

## OWNER'S MANUAL



**Congratulations** on your purchase of the **Pro-1200 SE** direct-drive cleaning unit. This instruction and parts manual is a guide for operating and servicing your **Sapphire Scientific** equipment.

Proper operation and service are necessary to ensure the outstanding performance of this unit. When properly maintained, your unit will have a long and trouble-free life.


The following service methods outlined in this manual are detailed in a manner that operation and servicing may be performed properly and safely. Because service levels vary due to the skill of the mechanic, tools and parts availability, ensure that prior to attempting any maintenance or repair, you are familiar with the equipment and have all the proper tools to complete the task. Please call a **Sapphire Scientific** service representative at 866-445-3030 for help with maintenance, repair and warranty related questions.

The headings “**WARNING**” and “**CAUTION**” are utilized to warn you that steps must be taken to prevent personal injury or damage to the equipment. Please make sure that you have read and understand these instructions entirely before proceeding with the operation of this unit.

**THIS UNIT MUST BE INSTALLED BY THE DEALER THAT YOU PURCHASED IT FROM IN ACCORDANCE WITH THE SAPPHIRE SCIENTIFIC INSTALLATION PROCEDURES.**

This unit was manufactured by:

**Sapphire Scientific**  
2604 Liberator  
Prescott, AZ 86301  
USA

 **WARNING!** Do not alter or modify your **Pro-1200 SE** in any way. Use only replacement parts authorized by **Sapphire Scientific**. Modifications or use of unapproved parts could create a hazard and will void your warranty. Contact a **Sapphire Scientific** service representative at 866-445-3030 for assistance.

**Be sure to fill out the warranty card online at: <http://www.sapphirescientific.com>**

This service and operations manual is written specifically for the **Pro-1200 SE** unit.

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**Pro-1200 SE MANUAL**  
**SAPPHIRE SCIENTIFIC P/N 49-139**  
**REVISION B, NOVEMBER 2015**

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## SAPPHIRE SCIENTIFIC LIMITED WARRANTY

### Sapphire Scientific Pro-1200 SE

#### What Does This Warranty Cover?

This warranty covers the Sapphire Scientific Model Pro-1200 SE and is provided to the original purchaser only.

#### How Long Does This Warranty Last?

This warranty runs for:

Three (3) years from the date of installation on parts and labor (Excluding normal maintenance items.) Factory installed original belts are covered for 500 hours. Water box, recovery tank and frame are covered for five years. All other components including seals, o-rings and electrical components are covered for the entire three year warranty period.

#### What Sapphire Scientific Will Do:

If a defect in materials or workmanship occurs within the warranty period, Sapphire Scientific at its election will repair or replace the defective part at no charge.

#### What This Warranty Does Not Cover:

This warranty does not cover or apply to defects due directly or indirectly to misuse, abuse, disassembly, alteration, corrosive chemicals, improper voltage, improper fuel, fire, flood, negligence, accident, improperly or incorrectly performed maintenance or repair, or failure to perform necessary or recommended maintenance or repair (See your Owner's Manual) or if the use of this product is not in compliance with the instructions and specifications for its use. This warranty does not cover normal maintenance items such as air and oil filters, lubricants and tune up parts. Paint is not covered. Water box, recovery tank and frame are covered for five years. All other components including seals, o-rings and electrical components are covered for the entire two year warranty period. We limit all implied warranties to: Three (3) years from the installation date on parts and labor. It is strongly recommended that this truck mount be used with, and only with, Sapphire Scientific Chemicals and as directed by label instructions on chemical bottles.

OTHER THAN THE WARRANTIES PROVIDED HEREIN, SAPPHIRE SCIENTIFIC MAKES NO EXPRESS OR IMPLIED, ORAL OR WRITTEN WARRANTIES WITH RESPECT TO THIS PRODUCT OR WORKMANSHIP AND ALL WARRANTIES IMPLIED BY LAW INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO THE DURATION OF THIS WARRANTY. **Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.** WE SHALL IN NO EVENT BE LIABLE FOR DEATH, INJURIES TO PERSONS OR PROPERTY OR FOR INCIDENTAL, CONTINGENT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING FROM USE OF OUR PRODUCTS. **Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.**

#### How Do I Get Service?

In order to be eligible for service under this warranty you MUST do the following: (a) fill out the warranty registration card on-line within thirty (30) days of the installation of our product; (b) write or call a service representative at Sapphire Scientific for a return material authorization (RMA); and (c) have the serial number available. Proof of proper maintenance may be required before warranty is granted.

