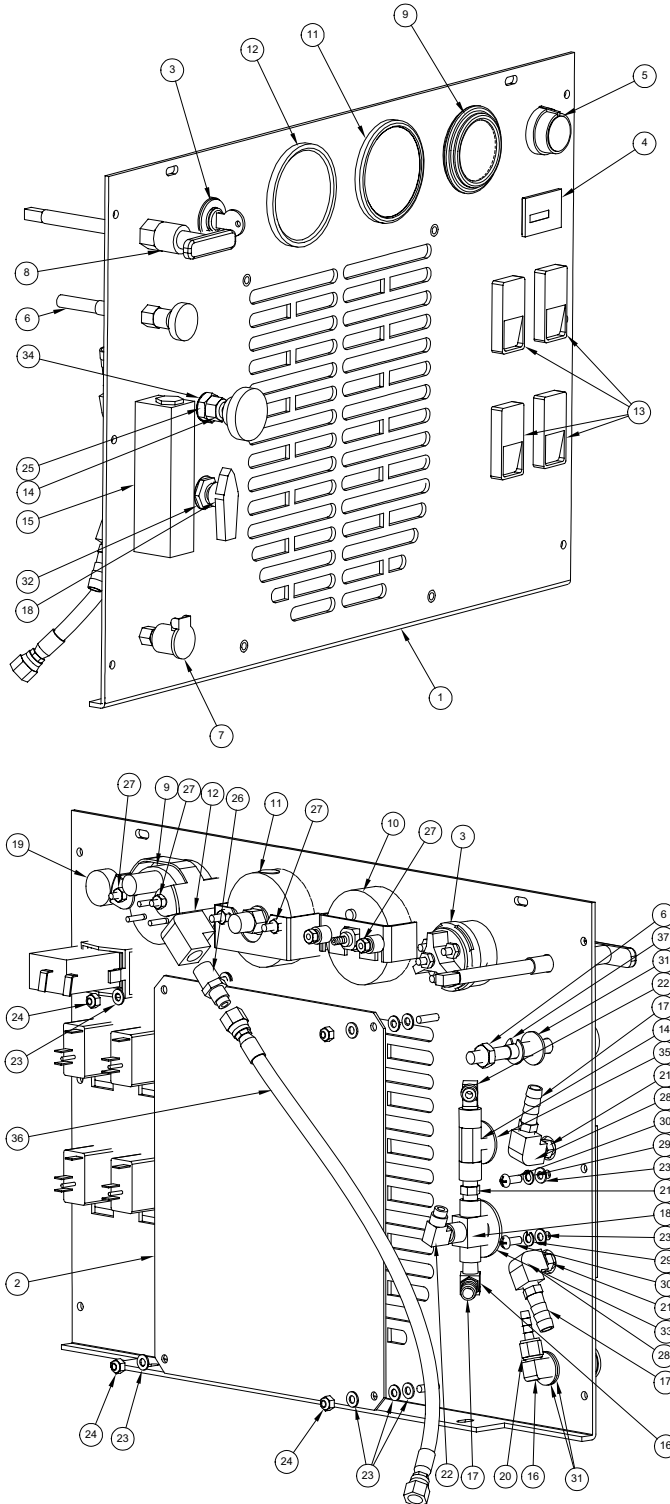
D-6891 Rev -



70 Gallon Universal Recovery Tank Cover Assembly Parts List

Item	Part Number	Description	Qty
1	000-041-443	Cover, Single Vac. 70 Gallon Universal Recovery Tank - Wel	1
2	000-052-222	Elbow, 2" Barb x 2" FPT	1
3	000-057-202	Gasket, End - Recovery Tank	2
4	000-057-203	Gasket, Middle - Recovery Tank	2
5	000-057-204	Gasket, Middle - Recovery Tank - 70 Gallon	2
6	000-057-015	Gasket, 1-1/2" Bulkhead Fitting	1
7	000-052-219	Adapter, 2" NPT x 2" F Slip	1
8	000-086-008	Latch, Bungie - Strike	1
9	000-143-539	Screw, #6-32UNC x 0.50" Lg. Button Head Allen	2
10	000-094-063	Nut, #6-32UNC Nylock	2

Figure 11-12 Dash Assembly
D-5044 Rev G



Boxxer 421

Dash Assembly Parts List

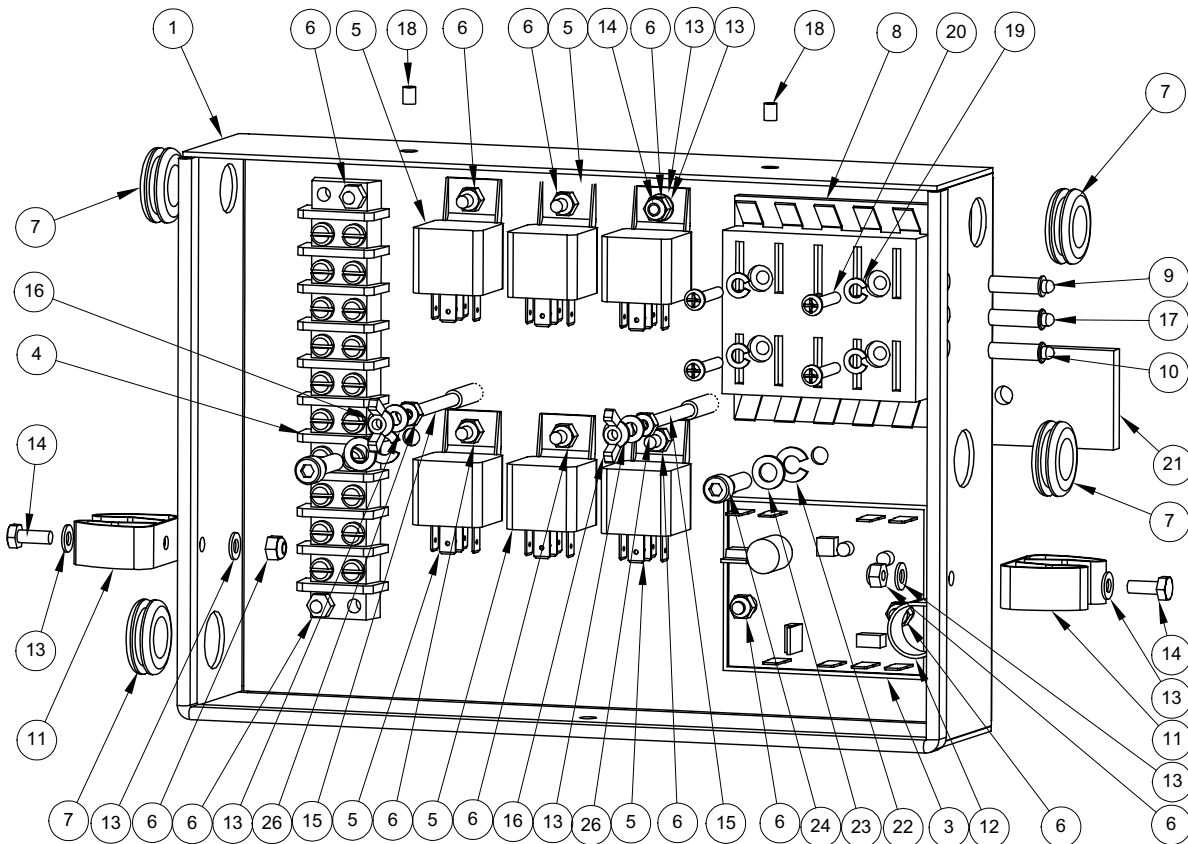
Item	Part Number	Description	Qty
1	000-100-120	Panel, Dash - Boxxer 421	1
2	000-100-123	Panel, Perforated Grill - Boxxer 421	1
3	000-157-008	Switch, Ignition	1
4	000-074-018	Meter, Rectangular w/o Bezel	1
5	000-061-056	Knob, Temperature Adjustment	1
6	000-025-011	Cable, Choke (5 Foot)	1
7	000-052-272	Cup, Gravity Feed Oil Blower Lubrication Port	1
8	000-025-020	Cable, Throttle Kohler	1
9	000-074-016	Gauge, Temperature	1
10	000-074-017	Guage, 0-30" Hg Vac. 2 1/2" Hydramaster Face	1
11	000-074-007	Gauge, Pressure (0-1500 PSI)	1
12	000-052-088	Elbow, 1/4" FPT x FPT	1
13	000-157-040	Switch, 20 AMP Rocker	4
14	000-169-160	Valve, Chemical Metering	1
15	000-074-030	Meter, Chemical Flow Raw	1
16	000-052-084	Elbow, 1/8" NPT Street	2
17	000-052-099	Insert, #26 (1/8" NPT x 3/8" Barb)	3
18	000-169-0171	Valve, 3-Way Ball O-Ring Style	1
19	000-149-560	Thermostat, Potentiometer Use w/ RTD	1
20	000-052-096	Insert, #F23 (1/8" FPT x 3/16" Barb)	1
21	000-052-069	Nipple, 1/8" NPT Hex	3
22	000-052-531	Elbow, 1/8" NPT x 1/4" SAE	2
23	000-174-001	Washer, #10 Flat	14
24	000-094-034	Nut, #10-24UNC Nylock	4
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	000-094-070	Nut, 5mm Nylock	6
28	000-052-089	Elbow, 1/8" NPT Female	2
29	000-174-014	Washer, #10 Lock	2
30	000-143-328	Screw, #10-32UNF x 1/2" Lg. Phillips Head	2

Dash Assembly Parts List

Item	Part Number	Description	Qty
31	000-174-032	Washer, 3/8" Flat	3
32	000-174-030	Washer, 5/8" I.D. x 7/8" O.D. x 0.010" Thk.	1
33	000-174-034	Washer, 0.688" I.D. x 1.50" O.D. x 0.078" Thk.	1
34	000-174-062	Washer, 1/2" I.D. x 3/4" O.D. x 0.010" Thk.	1
35	000-174-038	Washer, 7/16" S.A.E. Flat	1
36	000-068-651	Hose, 3/16" x 16" Lg. Teflon w/ 1/4" JIC Ends	1
37	000-174-057	Washer, 3/8" Lock	1

Figure 11-13 Electrical Control Panel Assembly

C-4974 Rev E



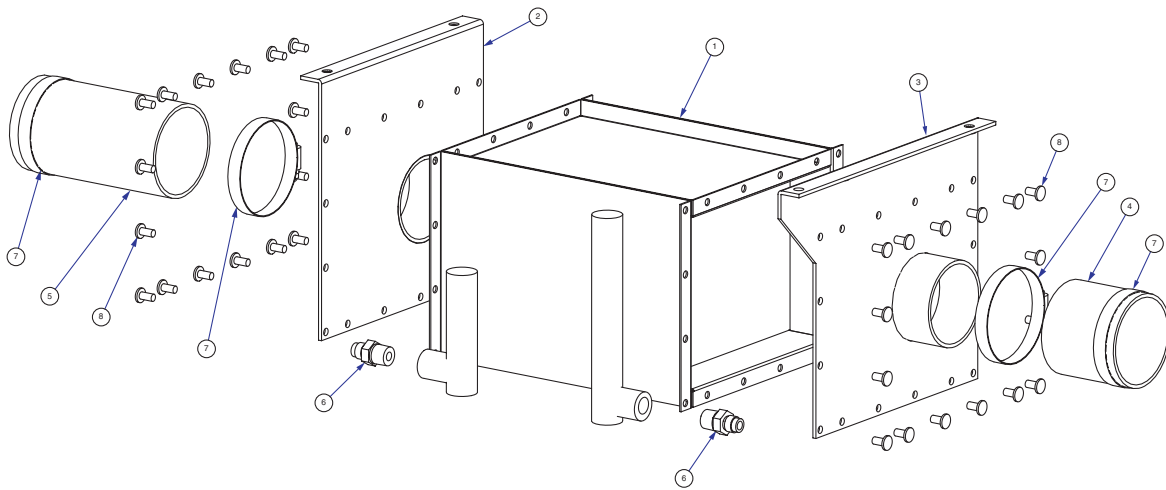
Boxxer 421

Electrical Control Panel Assembly Parts List

Item	Part Number	Description	Qty
1	000-100-113	Panel, Electrical Control - Boxxer 421	1
2	000-041-377	Cover, Electrical Panel - Boxxer 421	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	6
6	000-094-034	Nut, #10-24UNC Nylock	12
7	000-060-002	Grommet, Large Wiring	4
8	000-056-020	Fuse Panel	1
9	000-084-010	Light, Green LED Indicator Mini	1
10	000-084-011	Light, Red LED Indicator Mini	1
11	000-033-066	Clamp, 3/4" Spring	2
12	000-033-023	Clamp, 3/4" Nylon Hose	1
13	000-174-001	Washer, #10 Flat	8
14	000-143-126	Screw, #10-24UNC x 0.50" Lg. Hex Head	3
15	000-156-030	Stud, #10-32UNF x 2" Lg. Boxxer Elec. Panel Cover	2
16	000-094-108	Nut, #10-32UNF Wing	2
17	000-084-012	Light, Yellow Led Indicator Mini	1
18	000-143-111	Screw, #10-24UNC x 0.25" Lg. Set	2
19	000-174-014	Washer, #10 Lock	4
20	000-143-545	Screw, #8-32UNC x 1.00" Lg. Phillips Head	4
21	000-154-111	Spacer, Electrical Panel - Boxxer 421	1
22	000-174-019	Washer, 1/4" Lock	2
23	000-174-003	Washer, 1/4" Flat	2
24	000-143-080	Screw, 1/4"-20UNC x 1.00" Lg. Socket Head	2
25	000-131-027	Trimlok, 3/8" Wrinkled	1
26	000-094-058	Nut, #10-32 UNF - Nylock	2

Figure 11-14 Blower Heat Exchanger Assembly

C-4944 Rev A



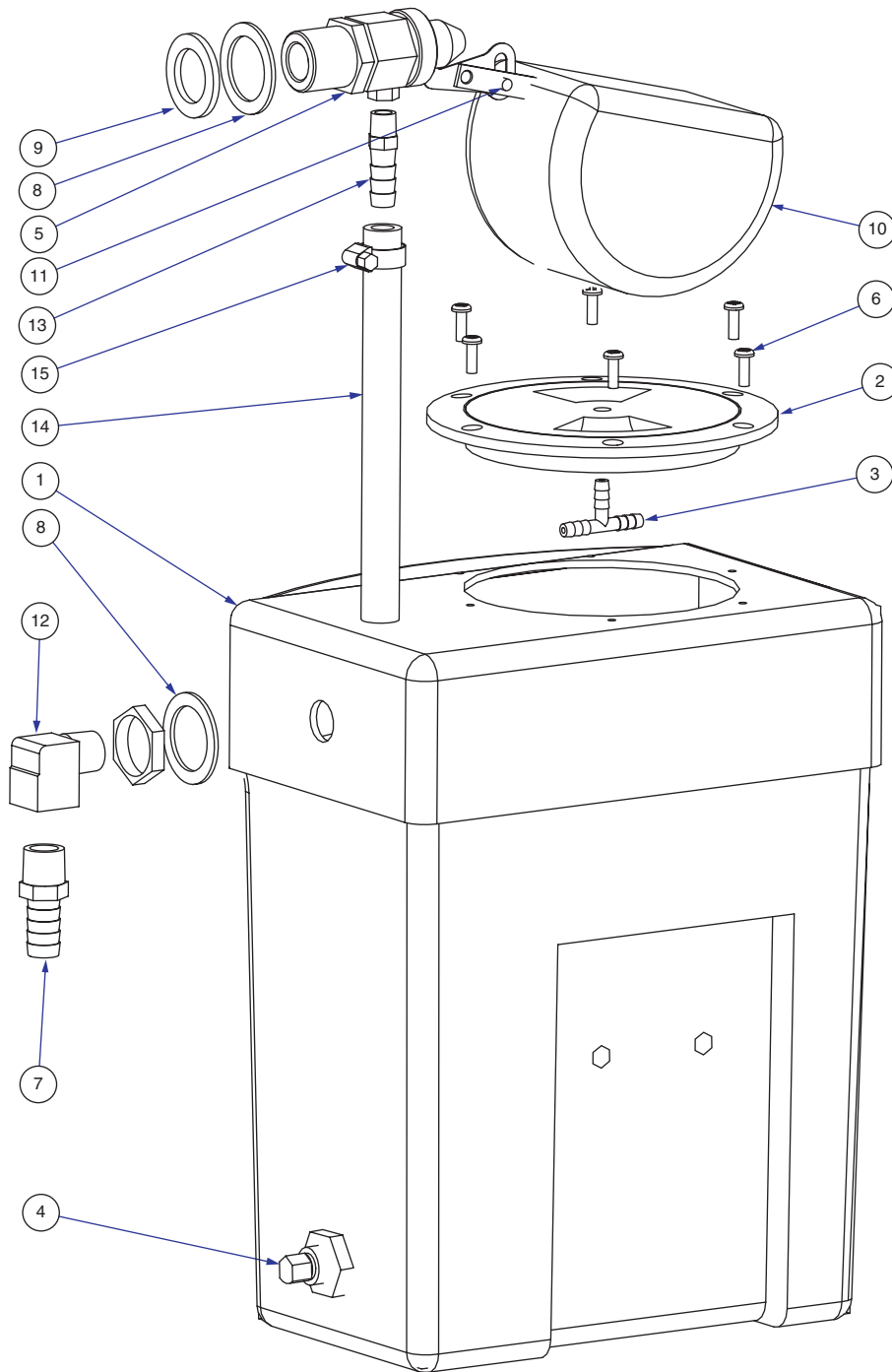
Blower Heat Exchanger Assembly Parts List