#### Contact us at:

Sapphire Scientific

2604 Liberator, Prescott, AZ 86301

Phone: 928-445-3030 / 866-445-3030

If Sapphire Scientific uncovers a defect we will repair or replace the product, at our election. Ground shipping and transportation costs will be covered by the manufacturer. Returning defective parts to the manufacturer, if required, shall be the responsibility of the purchaser. Warranty may be denied if defective parts are not returned within the allotted 30 days. If it is determined that there is no defect in the product, or that the defect resulted from causes not within the scope of our warranty, then the product will be repaired or replaced only at your request and at your expense and you must bear all shipping costs.

#### How Does State Law Apply?

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

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## SECTION ONE: GENERAL INFORMATION

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## CONTACT INFORMATION

For information about unit operation, maintenance or repair of your Sapphire Scientific equipment, please contact your local distributor.

To locate a local distributor, please visit our web site: <http://www.sapphirescientific.com/>

North American Distributors:

[http://www.sapphirescientific.com/SSX\\_DistributorListings\\_NorthAmerica.aspx](http://www.sapphirescientific.com/SSX_DistributorListings_NorthAmerica.aspx)

If you need to contact Sapphire Scientific directly, for questions regarding this manual, service questions that cannot be resolved by your distributor, or other general information, please contact our service department here:

Phone: 1-800-932-3030

Service Email: [service@sapphirescientific.com](mailto:service@sapphirescientific.com)

Please fill in the information below so that you will have it on hand when contacting your distributor or Sapphire Scientific.

**Serial Number:**

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**Date of Purchase:**

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**Purchased From (Distributor):**

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## WARNINGS AND CAUTIONS

### **WARNING**

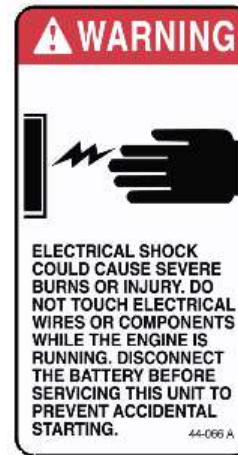
Sapphire Scientific uses this WARNING symbol throughout the manual to warn of the possibility of physical injury or fatality. Please read all warnings carefully before operating the equipment.

### **CAUTION**

Sapphire Scientific uses this CAUTION symbol throughout the manual to warn of the possibility of damage to equipment or personal property.

**FOR YOUR SAFETY**

The following warning labels are on your **Pro-1200 SE** console. These labels point out important **WARNINGS** and **CAUTIONS**, which must be followed at **ALL** times. Failure to follow these warnings could result in injury or fatality to yourself and/or others or property damage. Please follow these instructions carefully! **Do NOT** remove these decals.



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





 **WARNING**

1. **Read the operator's manual before starting this unit.**

Failure to adhere to instructions could result in severe personal injury or could be fatal.

 **WARNING**

2. **Operate your vehicle and equipment in a well-ventilated area.**

Exhaust fumes contain carbon monoxide, which is an odorless and deadly poison that can cause severe injury or death. **DO NOT** run the vehicle in an enclosed area. **DO NOT** operate this unit where the vehicle exhaust may enter a building doorway, window, vent or other opening.



 **WARNING**

3. **DO NOT** place hands, feet, hair, clothing or any body parts near rotating or moving parts. Rotating machinery can cause severe injury or death.

 **WARNING**

4. **NEVER** operate this unit without belt and safety guards. High speed moving parts, such as belts and pulleys should be avoided while the unit is running. Severe injury, fatality and/or damage may result.

 **WARNING**

5. **NEVER** service a unit while it is running. High speed mechanical parts as well as high temperature components and fluids may result in severe injury or fatality.

 **WARNING**

6. Vacuum pump and heat exchanger components, hoses and fittings will be extremely hot from operation. To prevent severe burns, **DO NOT** touch these areas while the unit is running, or shortly after the unit is shut off.

 **WARNING**

7. **Water under pressure can cause severe personal injury or fatality.** Shut down unit, allow to cool down, and relieve system of all pressure before removing caps, valves, plugs, fittings, filters or hardware.

## SECTION ONE – GENERAL INFORMATION

### **WARNING**

8. **DO NOT** smoke around the vehicle. Gas fumes could accumulate and ignite. Battery gasses are extremely flammable. This will prevent possible explosions.

### **WARNING**

9. All high-pressure hoses must be rated at 250° F and 3000 PSI. Severe injuries may result from improper hoses.

### **WARNING**

10. The Occupational 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 at a distance of 10 feet. Please check with your local state agencies to see if OSHA standards apply to your application.

### **WARNING**

11. This unit produces high solution pressure. Improper use could result in injury.

 **CAUTION**

12. **DO NOT** damage the vehicle in any way during the installation. Avoid component or hose contact with moving parts, hot surfaces, brake lines, fuel lines, catalytic converters, exhaust pipes, mufflers, rotating parts or sharp objects.

 **CAUTION**

13. **DO NOT** exceed the vehicle's payload capacity. This will prevent unsafe or hazardous driving conditions. Before installing any components into the vehicle, check with the vehicle manufacturer for the Gross Vehicle Weight Rating (GVWR). GVWR is the maximum allowable combined weight of the vehicle, including all passengers, fuel, fluids, tools and cargo.

**Example:** If the GVWR for a vehicle is 9600 lbs. and the vehicle has a base curb weight of 6406 lbs., this leaves a payload capacity of 3194 lbs. (GVWR - Curb Weight = Payload Capacity).

 **CAUTION**

14. Always keep your vehicle clean and orderly. Tools and accessories must be securely stowed while driving the vehicle.

 **CAUTION**

15. Ensure that you have received proper training and are familiar with the start-up and shut-down procedures prior to operation.

 **CAUTION**

16. **DO NOT** alter or modify your **Pro-1200 SE** in any way. Use only replacement parts authorized by **Sapphire Scientific**. Modifications or use of unapproved parts could create a hazard and will void your warranty. Contact a **Sapphire Scientific** service representative at 866-445-3030 for assistance. This includes the use of any open ended hoses.

 **CAUTION**

17. Failure to apply preventative measures towards freezing can result in system failure and loss of warranty on affected parts. Water freezes at 32° F and 0° C.

## **SPECIFICATIONS**

Vehicle Engine Speed	1300-1500 RPM (High Speed/No Load)
	1100-1300 RPM (Med Speed/No Load)
	900-1100 RPM (Low Speed/No Load)
Water Pump (High Speed)	1585 RPM @ 1400 Engine RPM
Water Pump Flow Rate (High Speed)	5.0 GPM
Water Pump Pressure (Max)	1200 PSI
Vacuum Pump (High Speed)	3450 RPM @ 1400 Engine RPM
Vacuum Pump (Med Speed)	2955 RPM @ 1400 Engine RPM
Vacuum Pump (Low Speed)	2463 RPM @ 1400 Engine RPM
Vacuum Relief Valve	13 in. Hg
Waste Tank Capacity at Shut-Off	84 gallons
Waste Tank Gross Capacity	100 gallons
Console/Tank Weight (empty)	700 lbs.
Console/Tank Weight (full waste tank)	1401 lbs.

## **TORQUE VALUES**

Pulley Hub (At drive shaft end)	15 ft./lbs. (180 in./lbs.)
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## **JET SIZING**

Sapphire Scientific recommends that the total floor tool tip size be #4 or #6
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## INSTALLATION REQUIREMENTS

Prior to the installation of the unit, the vehicle that it will be installed in should be delivered to the installer. It is the purchaser's responsibility to ensure that the vehicle meets or exceeds payload capacity for all equipment being installed.

The Pro-1200 SE Direct Drive unit weighs approximately 1400 lbs. with a full waste tank. If a water pond is being installed, an additional 1100 lbs. needs to be included. Every accessory added will add weight.

Please adhere to the following recommendations prior to installing the unit:

1. It is NOT recommended that this unit be installed in any motor vehicle with a payload capacity less than 3000 lbs. To calculate the payload capacity, subtract the vehicle's base curb weight from its Gross Vehicle Weight Rating (GVWR). (GVWR - Curb Weight = Payload Capacity)
2. The combined weight of all equipment (including all fresh and/or waste water, tools and accessories) must NOT exceed the vehicle's payload capacity.
3. Sapphire Scientific does not recommend using any type of flooring materials that absorb water. This condition will result in rust and corrosion of the vehicle floor.
4. Insulation under rubber mats should be removed prior to installation of unit.

## RESPONSIBILITIES

### TRAINING

1. The dealer you purchased your unit from is responsible for training you in the operation, maintenance and safety precautions of your Pro-1200 SE unit.
2. It is the purchaser's responsibility to become familiar with the entire Owner's Manual, most importantly all Warnings, Cautions and Notices.
3. It is the purchaser's responsibility to review all warranty information.

### INSTALLATION

1. The installer is responsible for correctly installing and properly securing equipment with proper hardware and underside mounting plates.
2. Check the components and oil levels prior to starting the unit.
3. Check that all components are operating at the factory specification.
4. Check all hoses and accessories for correct operation.
5. Check all tools/wands for correct operation.