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

Boxxer 421

Figure 11-15 Water Box Assembly

C-5045 Rev A

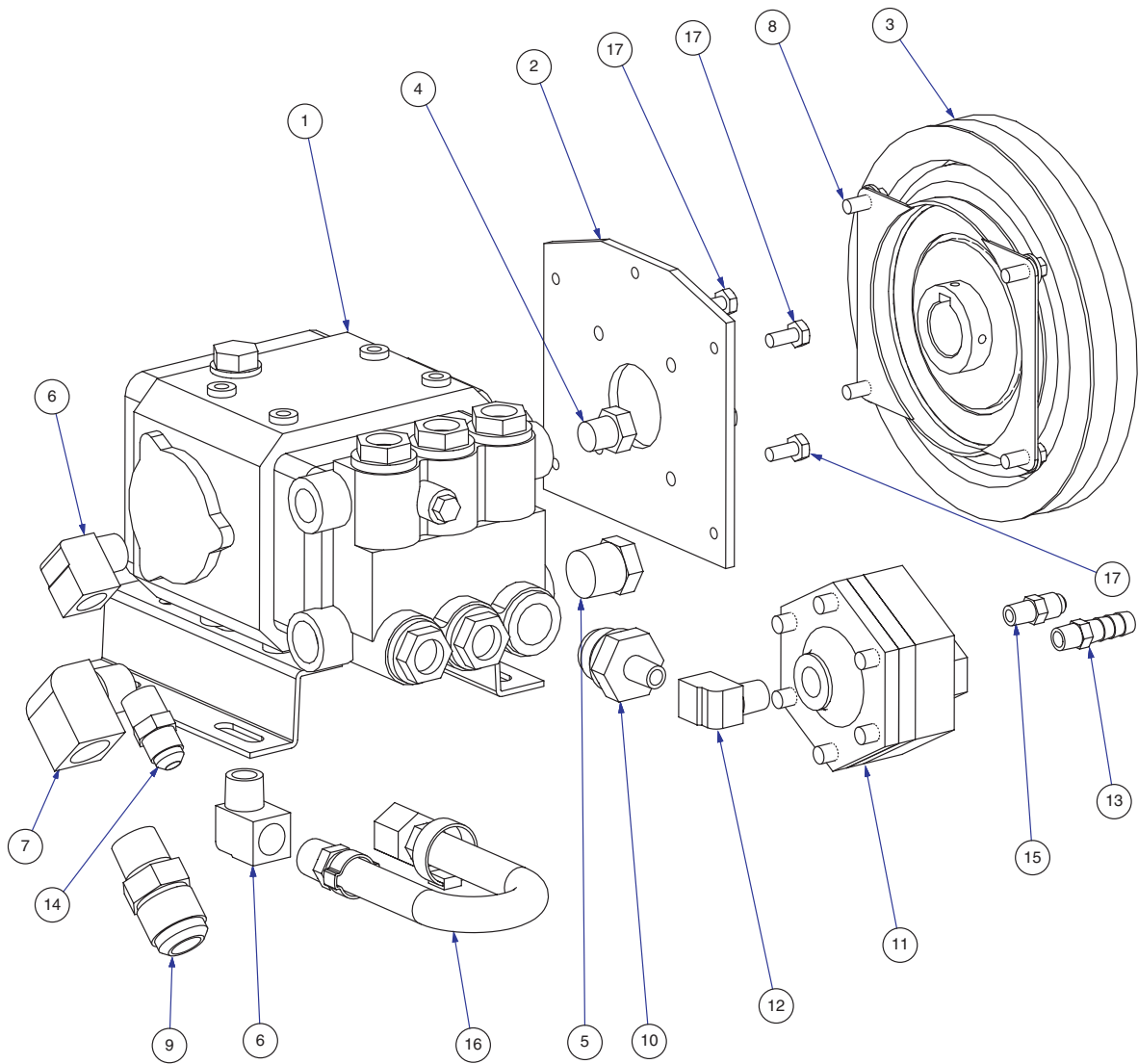


Water Box Assembly Parts List

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 11-16 Hydra Pump II Assembly

C-5043 Rev A



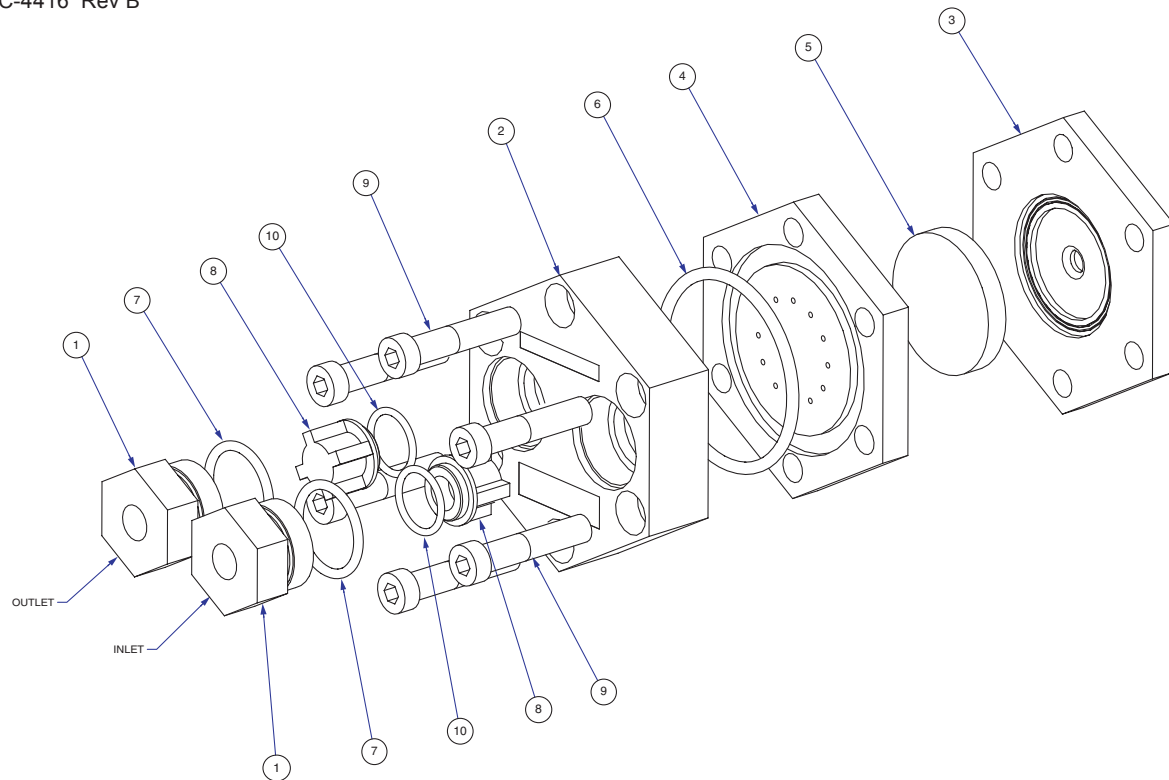
Hydra Pump II Assembly Parts List

Item	Part Number	Description	Qty
1	000-111-042	Pump, Hydra II Hi PSI 3.5 GPM	1
2	000-105-148	Plate, Hydra Pump II Clutch Mounting	1
3	000-036-008	Clutch, Electric Pump	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	000-143-141	Screw, 1/4"-20UNC x 1/2" Lg. Whiz Lock	4
9	000-052-547	Nipple, 1/2 NPT x 3/4 SAE	1
10	000-001-096	Adapter, Chemical Pump To Comet Pump	1
11	000-111-035	Assembly, Chemical Pump (Fig. 11-17)	1
12	000-052-085	Elbow, 1/4" NPT Street	1
13	000-052-099	Insert, #26 (1/8" NPT x 3/8" Barb)	1
14	000-052-128	Nipple, 3/8" NPT x 3/8" Male Propane	1
15	000-052-530	Nipple, 1/8" MNPT x 1/4 SAE	1
16	000-068-219	Hose, Spitfire Pump Drain	1
17	000-143-221	Screw, 6mm-1 x 14mm Lg. Hex Head	4

Boxxer 421

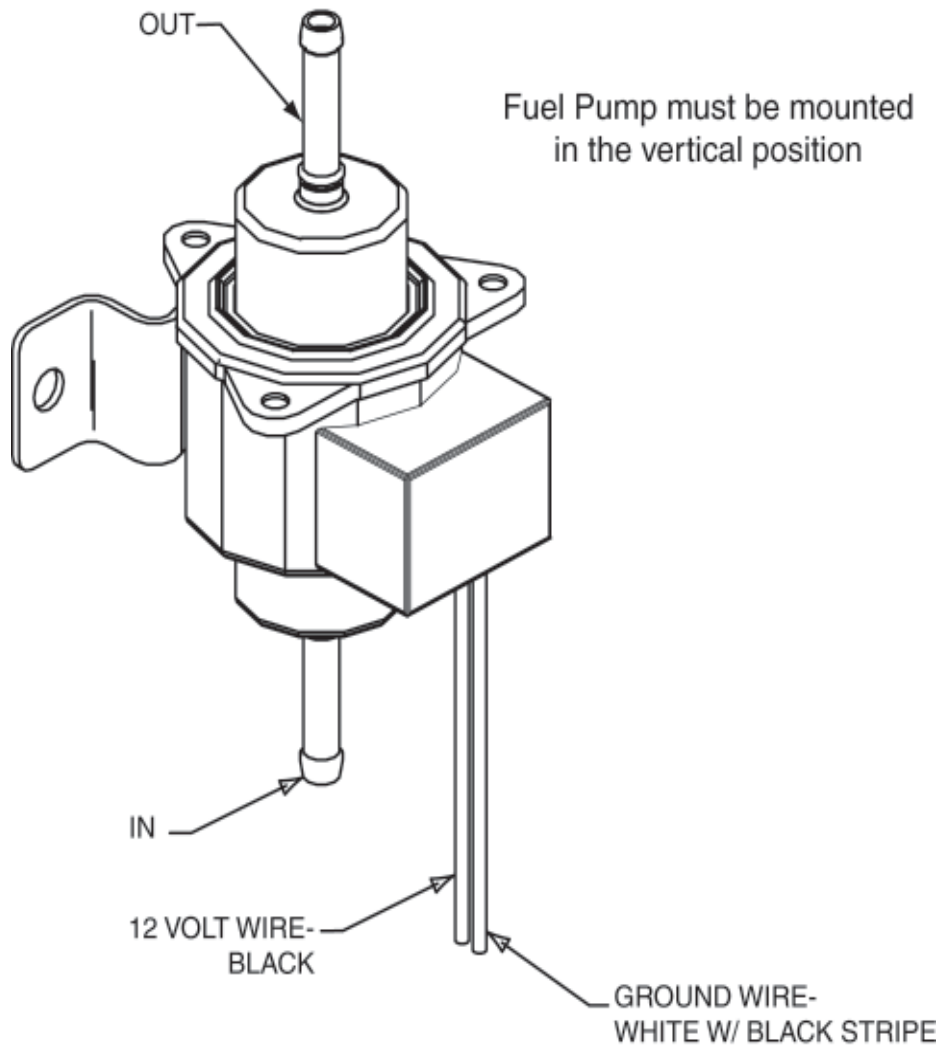
Figure 11-17 Chemical Pump Assembly

C-4416 Rev B



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

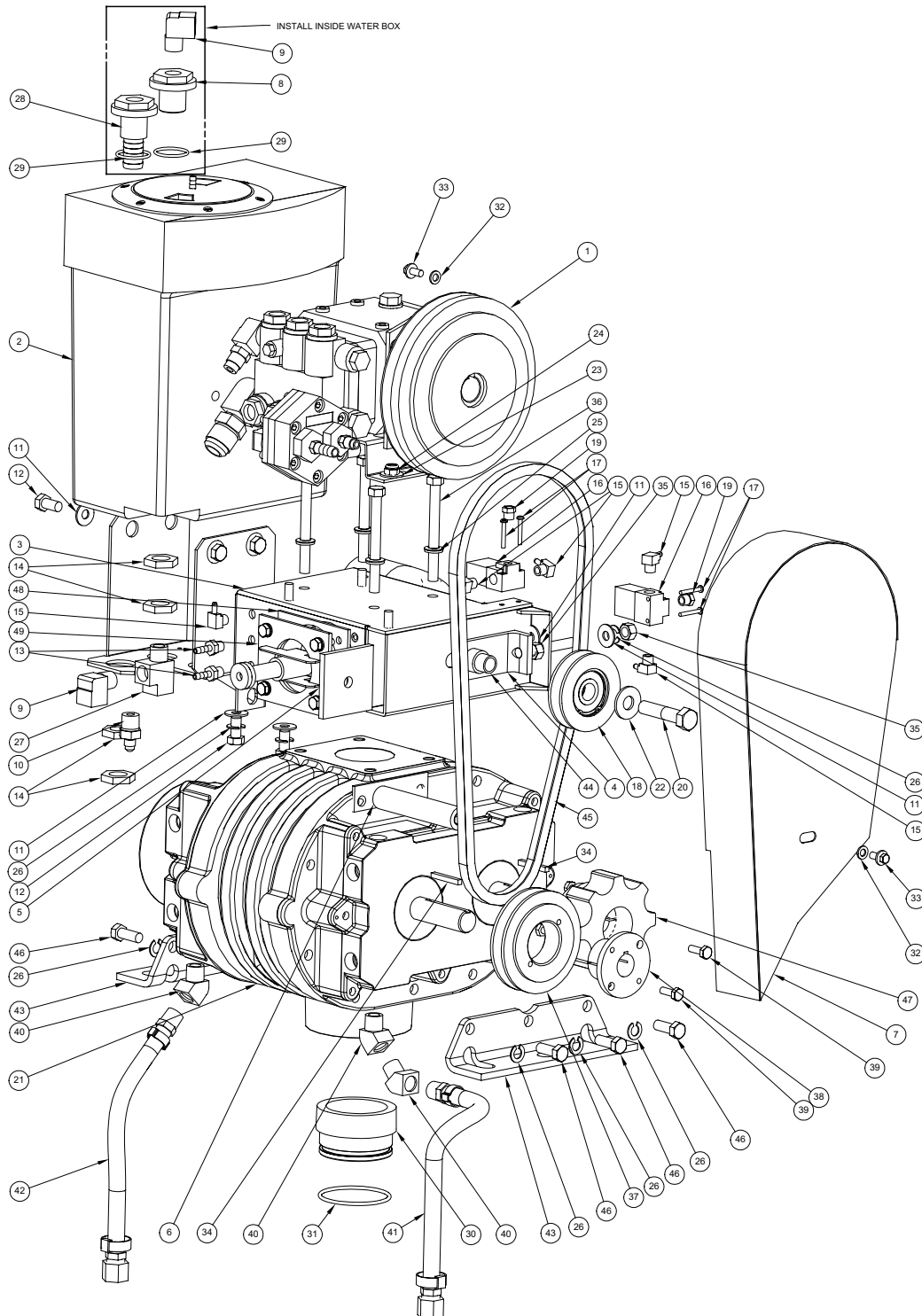
Figure 11-18 Fuel Pump Assembly
B-4627 Rev -



Boxxer 421

Figure 11-19 Blower Assembly

D-5041 Rev F



Blower Assembly Parts List

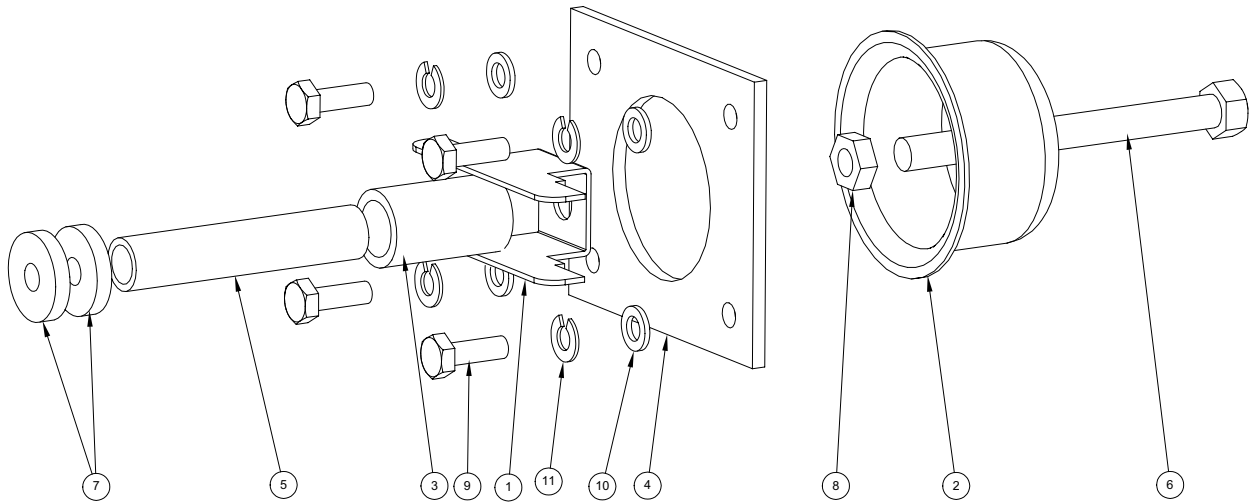
Item	Part Number	Description	Qty
1	Fig. 11-16	Pump Assembly - Boxxer 421	1
2	Fig. 11-15	Assembly, Water Box - Poly - Boxxer 421	1
3	000-013-074	Bracket, Pump Mounting	1
4	000-015-746	Bracket, Pump Idler - Boxxer 421	1
5	000-105-207	Plate, Pump Idler Nut - Boxxer 421	1
6	000-015-296	Bracket, Belt Guard 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	2
10	000-052-662	Nipple, 3/8" NPT x 1/4" M SAE	1
11	000-174-032	Washer, 3/8" Flat	8
12	000-143-017	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	000-052-106	Insert, 1/8" NPT x 5/32" Barb x 90°	5
16	000-169-070	Valve, Primary Vac. Solenoid	2
17	000-143-048	Screw, #6-32UNC x 1.00" Lg. Pan Head	4
18	000-109-093	Pulley, 3" "A" Sect. Ball Bearing - Assembled	1
19	000-106-014	Plug, Gearbox Vent	2
20	000-143-041	Screw, 1/2"-13UNC x 2.25" Lg. Hex Head	1
21	000-111-145	Blower, 4005 Dominator	1
22	000-174-012	Washer, 1/2" SAE H/D Flat	1
23	000-174-004	Washer, 5/16" Flat	4
24	000-094-038	Nut, 5/16"-18UNC Nylock	4
25	000-174-029	Washer, 3/8" Rubber Back	4
26	000-174-057	Washer, 3/8" Lock	9
27	000-052-023	Tee, 3/8" NPT Male Street	1
28	000-052-661	Insert, 3/4" Barb x Straight	1
29	000-097-041	O-Ring, 1/2" Bulkhead	2
30	000-001-024	Adapter, Blower To Silencer	1

Boxxer 421

Blower Assembly Parts List

Item	Part Number	Description	Qty
31	000-097-029	O-Ring, Blower To Silencer (2 3/4" ID x 2 1/2" OD x 1/8")	1
32	000-174-003	Washer, 1/4" Flat	2
33	000-143-141	Screw, 1/4"-20UNC x 1/2" Lg. Whiz Lock	2
34	000-077-001	Key, #3 & #4 Vacuum Pump Drive	2
35	000-094-014	Nut, 3/8"-16UNC Hex Zinc Plated	2
36	000-143-263	Screw, 3/8"-16UNC x 3.75" Lg. Hex Head Full Thread	4
37	000-109-040	Pulley, AK41-H	1
38	000-020-019	Bushing, #H x 7/8" Bore	1
39	000-143-001	Screw, 1/4"-20UNC x 0.75" Lg. Hex Head	2
40	000-052-083	Elbow, 3/8" NPT Street x 45°	3
41	000-068-219	Hose, Spitfire Pump Drain	1
42	000-068-219	Hose, Spitfire Pump Drain	1
43	000-015-814	Bracket, Dominator Mounting - Boxxer 421	2
44	000-154-049	Spacer, Pump Idler Mounting - Boxxer 421	1
45	000-010-126	Belt, #25-9403 XI (40.625" Lg.)	1
46	000-143-018	Screw, 3/8"-16UNC x 1.00" Lg. Grade 8	6
47	000-039-040	Coupler, Balanced 7/8" Bushing & Inner Sleeve - Black	1
48	000-057-207	Gasket, Vacuum Relief Valve Plate	1
49	Fig. 11-20	Assembly, Vacuum Relief Valve (Collector Box)	1