## RECEIVING YOUR PRO-1200 SE SYSTEM

### ACCEPTANCE OF SHIPMENT

Your Pro-1200 SE system was thoroughly tested, checked and inspected in its entirety prior to leaving our manufacturing facility. When receiving your unit, please make the following acceptance check:

1. The unit should not show any signs of damage. If there is damage, notify the deliverer immediately.
2. Carefully check your equipment. The Pro-1200 SE system should arrive with the following items as well as any additional optional accessories you may have ordered:

### EQUIPMENT LISTING

- Pro-1200 SE Console
- Pro-1200 SE Sub-Mount Waste Tank
- 5 Gallon Chemical Tank
- Center Console Assembly
- Drive Shaft and Front End Kit
- Angle, Tank Locator
- Drive Shaft Rear Pulley, Hub & Belts
- Floor Hose Manifold
- Install Kit
- Tube of Mystik® JT-6® No. 2 Grease
- Right-Angle Grease Coupler
- 100' of 2" Vacuum Hose
- 100' of 1/4" Solution Hose
- 50' of 1/2" Water Hose
- Low Profile 12" Wide Wand

## SECTION TWO: OPERATION

### UNDERSTANDING THE SYSTEMS

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## UNDERSTANDING THE SYSTEMS

**NOTE: Read and understand this section of the manual entirely before proceeding.**

This portion of the manual divides the unit up into systems and describes how each system works. Prior to proceeding into the operations and maintenance sections of this manual it is recommended that you acquire a basic understanding of how the unit functions.

### **WATER HEATING SYSTEM**

Water from the supply source (building hose bib or van fresh water tank with demand pump) enters the console through the water inlet connection located on the upper right corner of the lower front panel.

The water flows through a “Y” strainer and inlet pressure regulator, directly to the inlet side of the water pump where it is pressurized. From here it flows through the coolant heat exchanger collecting the first stage of heat from the van engine.

The water is routed through the vacuum heat exchanger where it is further heated by the vacuum pump exhaust air passing over approximately 60 feet of finned tubing.

The hot water then flows through the solution outlet manifold that contains a strainer and check valve. The chemical injection takes place inside the manifold.

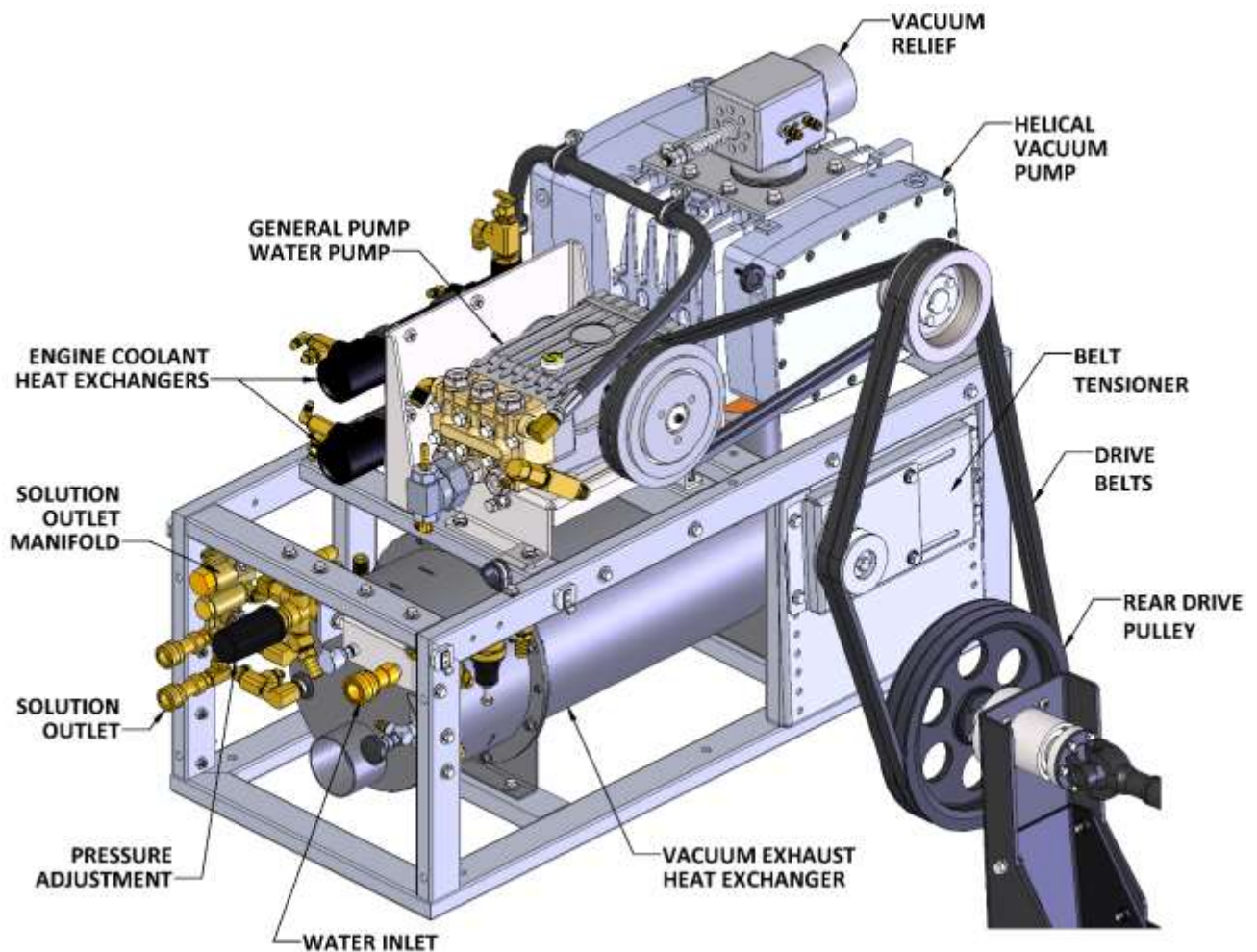
The mixture of hot water and chemical then flows through the outlet of the manifold to the cleaning tool.



The Pro-1200 SE uses coolant from the engine radiator. Be sure to inspect engine coolant levels regularly to maintain a full reservoir.



## WATER HEATING SYSTEM DIAGRAM



### **WATER REQUIREMENTS**

Because hard water deposits will damage the plumbing and heat exchange systems on this unit, Sapphire Scientific recommends that a high quality water softener be used in areas where the water hardness exceeds 3-1/2 grains. If a water softener is used, it must have a flow capacity of at least 5 GPM or greater, without any hose constrictions.

## **VACUUM SYSTEM**

The van engine through an electric clutch and driveshaft turns the vacuum pump generating the vacuum. The air is channeled into the top of the vacuum pump, compressed and discharged out the opposite end, creating airflow. This airflow is used to do the work necessary for the extraction process.

Vacuum ports on the tool being used, applied to the surface being cleaned, removes moisture, dirt and spent chemicals. These elements are drawn back to the waste tank utilizing hoses and the force of air. Particles of moisture and dirt are separated in the waste tank using a series of changes in direction and velocity. The air is then filtered and rushes into the vacuum pump inlet.

The vacuum pump is also compressing the air drawn through it. Heat is generated as the air is compressed. The hot discharge air goes through the vacuum heat exchanger and is discharged from the console exhaust tube.

The vacuum pump speed is factory set to maximize vacuum pressure and provide sustained system life.



Do not alter the vacuum speed outside the recommended range shown in this manual. Doing so can result in severe damage to the unit and voidance of warranty.

A level shut-off sensor (float switch) is located behind the console in the waste tank tower and will shut down the unit before the tank is at full capacity. This protects the vacuum pump from water damage.