Figure 11-20 Vacuum Relief Valve (Collector Box) Assembly
C-7156 Rev -



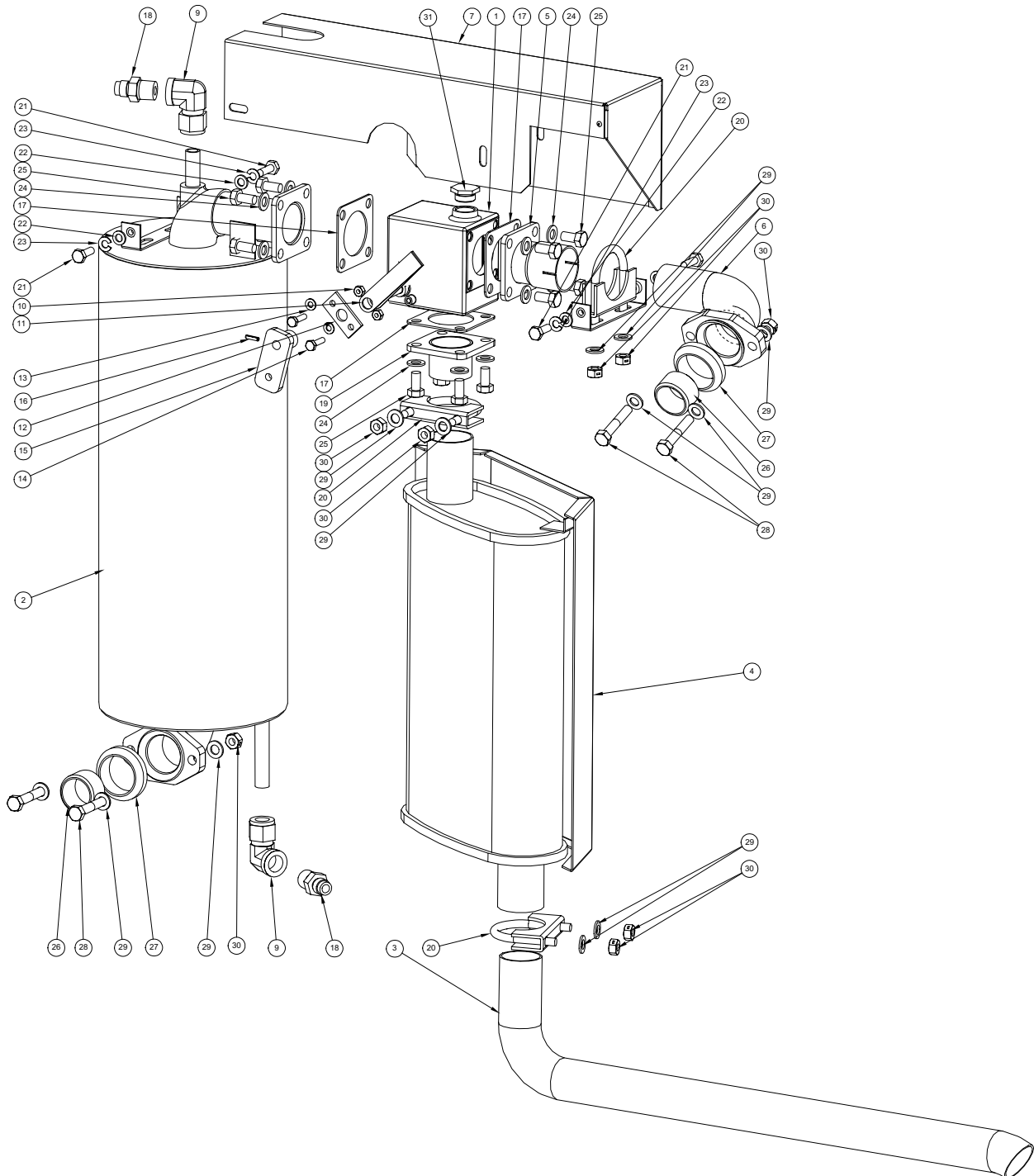
Vacuum Relief Valve (Collector Box) Assembly Parts List

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	000-105-337	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
9	000-143-001	Screw, 1/4"-20UNC x 0.75" Lg. Hex Head	4
10	000-174-003	Washer, 1/4" Flat	4
11	000-174-019	Washer, 1/4" Lock	4

Boxxer 421

Figure 11-21 Exhaust Assembly

D-4884 Rev C

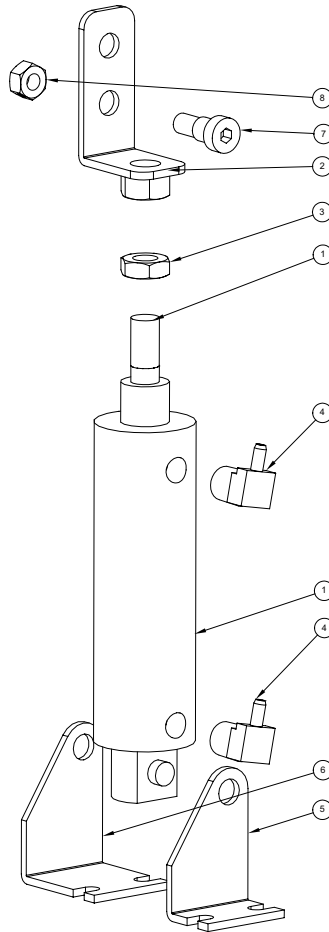


Exhaust Assembly Parts List

Item	Part Number	Description	Qty
1	000-169-045	Valve, Cast Exhaust Diverter	1
2	000-038-054	Core, Boxxer 421 After Burner Heat Exchanger - Weldment	1
3	000-125-152	Tube, Muffler Outlet - Boxxer 421	1
4	000-093-081	Muffler Exhaust Modified - Boxxer 421	1
5	000-001-099	Adapter, Exhaust Flange To Ø1.50" F Slip - Boxxer 421	1
6	000-052-703	Elbow, Exhaust Manifold To Diverter - Boxxer 421	1
7	000-041-397	Cover, Exhaust - Boxxer 421	1
8	000-015-764	Bracket, Exhaust Cover Mounting	1
9	000-052-600	Elbow, 1/2" Tube x 3/8" FPT	2
10	000-094-027	Nut, #10-24UNC Hex	2
11	000-155-030	Spring, Leaf	1
12	000-138-010	Retainer, Leaf Spring	1
13	000-174-001	Washer, #10 Flat	2
14	000-143-132	Screw, #10-24UNC x 0.75" Lg. Hex Head	2
15	000-015-631	Bracket, Air Cylinder Actuation	1
16	000-103-005	Pin, Roll - 0.125" x 0.500" Lg.	1
17	000-057-146	Gasket, Four Hole Exhaust Diverter	3
18	000-052-528	Nipple, 3/8" M JIC x 3/8" NPT	2
19	000-001-102	Adapter, Exhaust Flange To 1.50" M Slip	1
20	000-033-068	Clamp, 1-1/2" Muffler	3
21	000-143-001	Screw, 1/4"-20UNC x 0.75" Lg. Hex Head	4
22	000-174-003	Washer, 1/4" Flat	4
23	000-174-019	Washer, 1/4" Lock	4
24	000-174-069	Washer, 5/16" Inconel Belleville, Diverter Valve	12
25	000-143-572	Screw, 5/16"-18UNC x 5/8" Lg. Hex Grd. 5	12
26	000-125-128	Tube, 1-3/8" Od x 1/8" Wall x 7/8" Long	2
27	000-057-177	Gasket, Exhaust Donut 1.50"	2
28	000-143-124	Screw, 5/16"-18UNC x 1.75" Lg. Hex Head	4
29	000-174-049	Washer, 5/16" Flat	14
30	000-094-081	Nut, 5/16"-18UNC Hex 2-Way Locking	10
31	000-106-120	Plug, M18 x 1.5	1

Figure 11-22 Diverter Valve Actuator Assembly

C-4880 Rev B

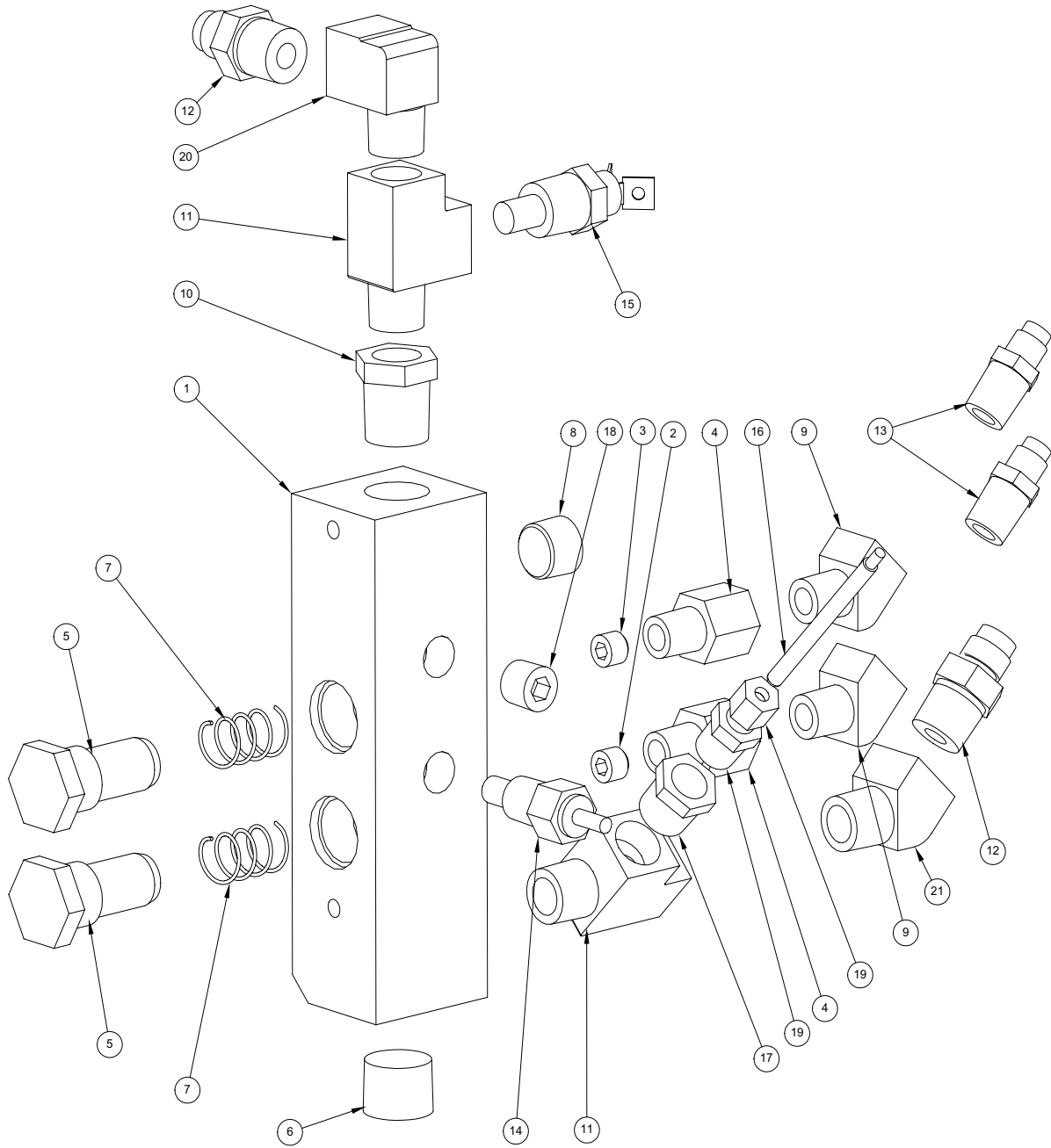


Diverter Valve Actuator Assembly Parts List

Item	Part Number	Description	Qty
1	000-169-169	Valve, Air Cylinder	1
2	000-015-630	Bracket, Air Cylinder Extension	1
3	000-094-092	Nut, 7/16"-20UNF Hex Jam	1
4	000-052-550	Elbow, 1/8" NPT x 3/16" Barb	2
5	000-015-750	Bracket, Air Cylinder Mount - Inner	1
6	000-015-748	Bracket, Air Cylinder Mount - Outer	1
7	000-143-573	Screw, 5/16-18 Shoulder, 3/8" Dia x 1/2"	1
8	000-094-081	Nut, 5/16"-18UNC Hex 2-Way Locking	1

Figure 11-23 Hi PSI Manifold Assembly

C-5123 Rev B



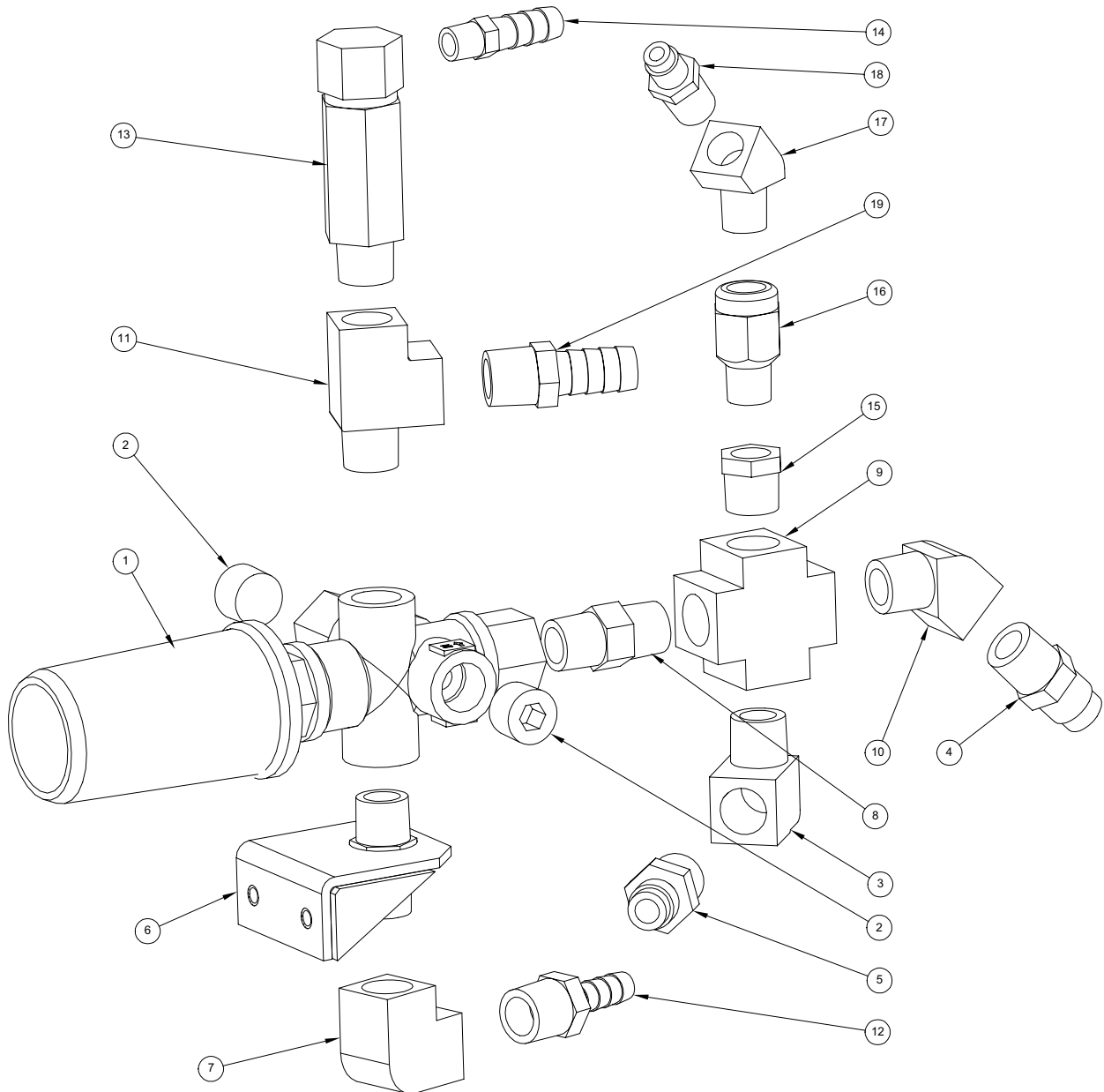
Boxxer 421

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	000-052-527	Nipple, 1/4" SAE x 1/4" NPT	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 Compression 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 11-24 By-Pass Valve Assembly