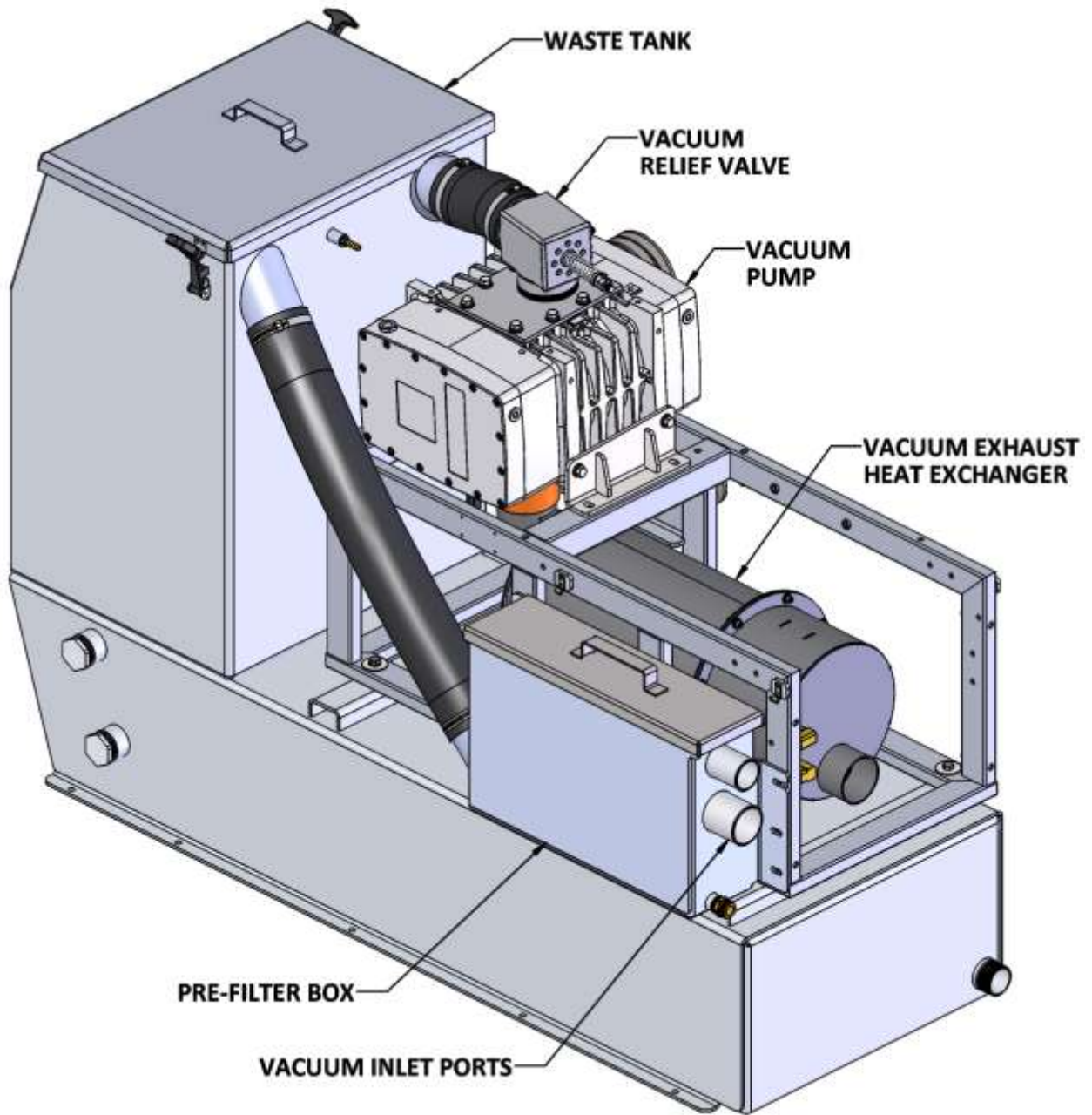
Waste tank level shut-off will not detect high foam levels. Foam entering the vacuum pump can cause damage to the unit. The use of a quality defoamer is recommended.

A green indicator lamp will illuminate to alert the operator when the tank is full, the unit will shut down and the waste water needs to be disposed of before the operation can continue.

**IN ACCORDANCE WITH EPA, STATE AND LOCAL LAWS, DO NOT DISPOSE OF WASTE WATER INTO GUTTERS, STORM DRAINS, STREAMS, RESERVOIRS OR ANY NON-COMPLIANT RECEPTICLE.**

Always check local laws and regulations regarding “gray” water disposal. The penalties for non-compliance can be serious.