D-5046 Rev C

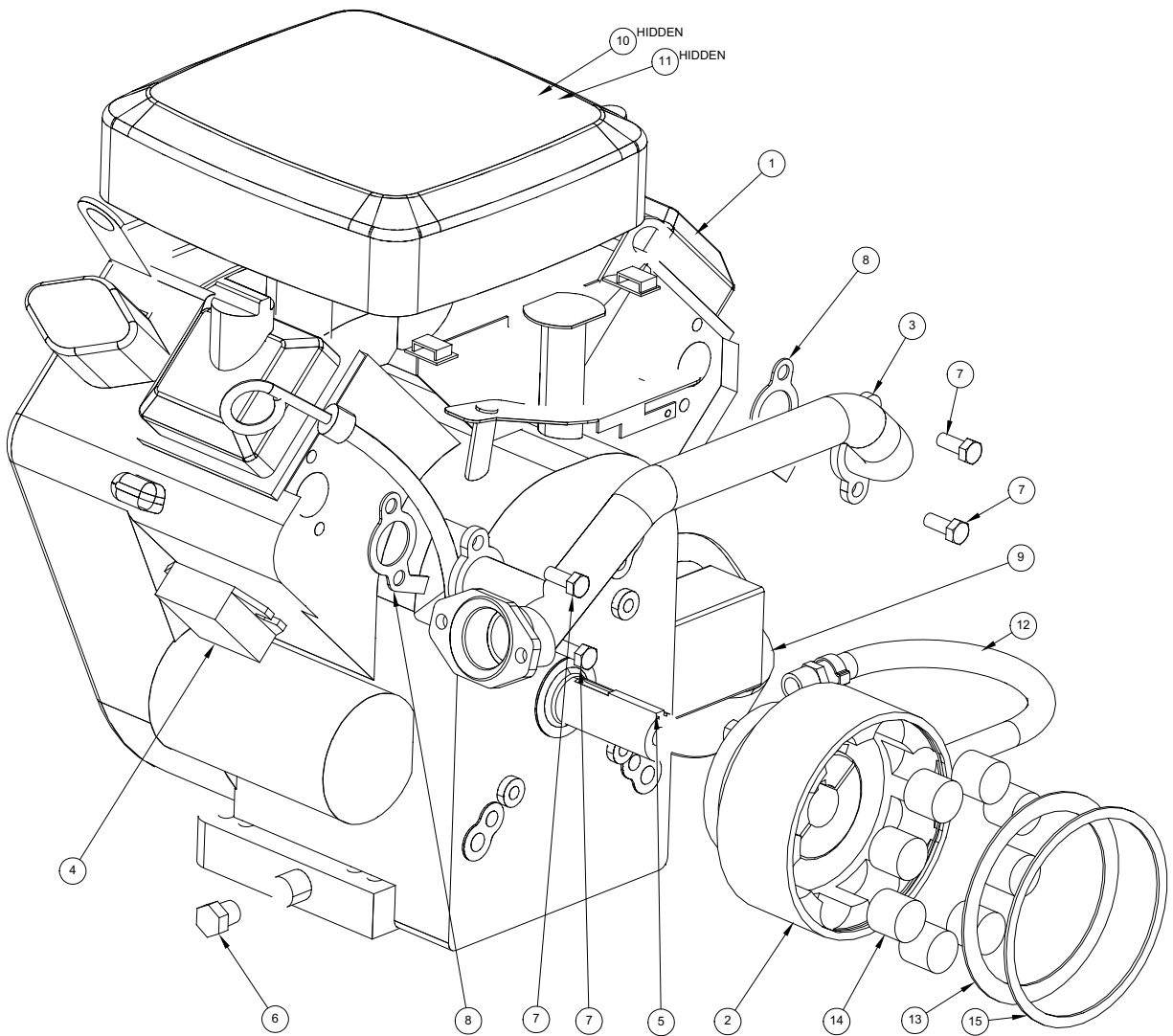


By-Pass Valve Assembly Parts List

Item	Part Number	Description	Qty
1	000-169-188	Valve, PSI Regulator 0-1500 PSI - 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	000-052-074	Nipple, 3/8" NPT Hex	1
9	000-052-113	Cross, 3/8" FPT	1
10	000-052-083	Elbow, 3/8" NPT Street x 45°	1
11	000-052-023	Tee, 3/8" NPT Male Street	1
12	000-052-104	Insert, #66 (3/8" NPT x 3/8" Barb)	1
13	000-169-011	Valve, Hi Temp Control 180°	1
14	000-052-099	Insert, #26 (1/8" NPT x 3/8" Barb)	1
15	000-052-061	Bushing, 3/8" NPT x 1/4" FPT	1
16	000-135-052	Regulator, Hi PSI Snubber	1
17	000-052-082	Elbow, 1/4" NPT Street x 45°	1
18	000-052-527	Nipple, 1/4" SAE x 1/4" NPT	1
19	000-052-105	Insert, #68 (3/8" NPT x 1/2" Barb)	1

Figure 11-25 Engine Assembly

D-5042 Rev A



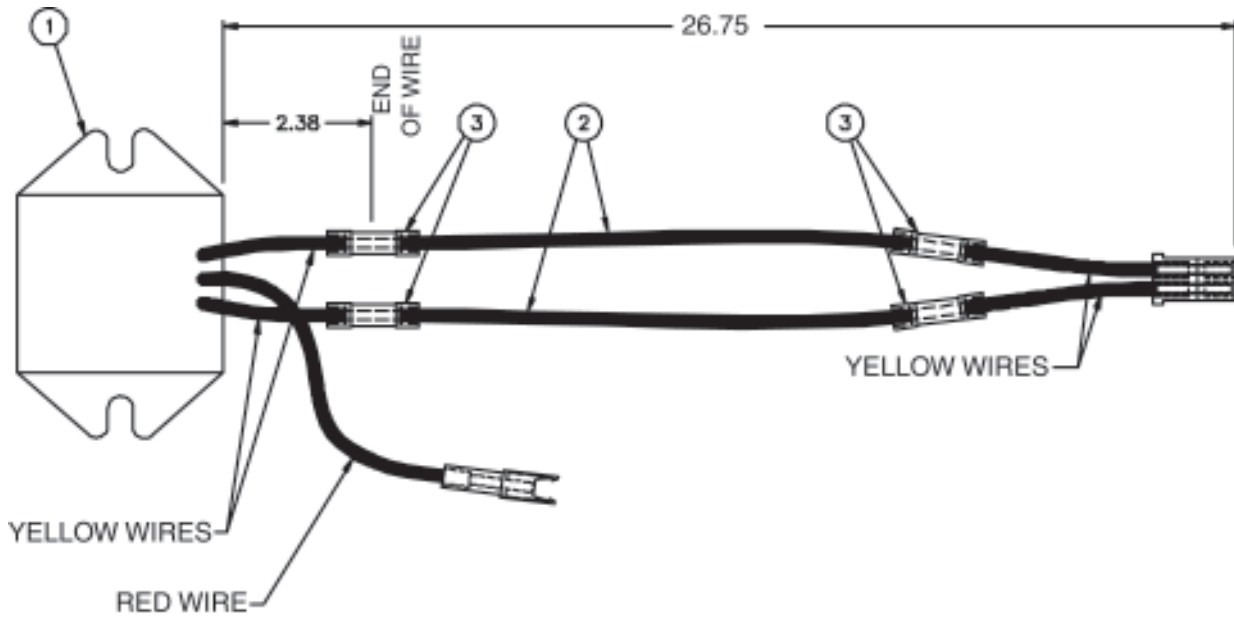
Boxxer 421

Engine Assembly Parts List

Item	Part Number	Description	Qty
1	000-047-012	Engine, 21 HP Briggs & Stratton	1
2	000-039-030	Coupler, Balanced w/1" Bushing & Outer Hub - Black	1
3	000-090-053	Manifold, Engine Exhaust - Boxxer 421	1
4	000-135-023	Voltage Regulator	1
5	000-077-006	Key, 0.25" x 1.5" Lg.	1
6	000-106-003	Plug, 3/8" NPT Hex	1
7	000-143-185	Screw, 8mm x 20mm Grade 8.8 Hex Head	4
8	000-057-082	Gasket, Exhaust Manifold - B&S 21 HP	2
9	000-049-014	Filter, 16HP Oil - All B & S	1
10	000-049-012	Filter, 16 HP Air-Vanguard I/C	1
11	000-049-053	Filter, B & S Vanguard Foam Air Filter Element	1
12	000-068-219	Hose, Spitfire Pump Drain	1
13	000-174-080	Washer, 5.00" O.D. x 4.13" I.D. x 0.060" Thk.	1
14	000-106-045	Plug, Coupler (EPDM, 70 Durometer)	8
15	000-139-022	Ring, 5" Retaining	1

Figure 11-26 Briggs and Stratton Voltage Regulator Modification

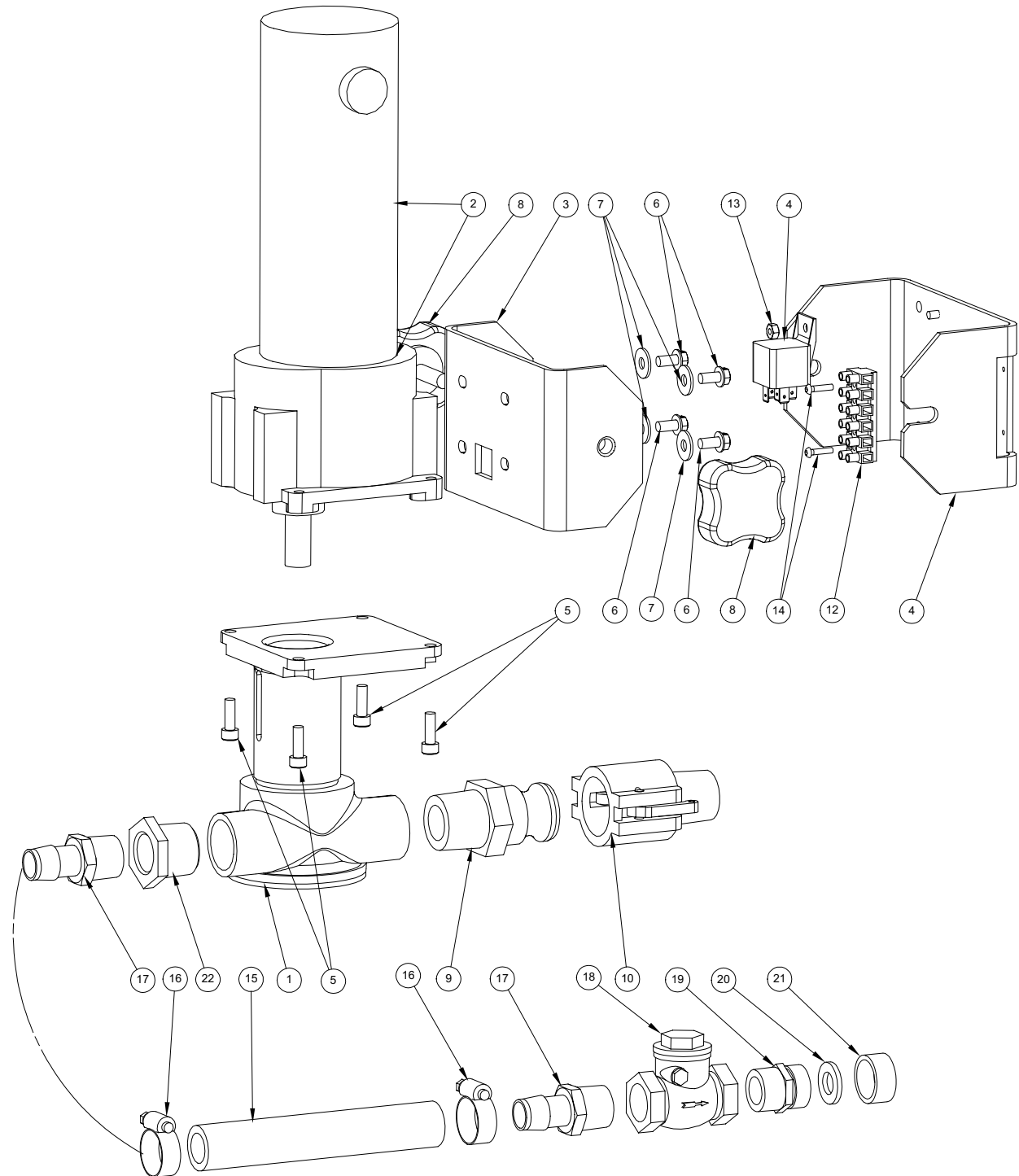
B-3475 Rev -



Item	Part Number	Description	Qty
1	---	Briggs & Stratton Voltage Regulator	1
2	000-178-026	Wire, 16 AWG Yellow	2
3	000-037-033	Butt Connector, #22 Pink	4

Boxxer 421

Figure 11-27 Dura-Flow APO Pump Assembly
D-5654 Rev E



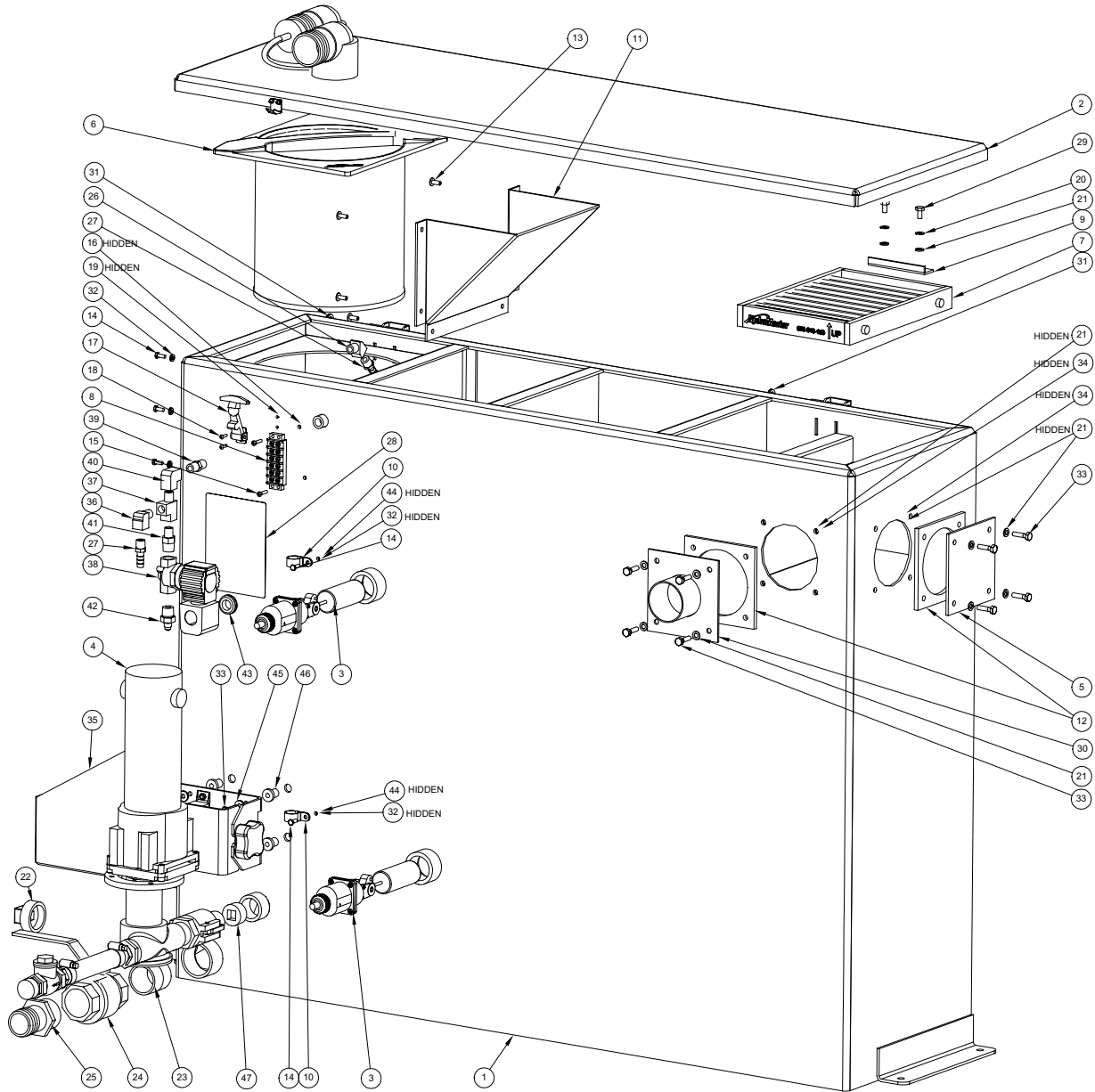
Dura-Flow APO Pump Assembly Parts List

Item	Part Number	Description	Qty
1	000-111-169	Assembly, APO Pump - Jabsco	1
2	000-091-042	Motor, Bison 438 Series	1
3	000-015-891	Bracket, APO Clamp	1
4	000-015-890	Bracket, Tank Mounted APO Support	1
5	000-143-566	Screw, 1/4-28UNF x 0.75" Lg. Socket Head	4
6	000-143-074	Screw, 1/4"-20UNC x 0.50" Lg. Hex Head Self-Tapping	4
7	000-174-002	Washer, 1/4" Flat	4
8	000-061-131	Knob, Handle - Rdm	2
9	000-052-723	Fitting, 1" NPT Cam Lock - Banjo 100F	1
10	000-052-724	Fitting, 1" NPT Cam Lock - Banjo 100B	1
11	000-157-022	Switch, Relay	1
12	000-012-011	Block, 6 Post	1
13	000-094-027	Nut, #10-24UNC Hex	1
14	000-143-532	Screw, #6-32UNC x 5/8" Lg. Socket Head	2
15	000-068-069	Hose, 3/4" I.D. Weatherhead - Blue - Bulk.	1
16	000-033-026	Clamp, Size #10 Hose	2
17	000-052-338	Insert, #1212 (3/4" NPT x 3/4" Barb)	2
18	000-169-009	Valve, 3/4" FPT Swing Check	1
19	000-052-281	Nipple, 3/4" NPT x 3/4" Male Garden Hose	1
20	000-057-055	Gasket, Garden Hose	1
21	000-027-014	Cap, Garden Hose	1
22	000-052-425	Bushing, 1" NPT x 3/4" FPT	1

Boxxer 421

Figure 11-28 100 Gallon Universal Recovery Tank Assembly

D-6918 Rev A



100 Gallon Universal Recovery Tank Assembly Parts List

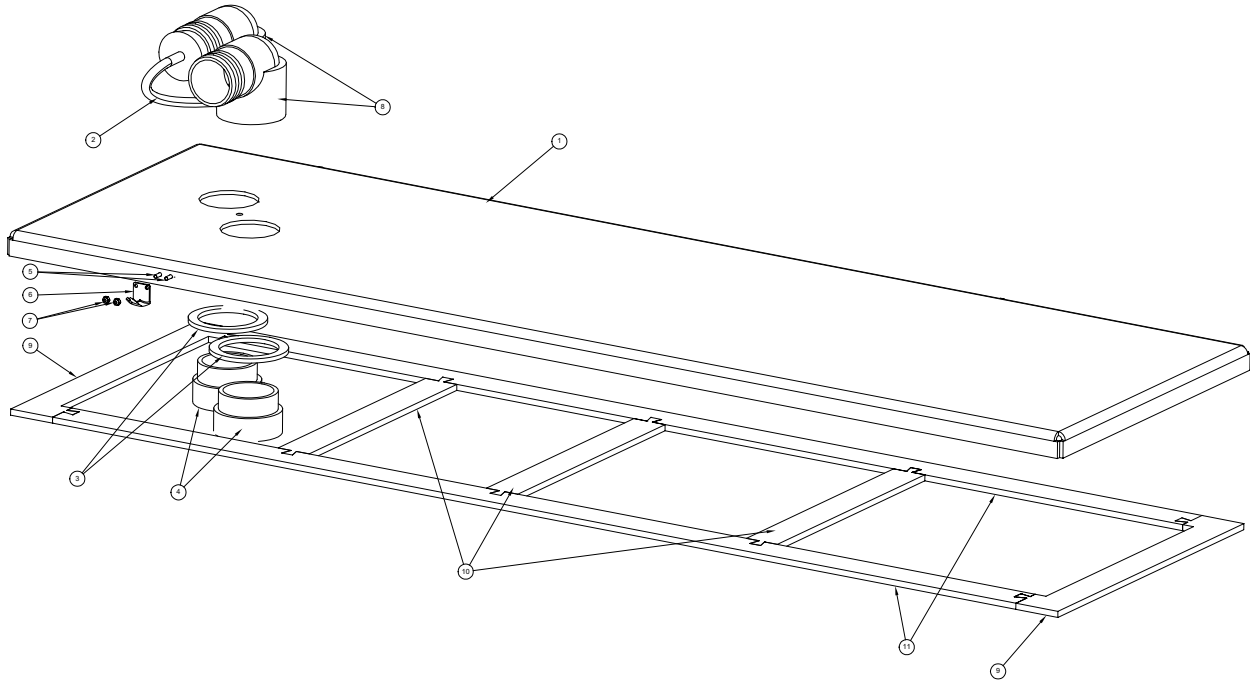
Item	Part Number	Description	Qty
1	000-159-129	Tank, 100 Gallon Universal Recovery - Weldment	1
2	Fig. 11-29	Assembly, Recovery Tank Cover - 100 Gallon	1
3	000-157-090	Float, Lever Switch	2
4	000-079-091	Kit, Dura-Flow APO - Production (Fig. 11-27)	1
5	000-105-336	Plate, Vacuum Port Cover - 100 Gallon Universal Recovery T	1
6	000-049-152	Filter, Recovery Tank Basket	1
7	000-049-153	Filter, Flat - Recovery Tank	1
8	000-012-002	Block, 6 Post Terminal	1
9	000-015-932	Bracket, Flat Filter Securing - Universal Recovery Tank	1
10	000-033-023	Clamp, 3/4" Nylon Hose	2
11	000-049-154	Deflector, Air - Univeral Recovery Tank	1
12	000-057-206	Gasket, Adapter - Universal Recovery Tank	2
13	000-140-023	Rivet, AB8-6A Aluminum Pop	6
14	000-143-126	Screw, #10-24UNC x 0.50" Lg. Hex Head	5
15	000-143-051	Screw, #8-32UNC x 0.75" Lg. Binder Head Phillips	2
16	000-094-059	Nut, #8-32UNF Nylock	2
17	000-086-008	Latch, Bungie	1
18	000-143-539	Screw, #6-32UNC x 0.50" Lg. Button Head Allen	2
19	000-094-063	Nut, #6-32UNC Nylock	2
20	000-174-019	Washer, 1/4" Lock	2
21	000-174-003	Washer, 1/4" Flat	18
22	000-106-019	Plug, 1-1/2" NPT	1
23	000-052-763	Nipple, 1-1/2" IPS Close s/s	1
24	000-169-022	Valve, 1-1/2" Full Port Ball	1
25	000-052-226	Insert, 1-1/2" NPT x 1-1/2" Barb (Grey)	1
26	000-052-082	Elbow, 1/4" NPT Street x 45°	1
27	000-052-102	Insert, #46 (1/4" NPT x 3/8" Barb)	2
28	000-081-220	Label, Maintenance & Lubrication Schedule	1
29	000-143-333	Screw, 1/4"-20UNC x 0.50" Lg. Hex Head	2
30	000-001-131	Adapter, Tank To Ø2.5" Blower Hose - Universal Recovery T	1

100 Gallon Universal Recovery Tank Assembly Parts List

Item	Part Number	Description	Qty
31	000-174-029	Washer, 3/8" Rubber Back	2
32	000-174-036	Washer, #10 Flat Rubber Backed	5
33	000-143-002	Screw, 1/4"-20UNC x 1.00" Lg. Hex Head	12
34	000-094-009	Nut, 1/4"-20UNC Hex Nylock	8
35	000-166-002	Tray, Soap Jug - Weldment	1
36	000-052-085	Elbow, 1/4" NPT Street	1
37	000-052-090	Tee, 1/4" NPT Branch M-F-F	1
38	000-169-082	Valve, 12 Volt Solenoid 1200 PSI	1
39	000-052-071	Nipple, 1/4" NPT Hex	1
40	000-052-088	Elbow, 1/4" FPT x FPT	1
41	000-052-073	Nipple, 3/8" NPT x 1/4" NPT Hex	1
42	000-052-662	Nipple, 3/8" NPT x 1/4" M SAE	1
43	000-060-002	Grommet, Large Wiring	1
44	000-094-034	Nut, #10-24UNC Nylock	2
45	000-174-060	Washer, 1/4" Flat Rubber Backed	4
46	000-094-113	Nut, 1/4"-20UNC Neoprene Wellnut	4
47	000-106-049	Plug, 1" NPT Allen Head	1

Figure 11-29 100 Gallon Universal Recovery Tank Cover Assembly

D-6919 Rev -

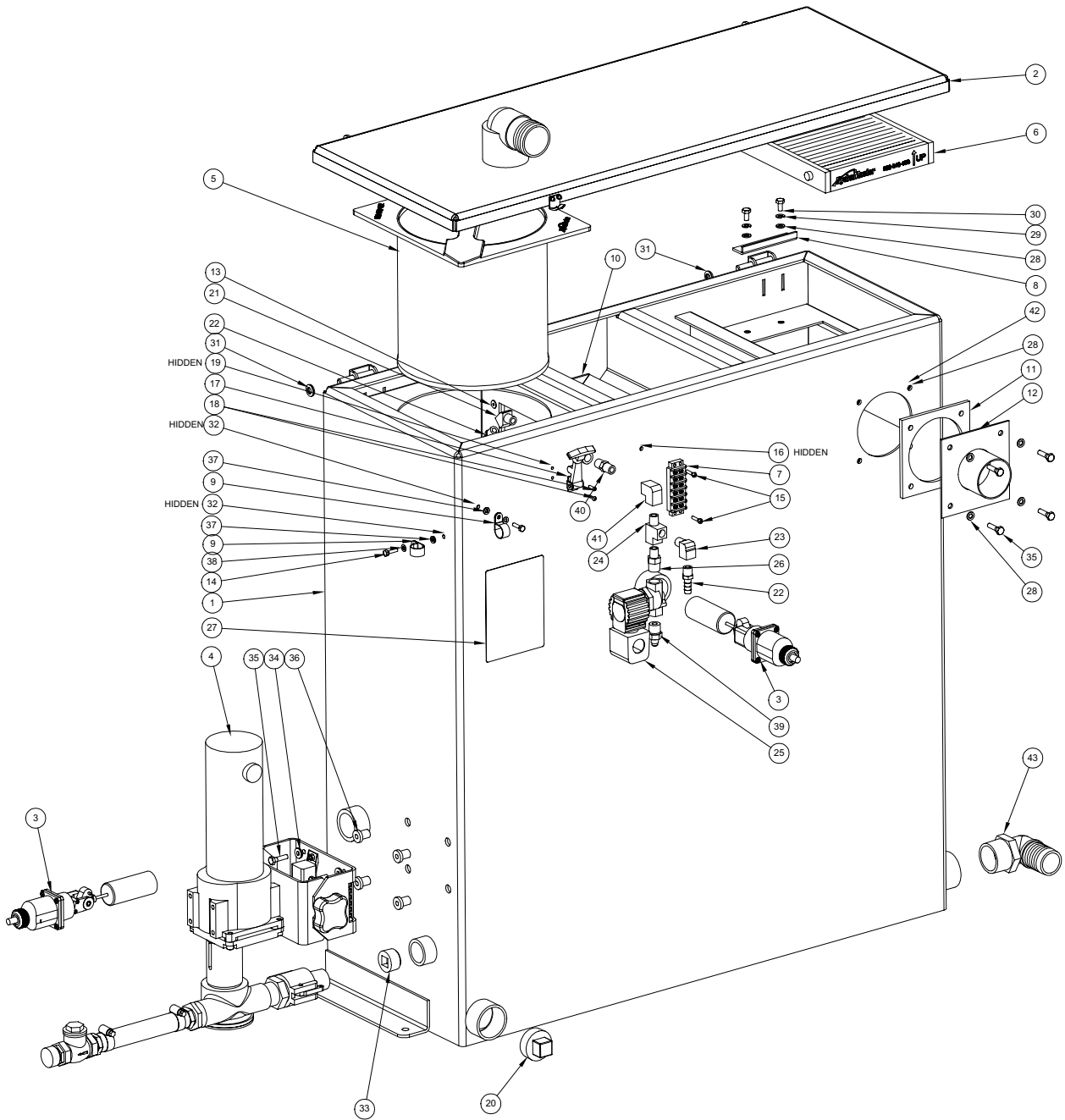


100 Gallon Universal Recovery Tank Cover Assembly Parts List

Item	Part Number	Description	Qty
1	000-041-447	Cover, 100 Gallon Universal Recovery Tank - Weldment	1
2	000-078-039	Vacuum Inlet Stopper Assembly - Recovery Tank	1
3	000-057-015	Gasket, 1-1/2" Bulkhead Fitting	2
4	000-052-219	Adapter, 2" NPT x 2" F Slip	2
5	000-143-539	Screw, #6-32UNC x 0.50" Lg. Button Head Allen	2
6	000-086-008	Latch, Bungie - Strike	1
7	000-094-063	Nut, #6-32UNC Nylock	2
8	000-052-222	Elbow, 2" Barb x 2" FPT	2
9	000-057-202	Gasket, End - Recovery Tank	2
10	000-057-203	Gasket, Middle - Recovery Tank	3
11	000-057-205	Gasket, Side - Recovery Tank - 100 Gallon	2

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Figure 11-30 70 Gallon Universal Recovery Tank For 85 RMT Assembly
D-7157 Rev -



70 Gallon Universal Recovery Tank For 85 RMT Assembly Parts List

Item	Part Number	Description	Qty
1	000-159-128	Tank, 70 Gallon Universal Recovery - Weldment	1
2	Fig. 11-11	Assembly, Cover - Single Vac. - 70 Gallon Universal Tank	1
3	000-157-090	Float, Lever Switch	2
4	000-079-091	Kit, Dura-Flow APO - Production (Fig. 11-27)	1
5	000-049-152	Filter, Recovery Tank Basket	1
6	000-049-153	Filter, Flat - Recovery Tank	1
7	000-012-002	Block, 6 Post Terminal	1
8	000-015-932	Bracket, Flat Filter Securing - Universal Recovery Tank	1
9	000-033-023	Clamp, 3/4" Nylon Hose	2
10	000-049-154	Deflector, Air - Universal Recovery Tank	1
11	000-057-206	Gasket, Adapter - Universal Recovery Tank	1
12	000-001-131	Adapter, Tank To Ø2.5" Blower Hose - Universal Recovery T	1
13	000-140-023	Rivet, AB8-6A Aluminum Pop	6
14	000-143-132	Screw, #10-24UNC x 0.75" Lg. Hex Head	2
15	000-143-051	Screw, #8-32UNC x 0.75" Lg. Binder Head Phillips	2
16	000-094-059	Nut, #8-32UNF Nylock	2
17	000-086-008	Latch, Bungie	1
18	000-143-539	Screw, #6-32UNC x 0.50" Lg. Button Head Allen	2
19	000-094-063	Nut, #6-32UNC Nylock	2
20	000-106-019	Plug, 1-1/2" NPT	1
21	000-052-082	Elbow, 1/4" NPT Street x 45°	1
22	000-052-102	Insert, #46 (1/4" NPT x 3/8" Barb)	2
23	000-052-085	Elbow, 1/4" NPT Street	1
24	000-052-090	Tee, 1/4" NPT Branch M-F-F	1
25	000-169-082	Valve, 12 Volt Solenoid 1200 PSI	1
26	000-052-073	Nipple, 3/8" NPT x 1/4" NPT Hex	1
27	000-081-220	Label, Maintenance & Lubrication Schedule	1
28	000-174-003	Washer, 1/4" Flat	10
29	000-174-019	Washer, 1/4" Lock	2
30	000-143-333	Screw, 1/4"-20UNC x 0.50" Lg. Hex Head	2

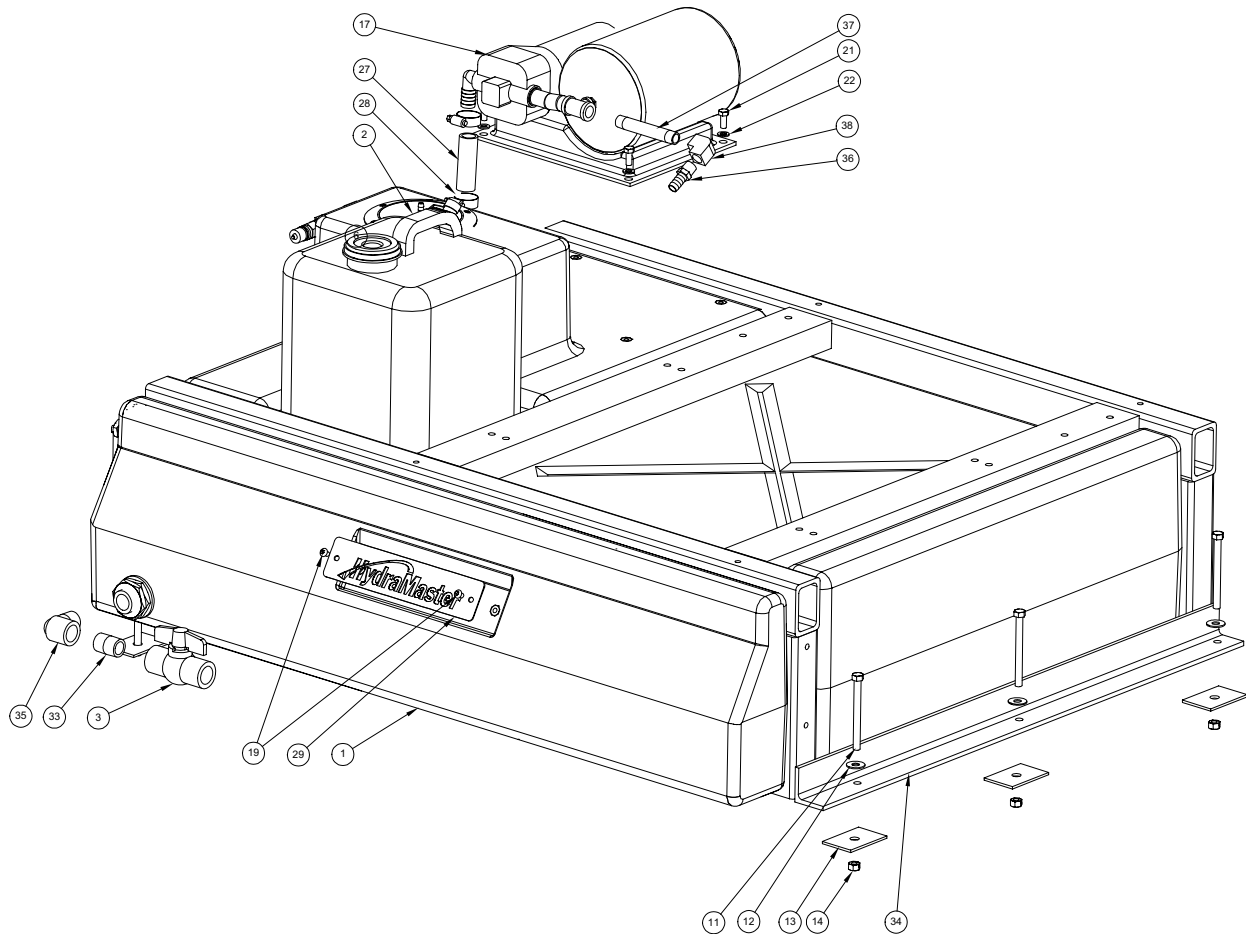
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70 Gallon Universal Recovery Tank For 85 RMT Assembly Parts List

Item	Part Number	Description	Qty
31	000-174-029	Washer, 3/8" Rubber Back	2
32	000-094-034	Nut, #10-24UNC Nylock	2
33	000-106-049	Plug, 1" NPT Allen Head	1
34	000-174-060	Washer, 1/4" Flat Rubber Backed	4
35	000-143-002	Screw, 1/4"-20UNC x 1.00" Lg. Hex Head	8
36	000-094-113	Nut, 1/4"-20UNC Neoprene Wellnut	4
37	000-174-036	Washer, #10 Flat Rubber Backed	2
38	000-174-001	Washer, #10 Flat	2
39	000-052-662	Nipple, 3/8" NPT x 1/4" M SAE	1
40	000-052-071	Nipple, 1/4" NPT Hex	1
41	000-052-088	Elbow, 1/4" FPT x FPT	1
42	000-094-009	Nut, 1/4"-20UNC Hex Nylock	4
43	000-052-727	Elbow, 1.5" x 1.5" NPT x 90°	1