### VACUUM SYSTEM DIAGRAM

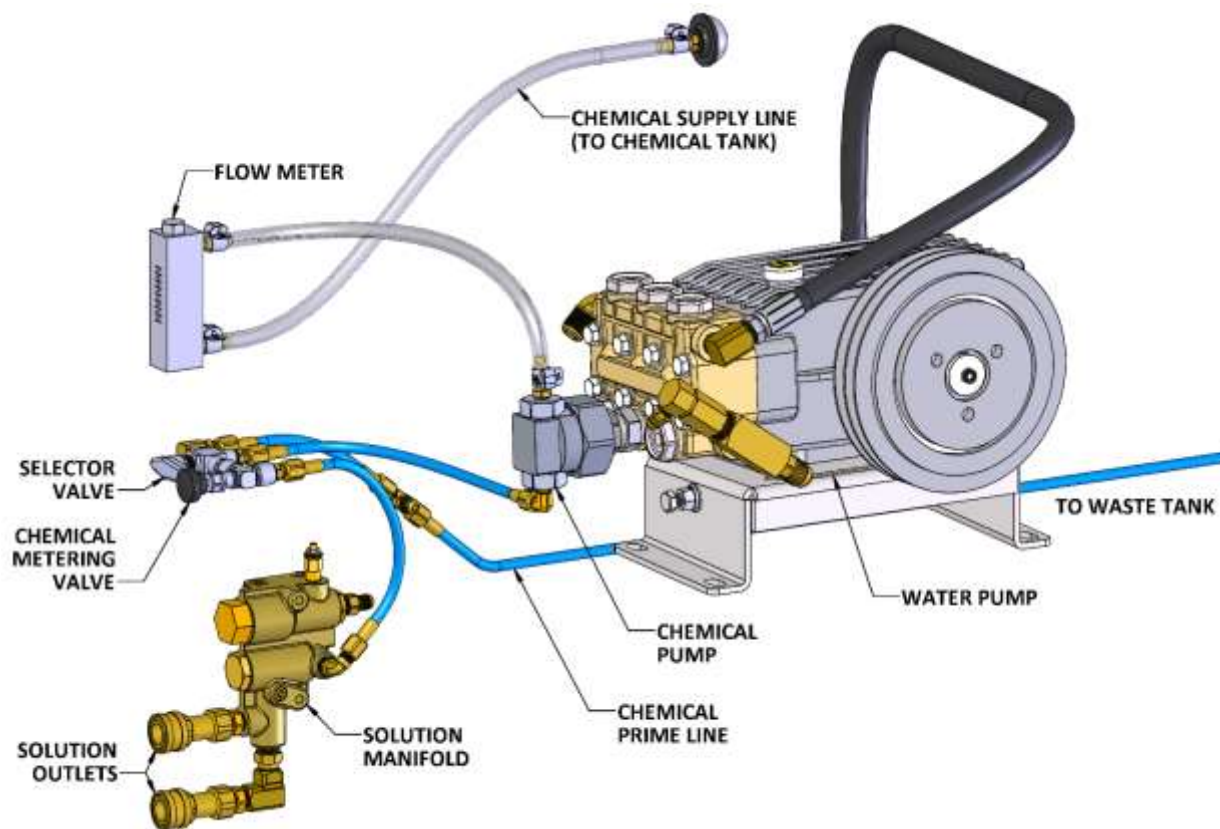


## **CHEMICAL SYSTEM**

The chemicals are drawn from the chemical container through a strainer into the flow meter mounted on the control panel. The flow meter indicates the rate of chemical flow in gallons per hour.

The chemicals then flow through the stainless steel chemical pump. The chemical is injected into a three-way selector valve located on the front panel. This valve may be used to turn the chemical flow ON, OFF or to PRIME the chemical pump.

When in the ON position, the chemicals then flow through the chemical metering valve to the solution outlet. This valve controls the rate of flow to chemical into the cleaning solution, which is indicated on the flow meter.




## **CHEMICAL REQUIREMENTS**

The Sapphire Scientific Pro-1200 SE Direct-Drive unit's unique last step chemical injection system can be used with a variety of water diluted chemical compounds, either acidic or alkaline, depending on the work to be performed. We recommend only using Chemspec brand of chemistry.

## PREPARATION AND OPERATION

This section of the operator's manual explains how to prepare, start, operate, shut down and maintain your **Pro-1200 SE** direct-drive cleaning unit. The **Pro-1200 SE** unit is easy to operate, however only trained operators should proceed.

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

### VEHICLE PREPARATION

#### **ENSURE THERE IS ADEQUATE FUEL**

Check the fuel tank to ensure there is adequate fuel to complete the job and transport the vehicle. This unit consumes approximately 2 US gallons of fuel per hour, depending on the speed setting.

#### **CHECK VEHICLE SETTINGS**

Park the vehicle in a well-ventilated area, place automatic transmission in Park and set the emergency brake. **Make sure the heat and AC on the van are set to the OFF position.**

#### **VEHICLE WILL BE RUNNING**

The vehicle must remain running and the accelerator and brake cannot be tampered with. If the vehicle is to be left unattended, the doors should be locked and the hoses run through a security access door.

#### **REMOVE TOOLS FROM THE VEHICLE**

Remove any tools, accessories or hoses from the vehicle that you will require.

 **CAUTION**

Do not park the vehicle on a lawn or close to shrubs, as heat from exhaust or water overflow may cause damage.

 **CAUTION**

Do not allow vacuum or solution hoses to rest against vehicle exhaust pipe. This can result in damage.

 **CAUTION**

Do not operate machine with covers or guards removed.

## **UNIT PREPARATION**

### **WATER SUPPLY CONNECTION**

**NOTE:** Prior to connecting your water inlet hose to any supply faucet, flush out the faucet until the water is free of any debris. Also, flush out any debris from your water inlet hose.

1. Connect the hose to the water supply faucet and flush out any debris from the faucet and hose.
2. Connect the hose to the water inlet fitting on the front of the unit. Activate the valve on the water inlet to an open position.
3. Turn the water supply faucet on.