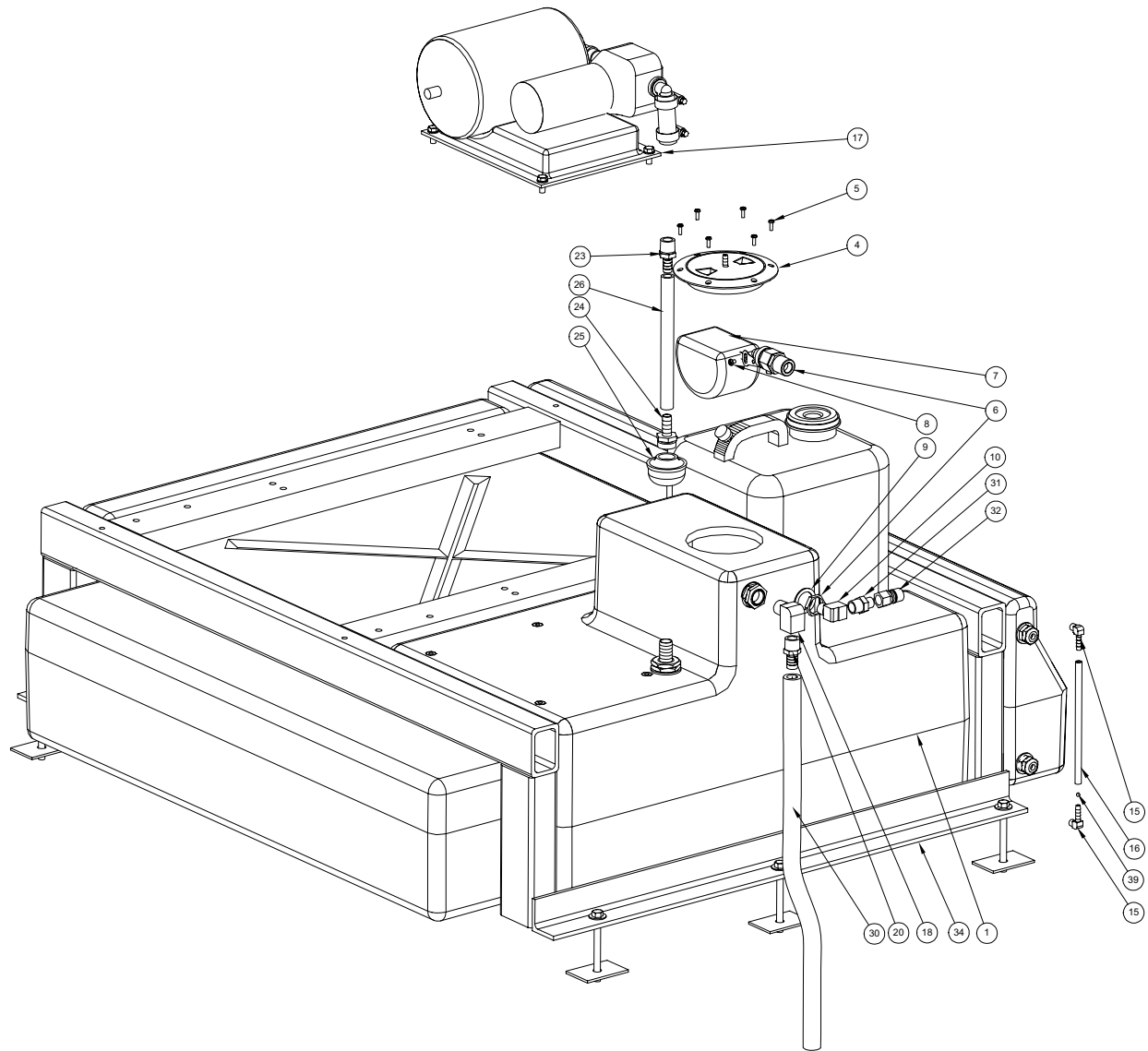
Figure 11-31 85 Gallon Rotomolded Tank Assembly - Front View

D-5566 Rev B



Boxxer 421

Figure 11-32 85 Gallon Rotomolded Tank Assembly - Rear View
D-5566 Rev B



85 Gallon Rotomolded Tank Assembly Parts List

Item	Part Number	Description	Qty
1	000-159-116	Tank, Boxxer Fresh Water - Rotomolded	1
2	000-159-016	Jug, 5 Gallon Plastic Chemical - Standard	1
3	000-169-202	Valve, 3/4" FPT Ball Valve	1
4	000-041-004	Cover, Poly Water Box Mod. w/ Vent	1
5	000-143-314	Screw, #8 x 1/2" Lg. Pan Head	6
6	000-169-167	Valve, Mechanical Incoming Water - Water Box	1
7	000-005-007	Float, Water Box	1
8	000-143-336	Screw, #10-32UNF x 0.25" Lg. Pan Head Phillips	1
9	000-174-063	Washer, 1.5" O.D. x 1.073" I.D. x 0.075" Thk.	1
10	000-052-086	Elbow, 3/8" NPT Street	1
11	000-143-198	Screw, 3/8"-16UNC x 4" Lg. Hex Head Full Thread	6
12	000-174-005	Washer, 3/8" Flat	6
13	600-011-003	Tie Down Cleat Washer	6
14	000-094-015	Nut, 3/8"-16UNC Hex 2-Way Locking	6
15	000-052-253	Elbow, 1/8" NPT x 1/4" Barb	2
16	000-068-025	Hose, 1/4" I.D. Clear	1
17	000-111-170	Pump, Flojet Fresh Water	1
18	000-052-087	Elbow, 1/2" NPT Street	1
19	000-143-565	Screw, 1/4-20 UNC x 0.375" Lg. Button Head	2
20	000-052-130	Insert, #810 Brass	1
21	000-143-012	Screw, 5/16"-18UNC x 0.75" Lg. Hex Head	4
22	000-174-049	Washer, 5/16" Flat	4
23	000-052-107	Insert, #88 (1/2" NPT x 1/2" Barb)	1
24	000-052-160	Insert, 3/4" M Garden x 1/2" Barb	1
25	000-049-020	Filter, Screen - Medium	1
26	000-068-018	Hose, 1/2" I.D Bulk	1
27	000-068-069	Hose, 3/4" I.D. Weatherhead Blue - Bulk	1
28	000-033-029	Clamp, Size 12 Hose	2
29	000-105-313	Plate, HydraMaster Name- Roto Tank	1
30	000-068-020	Hose, .625" I.D. - Green Stripe	1

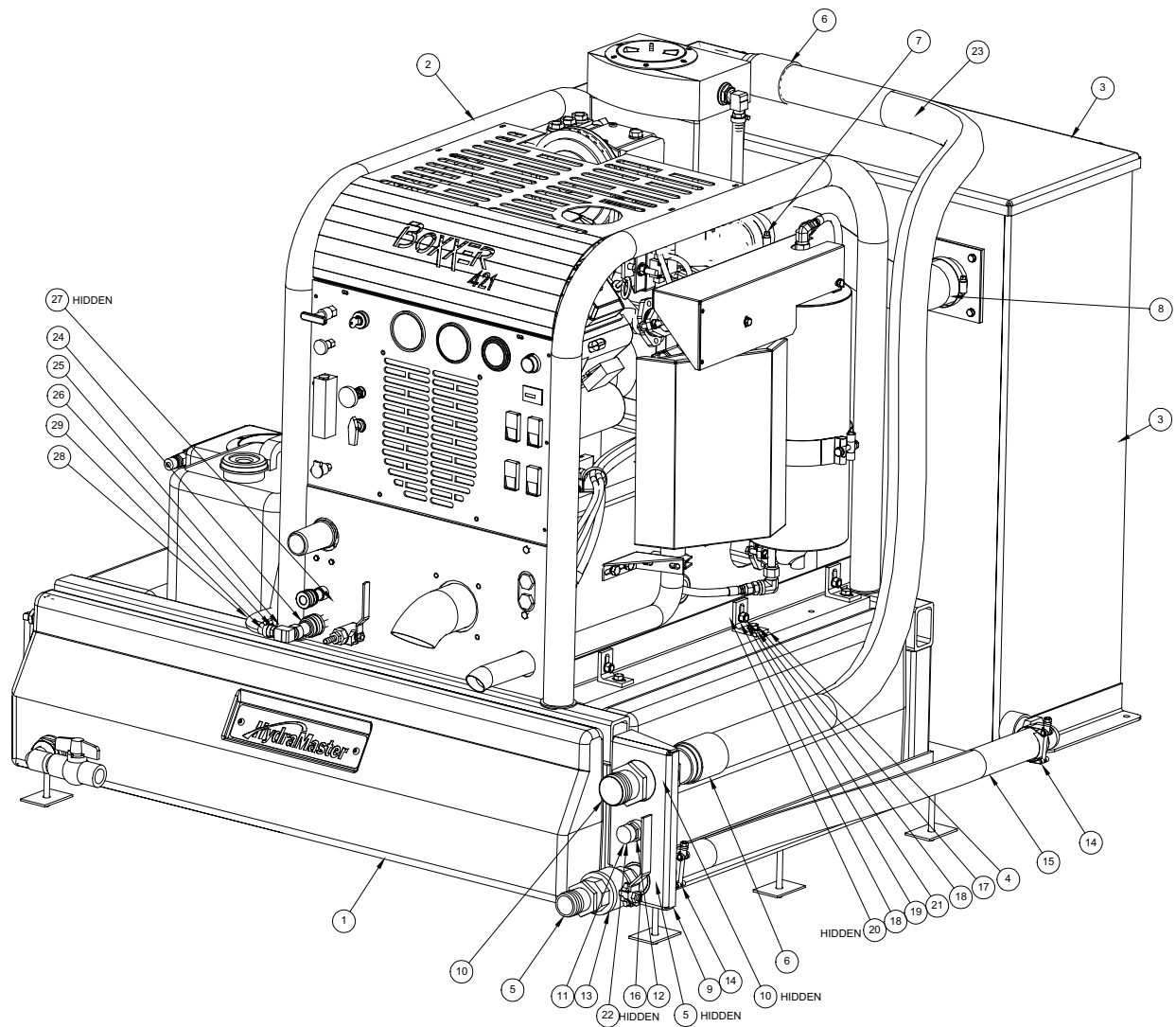
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85 Gallon Rotomolded Tank Assembly Parts List

Item	Part Number	Description	Qty
31	000-052-075	Nipple, 3/8" NPT x 1/2" NPT	1
32	000-052-052	Quick Connect, 660 Male w/ Viton Standard	1
33	000-052-326	Nipple, 3/4" NPT Close	1
34	000-055-169	Frame, Rotomolded Fresh Water Tank - Boxxer	1
35	000-052-726	Elbow, 3/4" Street (Grey)	1
36	000-052-105	Insert, #68 (3/8" NPT x 1/2" Barb)	1
37	000-052-408	Nipple, 3/8" NPT x 4" Lg.	1
38	000-052-142	Elbow, 3/8" FPT x FPT	1
39	000-005-008	Sight Float Bead, 5mm Red Wally Whale	1

Figure 11-33 85 RMT w/ Boxxer 421 Assembly - Front View

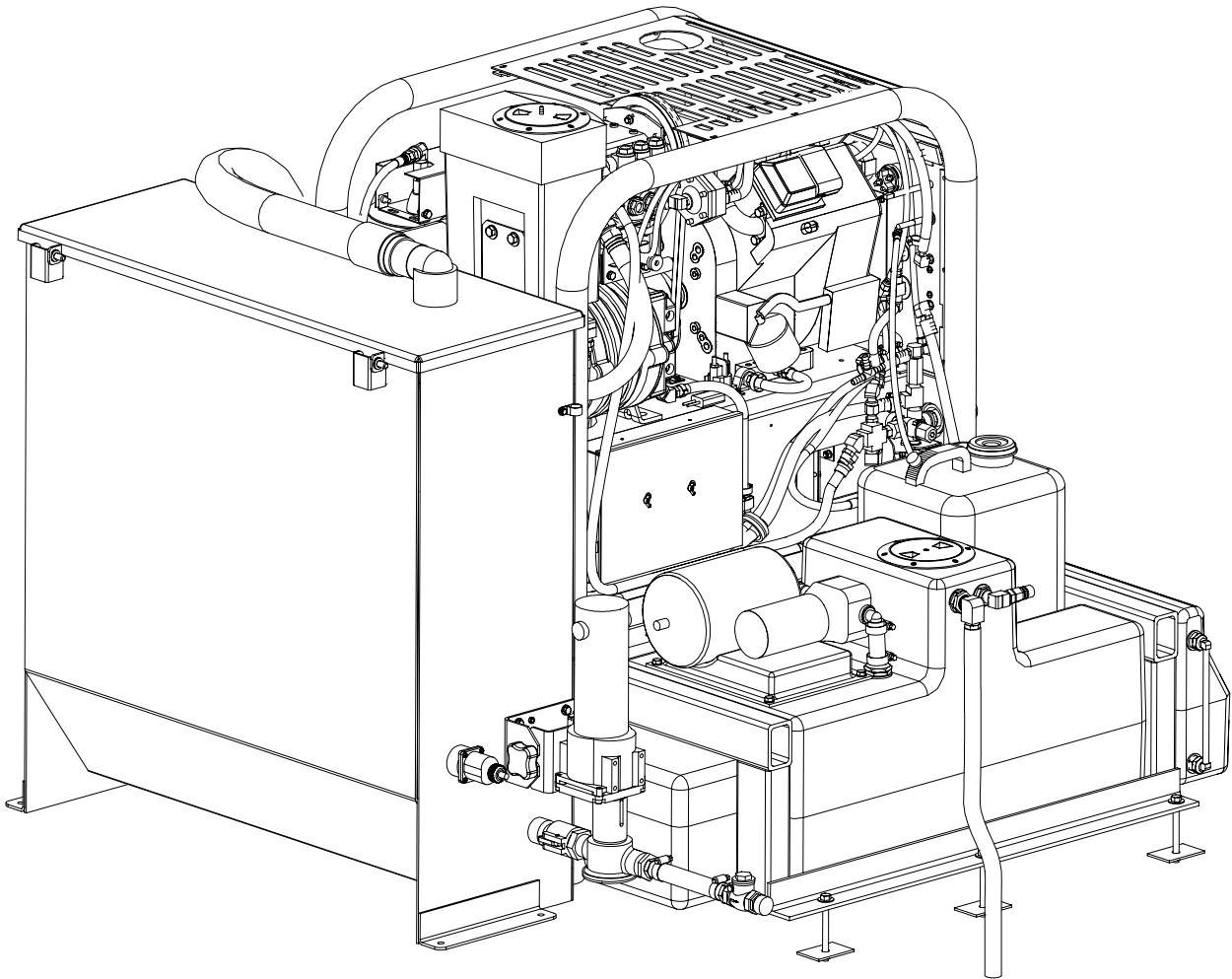
D-7158 Rev -



Boxxer 421

Figure 11-34 85 RMT w/ Boxxer 421 Assembly - Rear View

D-7158 Rev -



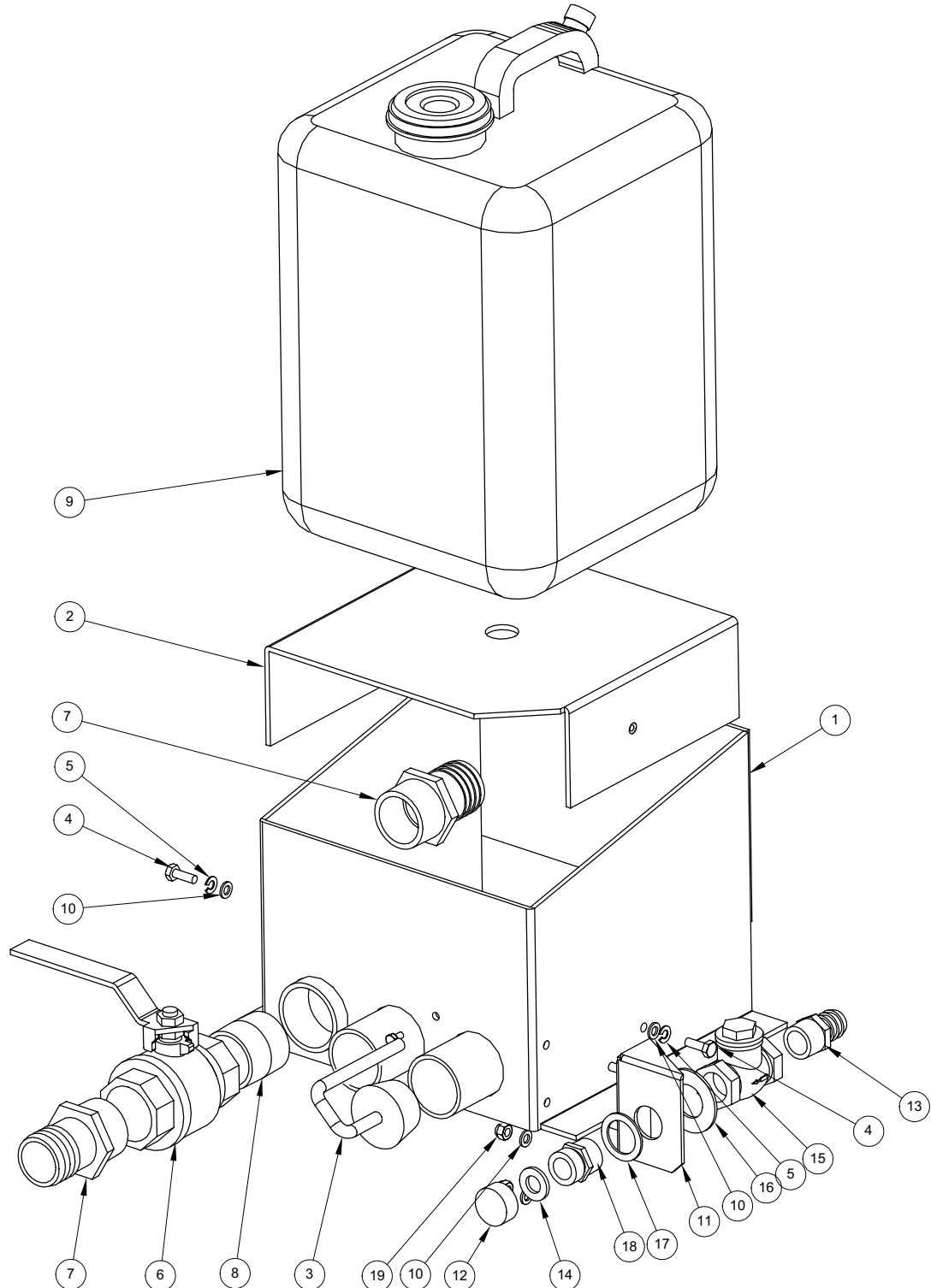
85 RTM w/ Boxxer 421 Assembly Parts List

Item	Part Number	Description	Qty
1	Fig. 11-31 & 11-32	Assembly, Rotomolded Tank - Boxxer	1
2	Fig. 11-1 - 11-6	Assembly, Machine - Boxxer 421	1
3	Fig. 11-33 & 11-34	Assembly, Recovery Tank For 85 RMT - 70 URT	1
4	000-015-265	Bracket, Machine Tie Down	6
5	000-052-226	Insert, 1-1/2" NPT x 1-1/2" Barb (Grey)	2
6	000-052-169	Cuff, 2" Vacuum Hose	2
7	000-033-012	Clamp, Size #44 Hose	2
8	000-068-011	Hose, 2.5" I.D. Red Stripe	1
9	000-015-884	Bracket, Dump & Vacuum Mounting - Boxxer	1
10	000-052-221	Insert, 2" NPT x 2" Barb (Grey)	2
11	000-027-014	Cap, Garden Hose	1
12	000-052-281	Nipple, 3/4" NPT x 3/4" Male Garden Hose	1
13	000-169-022	Valve, 1-1/2" Full Port Ball	1
14	000-033-063	Clamp, 1-1/2" T-Bolt	2
15	000-068-135	Hose, 1.5" I.D. Red Stripe	1
16	000-052-182	Nipple, 1-1/2" NPT Close Galvanized	1
17	000-143-017	Screw, 3/8"-16UNC x 3/4" Lg. Hex Head	6
18	000-174-057	Washer, 3/8" Lock	12
19	000-094-014	Nut, 3/8"-16UNC Hex Zinc Plated	6
20	000-174-032	Washer, 3/8" Flat	6
21	000-143-096	Screw, 3/8"-16UNC x 1.00" Lg. Hex Head	6
22	000-057-055	Gasket, Garden Hose	1
23	000-068-039	Hose, 2" I.D. Grey Vacuum (Black 068-042)	1
24	000-052-053	Quick Connect, 3/8 Female	1
25	000-052-086	Elbow, 3/8" NPT Street	1
26	000-052-105	Insert, #68 (3/8" NPT x 1/2" Barb)	1
27	000-033-117	Clamp, 1" Cushion Loop w/ 7/16" Mount Hole	1
28	000-068-018	Hose, 1/2" I.D. Black Bulk	1
29	000-033-004	Clamp, Size #6	2

Boxxer 421

Figure 11-35 Chemical Jug Tray Assembly

C-4945 Rev C



Chemical Jug Tray Assembly Parts List

Item	Part Number	Description	Qty
1	000-166-021	Tray, Chemical Jug - Outer - Weldment	1
2	000-166-025	Tray, Chemical Jug - Inner	1
3	000-078-039	Vacuum Inlet Stopper	1
4	000-143-001	Screw, 1/4"-20UNC x 0.75" Lg. Hex Head	2
5	000-174-019	Washer, 1/4" Lock	2
6	000-169-022	Valve, 1-1/2" Full Port Ball	1
7	000-052-226	Insert, 1-1/2" NPT x 1-1/2" Barb (Grey)	2
8	000-052-182	Nipple, 1-1/2" NPT Close Galvanized	1
9	000-159-016	Jug, 5 Gallon Plastic Chemical - Standard	1
10	000-174-003	Washer, 1/4" Flat	4
11	000-015-720	Bracket, Apo Outlet Mounting - Weldment	1
12	000-027-014	Cap, Garden Hose	1
13	000-052-338	Insert, #1212 (3/4" NPT x 3/4" Barb)	1
14	000-057-055	Gasket, Garden Hose	1
15	000-169-009	Valve, 3/4" FPT Swing Check	1
16	000-174-050	Washer, 1" Flat	1
17	000-174-063	Washer, 1.5" O.D. x 1.073" I.D. x 0.075" Thk.	1
18	000-052-281	Nipple, 3/4" NPT x 3/4" Male Garden Hose	1
19	000-094-009	Nut, 1/4"-20UNC Hex Nylock	2

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Boxxer 421 Hose Assemblies

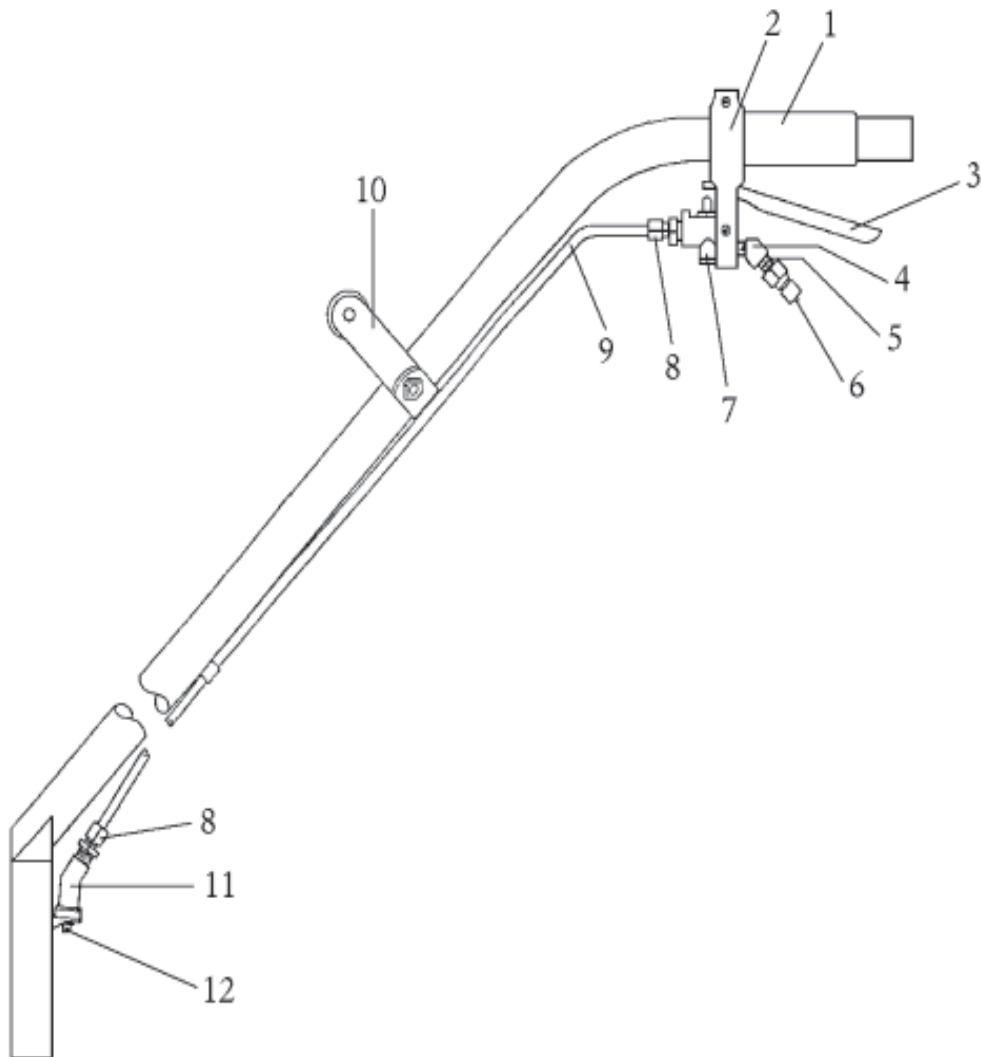
Hose Part No.	Hose Description	From	To	Qty
068-018	1/2" Rubber	Bypass Valve (169-081)	Poly Water Box Tank (159-105)	48 in
068-030	5/32" Vac.	0-30" Hg Vac. Gauge (074-017)	Blower Collector Box (013-051)	34 in
		Engine Intake	Diverter Check Valve (169-156)	48 in
		Diverter Check Valve (169-156)	3/16" Plastic Vac Tee (052-155)	24 in
		Gravity Feed Oil Cup (052-272)	Blower Collector Box (013-051)	50 in
		Blower Collector Box (013-051)	Diverter Check Valve (169-156)	9 in
		Diverter Check Valve (169-156)	3/16" Plastic Vac Tee (052-155)	1 1/2 in
		3/16" Plastic Vac Tee (052-155)	3/16" Plastic Vac Tee (052-155)	1 3/4 in
		3/16" Plastic Vac Tee (052-155)	Upr. Primary Vac. Solenoid Valve (169-070)	24 in
		3/16" Plastic Vac Tee (052-155)	Upr. Primary Vac. Solenoid Valve (169-070)	52 in
		Upr. Primary Vac. Solenoid Valve (169-070)	Air Cylinder Valve (169-169)	16 in
		Upr. Primary Vac. Solenoid Valve (169-070)	Air Cylinder Valve (169-169)	8 in
068-085	3/8" HiTemp	12v Solenoid (169-082) on Recovery Tank	180°F Valve (169-011)	5 ft
		Chem. Pump (111-035)	Chem. Meter. Valve (160-160)	2.5 ft
068-219	1/2" w/Inserts and Cap.	Engine Oil Drain Hose, Pump Oil Drain Hose, 2x Blower Oil Drain Hose		24 in
068-103	1/2" Blue	Hard Water MagnaClean (163-056)	Poly Water Box (159-105)	58 in
068-326	3/8" Clr w/braid	Chem. Jug Pick-up	Chem. Meter. Valve (169-160)	5 ft
		Chem. Jug Return	3-way Chem. Valve (169-0171)	5 ft

Boxxer 421 Hose Assemblies

Hose Part No.	Description	From	To	Qty
068-398	3" ID x 3 ply Silicone x 36"lg.	Blower Heat Ex. (038-053)	Silencer (093-080)	6 in
		Exhaust Turn Down Adapter (011-098)	Blower Heat Exchanger (038-053)	1/4 in
068-588	Throb	HydraPump (111-042)	Bypass Valve (169-081)	50 1/2 in
068-641	3/8" Teflon w/JIC ends	Bypass Valve (169-081)	Blower Heat Exchanger (038-053)	10 in
068-642	3/8" Teflon w/JIC ends	Blower Heat Ex. (038-053)	After-Burner (038-054)	19 1/2 in
068-643	3/8" Teflon w/JIC ends	Hi PSI Manifold (090-010)	Hi PSI Manifold (OUT) (090-008)	30 1/2 in
068-644	3/8" Teflon w/JIC ends	After-Burner (038-054)	Hi PSI Manifold (090-010)	49 1/2 in
068-645	3/16" Teflon w/ JIC Ends	Pressure Gauge, 0-1500p (074-007)	3/8" Female Cross (052-113), on Bypass Valve (169-081)	19 3/4 in
068-646	3/16" Teflon w/ JIC Ends	Chem. Pump (111-035)	3-Way Chemical Valve (169-0171)	29 1/4 in
068-647	3/16" Teflon w/ JIC Ends	Primary Orifice (180-004)	Poly Water Box Tank (159-105)	47 1/4 in
068-648	3/16" Teflon w/ JIC Ends	Secondary Orifice (180-006)	12V, 1200 PSI Solenoid Valve (169-082)	61 1/4 in
068-649	3/4" Steam OUT	HydraPump (111-042)	Poly Water Box Tank (159-105)	23 in
068-660	1/4 Fuel	Carburetor	Fuel Pump (111-008)	
068-086	2" Rubber	3/8" Dump Valve (169-064)	Bypass Valve (169-081)	18 in

Cleaning Wand Parts

Figure 12-1 HydraHoe Two-Jet Cleaning Wand Assembly



Wand Assembly Parts List

ITEM	PART NO.	DESCRIPTION	QTY
1	061-007	Handle Grip	1
2	015-203	Bracket, Low Pressure Wand Valve Holder	1
3	167-018	Trigger, Wand Low PSI	1
4	052-082	Elbow, ¼" Brass 45 Street	1
5	052-072	Nipple, ¼ Brass Close	1
6	052-050	Quick Connect, 440 Male with Viton	1
7	169-074	Valve, High PSI Brass	1
8	052-152	Compression, ¼" Male HydraHoe Fitting	2
9	168-001	Tube, HydraHoe Solution ¼" OD s/s	1
10	061-024	Handle Kit, Wand – Pressure Guide (see below)	1
11	052-450	Elbow, For Jet Assembly Wands	1
12	076-004	Jet, #11004 ¼" VV s/s	1
Handle Assy (Item 10)			
	094-035	Nut, 5/16-18 s/s Nylock Half	2
	143-012	Bolt, 5/16-18 x ¾" HHC s/s	2
	061-006	Handle, Pressure Guide	1

How to Order Parts

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.

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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

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.

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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 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): _____

GOLDEN GUARANTEE® LIMITED WARRANTY

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

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

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

This warranty covers parts, as specified, and does not cover labor which may be necessary in completing repairs. HydraMaster's liability to Purchaser, whether in contract or in tort arising out of warranties, representation, instructions, or defects from any cause shall be limited to repairing or

the defective part or parts using new or remanufactured parts. To qualify for warranty coverage, defective parts must be returned to HydraMaster within 30 days. No liability whatsoever shall attach to HydraMaster until said products have been paid for.

Except as stated in this section and in the proceeding section and except as to title, there are no guarantees or warranties of merchantability, fitness, performance or otherwise, express, implied or statutory, and HydraMaster shall have no liability for consequential, incidental, or other damages, howsoever caused, including but not limited to lost business, downtime, lodging. Parts supplied under this warranty will themselves be warranted only for the remaining time left in the original warranty period.

All components not specifically referenced in the schedule below are covered under this warranty for a period of one (1) year, excepting those parts which are considered, by HydraMaster, to be expendable in normal use, including but not limited to paint, labels and other cosmetic parts or features.

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

Deposits and/or build-up in the water, chemical, recovery or heating systems due to hardness in the water used or chemicals which results in deposits, will VOID all warranties on affected components.

The use or application of any chemical, including but not limited to acids or solvents, which results in damage to metal, rubber, plastic, or painted parts will VOID all warranties on those parts.

FRAME, COVER ASSEMBLIES:	3 years
VACUUM RECOVERY TANK:	3 years
ENGINE:	As provided by original Manufacturer's Warranty
VACUUM BLOWER: (Uncontested Through Tuthill).....	2 years
CHEMICAL SYSTEMS:	1 year
CLEANING WAND:	1 year
INTERNAL MACHINE HOSES:	1 year
HIGH PRESSURE BY-PASS VALVE:.....	1 year
EXTERNAL MACHINE HOSES:	1 year
BELTS, FITTINGS, FILTER SCREENS, GAUGES:.....	1 year
WATER HEATING SYSTEM:	1 year
WATER PRESSURE PUMP: (Through original Manufacturer.).....	1 year
ELECTRICAL COMPONENTS:	1 year

Sales:
1-800-426-1301



Accessories

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.



Retail pricing included for:

- Truckmount machines
- Accessories
- Hose reels
- Chemicals

Please contact your local distributor for more product and pricing information.

For a distributor near you, please visit www.hydramaster.com or call 1.800.426.1301.

February 15, 2007

Truckmount Retail Price List

Effective March 1, 2007

Standard Truckmount Package Pricing*

Retail Price

SpitFire™ Heat-Exchanger Systems

SpitFire™ 3.2 - #700-070-002.....	\$9,495.00
With 85 gal. Poly Fresh Water Tank (#159-118 & #079-093).....	12,079.95

Boxxer™ Heat-Exchanger Systems

Boxxer™ 421 - #700-070-011.....	\$14,595.00
With 100 gal. Recovery Tank Upgrade (#610-003-057).....	15,070.00
With 85 gal. Poly Fresh Water Tank (#159-118 & #079-092).....	17,179.95
Boxxer™ 427 - #700-070-033.....	\$17,995.00
With 100 gal. Recovery Tank Upgrade (#610-003-056).....	18,470.00

Boxxer™ Water Recovery System

Boxxer™ H ₂ O - #700-070-036.....	\$11,595.00
With APO (#000-079-091).....	12,990.00

Maxx™ Premium Heat-Exchanger Systems

Maxx™ 450 - #700-070-045.....	\$20,595.00
Maxx™ 450 Diesel - #700-070-044.....	21,695.00
Maxx™ 470 - #700-070-047.....	21,695.00

CDS™ Overdrive Van-Powered Systems

(Standard colors are HydraMaster Blue and Antique Vein.)

CDS™ 4.6 Chevy.....	\$16,495.00
CDS™ 4.6 Chevy with Salsa Heat Booster (#079-077).....	17,790.00
CDS™ 4.6 Ford.....	17,495.00
CDS™ 4.6 Ford with Salsa Heat Booster (#079-077).....	18,790.00
• For Electric Clutch Option (#000-079-076) add:.....	459.95
CDS™ 4.8 Chevy.....	\$17,995.00
CDS™ 4.8 Chevy with Salsa Heat Booster (#079-077).....	19,290.00
CDS™ 4.8 Ford.....	18,995.00
CDS™ 4.8 Ford with Salsa Heat Booster (#079-077).....	20,290.00

Rotary Extraction™ Systems

RX-20™ (RX-20 HE) High-Efficiency Model - #700-041-006.....	\$3,295.00
RX-20™ (RX-20 HE) with Extended 'Tallman' Handle - #700-041-106.....	3,395.00
Rotary DriMaster™ (RDM) Power Tool - #700-041-016.....	2,995.00

*Standard Package price does not include freight, installation, battery or dealer preparation.

Prices subject to change without notice. All prices quoted FOB Factory, Mukilteo, Washington.



Accessories

Retail Price List

Effective March 1, 2007

Part Number

Retail Price

RX-20 Rotary Extractor and Attachments

700-041-006	RX-20HE High Efficiency Model	\$3,295.00
700-041-106	RX-20HE With Extended "TallMan" Handle	3,395.00
000-163-018	RX-20 Mounting Bracket	79.95
190-041-020	RX-20 Pad and Bonnet Driver	149.00
190-041-024	RX-20 Hard Floor Attachment (LD)	549.00
190-041-026	RX-20 Hard Floor Attachment (MD)	549.00
190-041-025	RX-20 Hard Floor Attachment (HD)	549.00

Rotary DriMaster

700-041-016	RDM Rotary DriMaster Power Tool	\$2,995.00
000-163-057	RDM Mounting Bracket	79.95

Carpet and Upholstery Cleaning Tools

000-163-020	HydraHoe Carpet Cleaning Wand	\$495.00
000-163-104	2" S-Bend 2 Jet Wand	525.00
100-011-106	1½" S-Bend 2 Jet Wand	299.00
000-163-008	Utility Cleaning Tool (UT-40)	379.95
000-163-010	DriMaster Upholstery Tool (HydraMaster)	439.95
000-163-009	Truckmount Stair Tool (UT-14)	289.95
000-163-053	Pressure Washing Tool	99.95
000-163-007	Hand Spray Tool (#6 Jet)	74.95

Automatic Pump Out Systems

000-079-025	Drop-In APO (SpitFire 3.2)	\$795.00
000-079-097	Dura-Flow™ APO (CDS)	1,395.00
000-079-091	Dura-Flow™ APO (New Boxxers & Maxx)	1,395.00
000-079-094	Dura-Flow™ APO (Retrofit Boxxer & Maxx)	1,595.00

"Salsa" Heat Booster

000-079-077	"Salsa" Heat Booster for CDS	\$1,295.00
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Part Number

Retail Price

Fresh Water Supply Tanks

000-159-118	85 gal. Roto-Molded Tank	\$2,295.00
000-079-093	SpitFire 3.2 Kit - 85 gal. Roto-Molded Tank	289.95
000-079-092	Boxxer 421 Kit - 85 gal. Roto-Molded Tank	289.95
000-079-012	120 gal. Horizontal Tank	2,295.00
000-159-115	110 gal. Poly Tank (over wheel-well)	1,295.00
000-079-081	Pump-in Kit for Poly Tank	249.00

Custom Interior Packages . . . “Get Organized!”

Package 1

000-079-020-2 Custom Interior Package with 85 gallon freshwater tank: \$2,895.00

(Shelves cannot be mounted on tank - only hose reels)

Package 2

000-079-022-2 Custom Interior Package with 120 gallon freshwater tank: \$2,895.00

(Shelves & Reels can be mounted on tank)

Custom Interior Package Includes:

✓ Fresh Water Tank, ✓ Two-Bin Back Door Shelf Assembly, ✓ Custom Three-Tier Shelf, ✓ Wand Storage Rack, ✓ Stair Tool Holder, ✓ Furniture Tab / Snap Block Holder, and ✓ Rake Storage Clips.

HOSE REELS ARE ORDERED SEPARATELY (See hose reel price sheet)

Note: *Mix-n-Match shelving may be added to your 120 gallon tank (not to the 85 gallon tank) for an additional charge. See below.*

**Mix-N-Match Shelf System -
Add to Your 120 Gallon Fresh Water Tank**

All shelf configurations can be built out of the following 4 components:

000-166-014	Four-Compartment Bin	\$199.95
000-166-012	Air Mover Tray	239.95
000-083-002	Tall Side Support (sold as each)	82.95
	Tall Side Support (sold as set or 2)	165.90
000-900-900	Hardware Kit	16.95

EXAMPLE: A Mix-n-Match shelf with two airmover trays would be:

000-166-012	2 ea. Airmover Trays	\$479.90
000-083-002	2 ea. Supports	165.90
000-900-900	1 ea. Hardware Kit	16.95
	Total	\$662.75

Part Number**Retail Price****Interior Van Accessories**

000-163-015	Furniture Pad/Snap Block Holder	\$99.95
000-163-038	Custom Three-Tier Shelf.....	299.95
000-163-050	Two-Bin Back Door Shelf Assembly.....	179.95
000-163-078	Over-Wheelwell Shelf System No. 1 (2 Airmover trays).....	839.95
000-163-079	Over-Wheelwell Shelf System No. 2 (1 Airmover tray, 1 4-bin).....	829.95
000-163-017	Wand Storage Rack, Clip & Rail.....	22.95
000-079-048	Chemical Jug Assembly (complete with hose).....	289.95
000-079-049	APO kit for Chem Jug Assembly (complete with hose).....	48.95

Fuel Line Kits

000-078-074	1987-1996 Chev / 1987-1991 Dodge / 1987-2002 Astro (w/2" neck)	\$34.95
000-078-081	1987-1991 Ford / 1992-1997 Dodge / 1997-2002 Chev.....	69.95
000-078-082	1992-1997 Ford / 1999-2003 Ford (Diesel needs 2).....	99.95
000-078-183	1998 Ford (Diesel needs 2).....	56.95
000-078-110	1999-2003 Ford (Diesel needs 2).....	369.95
000-078-425	2004-2007 Ford	299.95
000-078-042	2004 Sprinter Diesel / 2004-2006 Dodge	222.95
000-078-407	2003-2007 Chev / 2003-2007 Astro (w/1" neck).....	299.95
000-078-181	1998-2003 Dodge	69.95
000-078-034	1997-2003 Chev Diesel (frame tank only)	79.95

Miscellaneous Accessories

000-159-016	5 gal. Chemical Jug.....	\$12.95
000-163-031	Professional Trigger Sprayer (6 pack)	52.95
000-163-056	MagnaClean Water Conditioner	399.95
70 to 100 UPG	100 gal. Recovery Tank Upgrade (for Boxxers)	478.00
000-079-076	CDS 4.6 Electric Clutch Option	459.95
000-078-381	CDS Security Hose Pass-Thru	39.95
000-078-382	CDS Security Hose Kit	195.95
000-078-414	Exhaust Thru-Floor Kit	184.95

Hydra-Wear

000-002-007	HydraMaster Monogrammed Jacket	\$64.95
000-002-019	HydraMaster Polo Shirt	41.95

Rotary DriMaster Marketing Literature

000-002-027	Post Card, RDM (200 pack)	\$25.97
000-002-028	Door Hanger, RDM (200 pack)	46.95
000-002-029	Self Mailer, RDM (200 pack)	36.95

Postcards

000-002-005	Reminder Post Cards (100 pack)	13.95
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Part Number**Retail Price****Decals**

000-081-057	"HydraMaster Equipped" 3-Color, 3" x 20" Decal	\$9.95
000-081-058	"Safeclean" Green on White Decal	8.95

Vacuum Tank Filter Bags

000-049-028	Long and Narrow, 7" x 34"	\$7.95
000-049-030	Short and Narrow, 7" x 20"	7.95
000-049-029	Short and Wide, 14" x 18"	7.95

Vacuum Hose Connectors

000-052-166	2" Diameter to 1½" Diameter	\$5.79
000-052-168	2" Diameter	4.79
000-052-162	1½" Diameter to 1½" Diameter	2.89

Vacuum Hose with Cuffs

000-068-136	Orange, 1½" Diameter, 10 foot whip	\$23.95
000-068-194	Gray, 1½" Diameter, 15 Feet	38.95
000-068-331	Gray, 1½" Diameter, 25 Feet	53.95
000-068-036	Gray, 1½" Diameter, 50 Feet	89.95
000-068-047	Orange, 1½" Diameter, 50 Feet	89.95
000-068-316	Blue, 1½" Diameter, 50 Feet	89.95
000-068-048	Orange, 2" Diameter, 50 Feet	109.95
000-068-065	Blue, 2" Diameter, 50 Feet	109.95

SuperFlex HP Solution Line

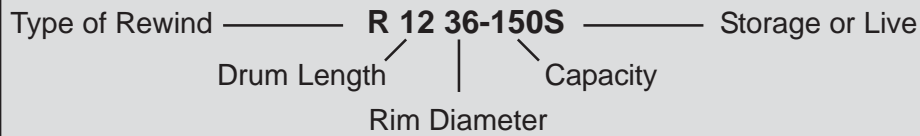
000-068-311	Orange, 25 Feet, M-F	\$86.95
000-068-315	Orange, 25 Feet, F-F	99.95
000-068-054	Orange, 50 Feet, M-F	139.95
000-068-199	Blue, 50 Feet, M-F	139.95
000-068-055	Orange, 50 Feet, F-F	159.95
000-068-198	Blue, 50 Feet, F-F	159.95
000-068-567	Blue, 50 Feet (without QC)	109.95
000-068-208	Blue, 100 Feet, F-F	229.95
000-068-053	Orange, 150 Feet, F-F	310.95
000-068-206	Blue, 150 Feet, F-F	310.95

All prices quoted F.O.B. Factory, Mukilteo, Washington. Prices subject to change without notice.

Hose Reels

Retail Price List

Effective July 1, 2007



Storage Hose Reels



Part No.	Model No.	Capacity	Width	Height	Depth	Retail Price
000-163-501	R1836-200S	200'	25"	38"	36"	\$398.94
000-163-502	R2336-300S	300'	30"	38"	36"	416.67
*000-163-503	R1244-200S	200'	19"	46"	44"	405.59
*000-163-504	R1544-250S	250'	22"	46"	44"	416.66
*000-163-505	R1844-300S	300'	25"	46"	44"	436.62

Storage Hose Reels - Electric Rewind



Part No.	Model No.	Capacity	Width	Height	Depth	Retail Price
000-163-510	E1236-200S	150'	23"	38"	36"	\$1,292.11
000-163-511	E1836-200S	200'	29"	38"	36"	1,303.19
000-163-512	E2336-300S	300'	34"	38"	36"	1,316.49
*000-163-513	E1244-200S	200'	23"	46"	44"	1,316.49
*000-163-514	E1544-250S	250'	26"	46"	44"	1,327.57
*000-163-515	E1844-300S	300'	29"	46"	44"	1,343.09

Live Hub Reels



Part No.	Model No.	Capacity	Width	Height	Depth	Retail Price
*000-163-522	R1244-200L	200'	19"	46"	44"	\$589.54

Live Hub Reels - Electric Rewind



Part No.	Model No.	Capacity	Width	Height	Depth	Retail Price
*000-163-532	E1244-200L	200'	23"	46"	44"	\$1,469.41

* These reels will not fit on a fresh water tank.



Triple Storage Reels for Vacuum, Solution and Garden Hoses - Electric or Manual



<i>Part No.</i>	<i>Model No.</i>	<i>Capacity</i>	<i>Width</i>	<i>Height</i>	<i>Depth</i>	<i>Retail Price</i>
000-163-540	R1836-518S	200'	25"	38"	52"	\$1,041.67
000-163-541	E1836-518S	200'	29"	38"	52"	1,930.50
000-163-542	R2336-518S	300'	30"	38"	52"	1,052.75
000-163-543	E2336-518S	300'	30"	38"	52"	1,968.09
000-163-544	E3036-518S	350'	32"	38"	52"	2,010.05

Triple Live Reels for Vacuum, Solution and Garden Hoses - Electric or Manual



<i>Part No.</i>	<i>Model No.</i>	<i>Capacity</i>	<i>Width</i>	<i>Height</i>	<i>Depth</i>	<i>Retail Price</i>
000-163-550	R1836-518L	200'	25"	38"	52"	\$1,258.86
000-163-551	E1836-518L	200'	29"	38"	52"	2,132.10
000-163-552	R2336-518L	300'	30"	38"	52"	1,278.81
000-163-553	E2336-518L	300'	30"	38"	52"	2,143.17

Storage Reels for Solution or Garden Hoses



<i>Part No.</i>	<i>Model No.</i>	<i>Capacity</i>	<i>Diameter</i>	<i>Width</i>	<i>Retail Price</i>	
000-163-560	605-18S	Storage	300' x 1/4"	18"	5"	\$118.42
000-163-561	605-18L-02	Live - 1/4"	300' x 1/4"	18"	5"	188.38
000-163-562	605-18L-05	Live - 1/2"	200' x 1/2"	18"	5"	210.55
000-163-565	605-22S	Storage	450' x 1/4"	22"	5"	129.16
000-163-566	605-22L-02	Live - 1/4"	450' x 1/4"	22"	5"	192.98
000-163-567	605-22L-05	Live - 1/2"	350' x 1/2"	22"	5"	217.20

Hose Reel Accessories



<i>Part No.</i>	<i>Model No.</i>	<i>Description</i>	<i>Retail Price</i>
000-163-581	82-28	Stacking Bracket for 2 Reels	\$56.00
000-163-582	82-29	Front Stand for 2 Solution Reels	160.08
000-163-583	172A	2" Vacuum Swivel Joint	153.51
000-163-584		12 Volt Electric Motor Rewind Kit	791.22
000-163-585	23-12S	12 Volt Motor	469.86
000-163-586	28-1	Switch	32.27
000-163-587	28-2	Solenoid	58.51
000-163-588	23-11-40	Circuit Breaker	26.27
000-163-589		To Make Portable	234.09
000-163-590		Wall Mount Bracket	37.64

FOB: Daton, NV

Carpet and Fabric Care Products Retail Price List

Effective January 15, 2007

Detergents, Rinse Agents, Bonnet Cleaners, and Presprays

<i>Product</i>	<i>Part Number</i>	<i>Package</i>	<i>Retail Unit Price</i>
Hydra-Dri	950-100-A	12 x 1.5 lb	\$6.97
<i>Powdered Truckmount</i>	950-100-B	4 x 6.5 lb	26.20
<i>Carpet Cleaning Detergent</i>	950-100-C	40 lb	128.80
	950-100-D	300 lb	825.00
Hydra-Clean	950-110-B	4 x 1 gal	\$18.85
<i>Ultra Concentrated</i>	950-110-C	5 gal	84.00
<i>Carpet Cleaning Detergent</i>	950-110-D	30 gal	511.00
	950-110-E	55 gal	783.15
RinseFree Powder	800-101-B	4 x 6.5 lb	\$28.50
<i>Carpet Cleaning Detergent</i>	800-101-C	40 lb	152.00
RinseFree Liquid	800-200-A	12 x 32 oz	\$11.33
<i>Carpet Cleaning Detergent</i>	800-200-B	4 x 1 gal	33.00
Rinse Out	950-140-B	4 x 1 gal	\$17.25
<i>Neutralizing Fiber Rinse</i>	950-140-E	55 gal	590.91
ClearWater Rinse	800-250-A	12 x 32 oz	\$8.83
<i>Low Residue Fiber Rinse</i>	800-250-B	4 x 1 gal	25.90
	800-250-O	55 gal	1,051.56
Zip-Dri	950-150-B	4 x 1 gal	\$25.85
<i>Low Residual Bonnet Cleaner</i>	950-150-E	55 gal	1,130.00
Fast Break	950-130-B	4 x 1 gal	\$28.40
<i>Ultra Concentrated</i>	950-130-C	5 gal	128.00
<i>Carpet Pre-Spray</i>			
Quake	950-125-B	4 x 1 gal	\$14.85
<i>Heavy Duty Pre-Spray</i>	950-125-C	5 gal	64.00
<i>& Traffic Lane Cleaner</i>	950-125-D	30 gal	395.000
	950-125-E	55 gal	684.75
Soil Break	950-120-A	12 x 1.5 lb	\$7.90
<i>Enzyme Carpet Pre-Spray</i>	950-120-B	4 x 6.5 lb	27.60
	950-120-C	40 lb	151.00
	950-120-D	300 lb	1,055.00



Detergents, Rinse Agents, Bonnet Cleaners, and Presprays (cont.)

<i>Product</i>	<i>Part Number</i>	<i>Package</i>	<i>Retail Unit Price</i>
Blitz	950-145-A	12 x 1.5 lb	\$7.75
<i>Heavy Duty Powdered Pre-Spray</i>	950-145-B	4 x 6.5 lb	27.40
	950-145-C	30 lb	111.00
	950-145-D	300 lb	940.00
Poly Break	950-135-B	4 x 1 gal	\$17.70
<i>Olefin Pre-Conditioner</i>	950-135-C	5 gal	75.92
Release	800-400-B	4 x 1 gal	\$19.40
<i>Liquid Traffic Lane</i>	800-400-C	5 gal	86.00
<i>Cleaner & Pre-Spray</i>	800-400-E	55 gal	694.28

Hard Floor Chemicals

<i>Product</i>	<i>Part Number</i>	<i>Package</i>	<i>Retail Unit Price</i>
Q.C.T.	950-155-B	4 x 1 gal	\$18.75
<i>Quarry and Ceramic Tile Cleaner</i>			
Hydra-Solv	950-165-B	4 x 1 gal	\$16.40
<i>Hard Surface Degreaser</i>			

Specialty Products

<i>Product</i>	<i>Part Number</i>	<i>Package</i>	<i>Retail Unit Price</i>
Grease Breaker	950-160-A	12 x 32 oz	\$12.00
<i>High Powered Cleaning Booster</i>	950-160-B	4 x 1 gal	34.00
	950-160-E	55 gal	1,670.00
Enzyme 5	950-170-A	12 x 32 oz	\$9.17
<i>5 Strain Enzyme Additive</i>	950-170-B	4 x 1 gal	24.25
	950-170-E	55 gal	800.00
Repel & Protect	950-185-B	4 x 1 gal	\$53.45
<i>Fluorochemical Protector/Dye Blocker for Carpet and Upholstery</i>			
Hydra Boost	950-175-A	12 x 2 lbs	\$14.67
<i>pH Stable Detergent Booster</i>			
De-Foam	950-177	4 x 8 lbs	\$19.50
<i>Powdered Defoaming Additive</i>			
TM DeScaler	800-800-B	4 x 1 gal	\$21.00
<i>Non-Acid Scale Remover</i>			

Deodorizers

<i>Product</i>	<i>Part Number</i>	<i>Package</i>	<i>Retail Unit Price</i>
MultiPhase	800-500-A	12 x 32 oz	\$7.67
<i>Triple Action</i>	800-500-B	4 x 1 gal	22.25
<i>Odor Neutralizer</i>	800-500-C	5 gal	100.00
	800-500-D	30 gal.	538.00
	800-500-E	55 gal	765.00
U-P-S	800-475-A	12 x 32 oz	\$7.75
<i>Urine Pre-Spray</i>	800-475-B	4 x 1 gal	22.25
	800-475-D	55 gal	745.00
OdorMate BASE	950-210-B	4 x 1 gal	\$15.75
<i>Odor Control System</i>			
OdorMate SCENT	950-200-B	4 x 1 gal	\$31.00
<i>"Tropical Breeze"</i>			

Upholstery Products

<i>Product</i>	<i>Part Number</i>	<i>Package</i>	<i>Retail Unit Price</i>
FabricMaster HEAVY DUTY	950-230-B	4 x 1 gal	\$17.80
<i>Upholstery Pre-Spray</i>			
FabricMaster FINE FABRIC	950-220-B	4 x 1 gal	\$18.00
<i>Upholstery Pre-Spray</i>			
Natural Orange	800-450-B	4 x 1 gal	\$28.50
<i>Carpet and Upholstery Pre-Spray</i>			

Spotting Agents

<i>Product</i>	<i>Part Number</i>	<i>Package</i>	<i>Retail Unit Price</i>
OJ Orange Jel	800-600-A	12 x 1 qt	\$22.00
<i>Clear Gel Solvent Spotter</i>			
Knock Out	950-260-A	6 x 1 qt A& B	\$19.47
<i>Coffee, Wine & Dye</i>		(Part A & Part B are sold as a set)	
<i>Stain Spotter</i>			
Knock Out Mixing Bottle	950-265-A	12 x 1 qt	\$2.40
<i>(12 per case)</i>			
Knock Out Dual Trigger Sprayer	950-266K	Each	\$11.95
<i>(Min order is 50 – price is each)</i>			

Spotting Agents (cont.)

<i>Product</i>	<i>Part Number</i>	<i>Package</i>	<i>Retail Unit Price</i>
Master Spotting Kit	950-290	each	\$197.00
<i>Master Spotting Kit Replacement Items:</i>			
Hydra Freeze	950-300	12 x 5 oz can	\$9.42
Wet Solvent	950-301	12 x 1 pt	7.90
Non-Volatile Dry Solvent	950-302	12 x 1 pt	8.37
Volatile Dry Solvent	950-303	12 x 14 oz can	11.53
Rust Out	950-304	12 x 1 pt	5.79
Ammonia	950-305	12 x 1 pt	6.26
Acetic Acid	950-306	12 x 1 pt	5.21
Enzyme	950-307	12 x 1 pt	6.26
Reducer	950-308	12 x 1 lb	8.37
Neutral Spotter	950-309	12 x 1 pt	6.26
SpotMaster GEL <i>Paint, Oil, Ink & Grease Spotter</i>	950-250-A	12 x 1 qt	\$11.00
SpotMaster CSR <i>Coffee & Stain Remover</i>	950-255-A	12 x 2 lbs	\$16.92
SpotMaster PRO <i>Professional Grade Spotter</i>	950-240-A	12 x 1 qt	\$7.50
SpotMaster Retail Spotter All-Purpose Textile Spotter with Trigger Bottles	950-270	12 x 22 oz	\$7.90
SpotMaster Retail Spotter All-Purpose Textile Spotter with Fliptop Cap	950-280	24 x 8 oz	\$4.16



Terms of the HydraMaster Money-Back Guarantee: Return the unused portion of the HydraMaster cleaning product within 30 days for a full refund of the purchase price. The distributor will submit a copy of the sales receipt to HydraMaster for product replacement.