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

### **CHECK YOUR DRAIN VALVES**

Make sure the waste tank and pre-filter box drains are closed.

### **CONNECT SOLUTION HOSES**

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

### **CHECK YOUR CHEMICAL LEVELS**

Check the chemical jug to make sure you have enough chemical mixed to finish the job. The hot water valve on the lower front panel is intended to be used to add water to the chemical jug when the unit is running.

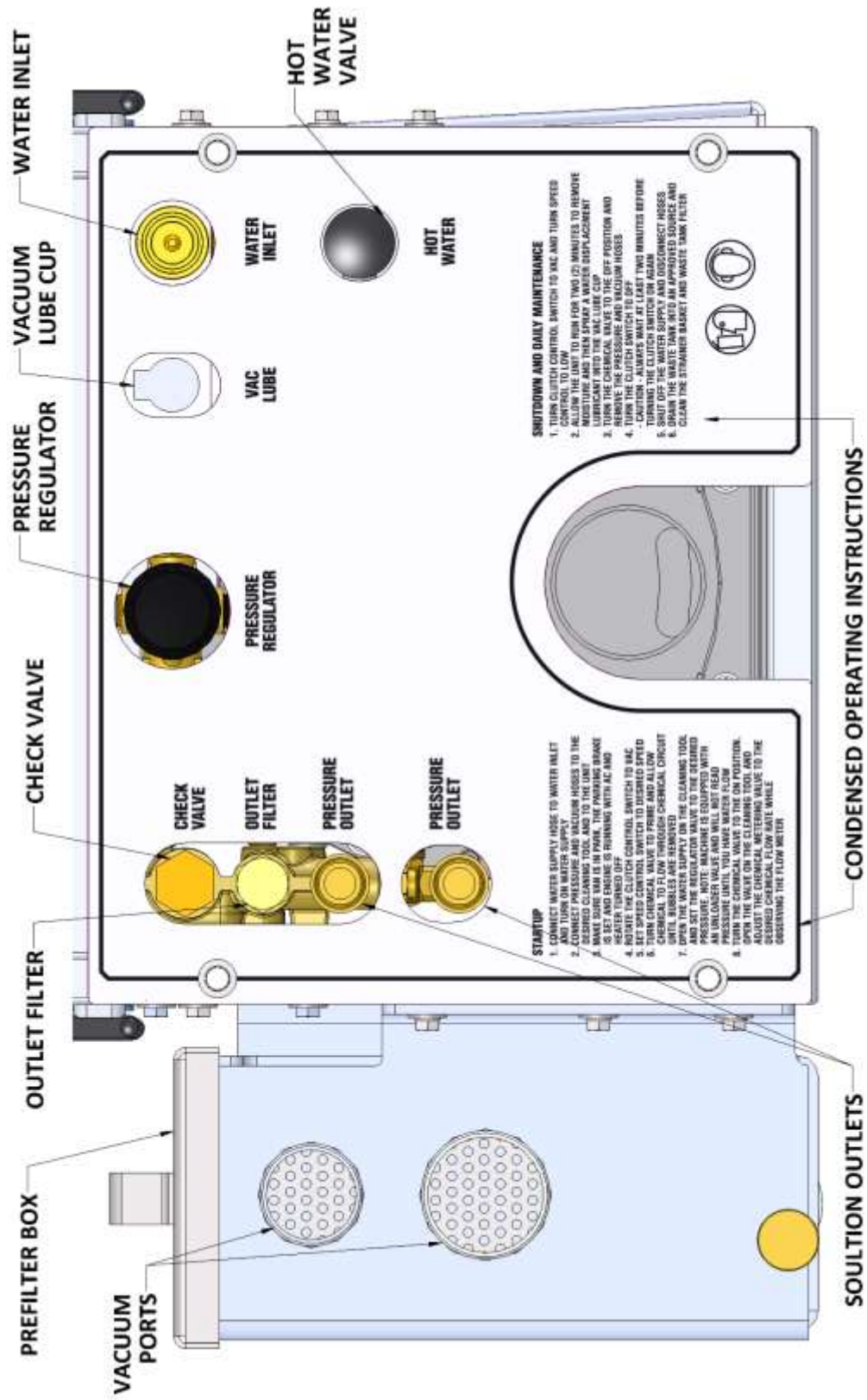
### **CHECK FILTERS**

Inspect the vacuum inlet filter and strainer basket in the waste tank. Inspect the strainer basket inside the pre-filter box. See the Shut Down and Daily Maintenance section below for more information.

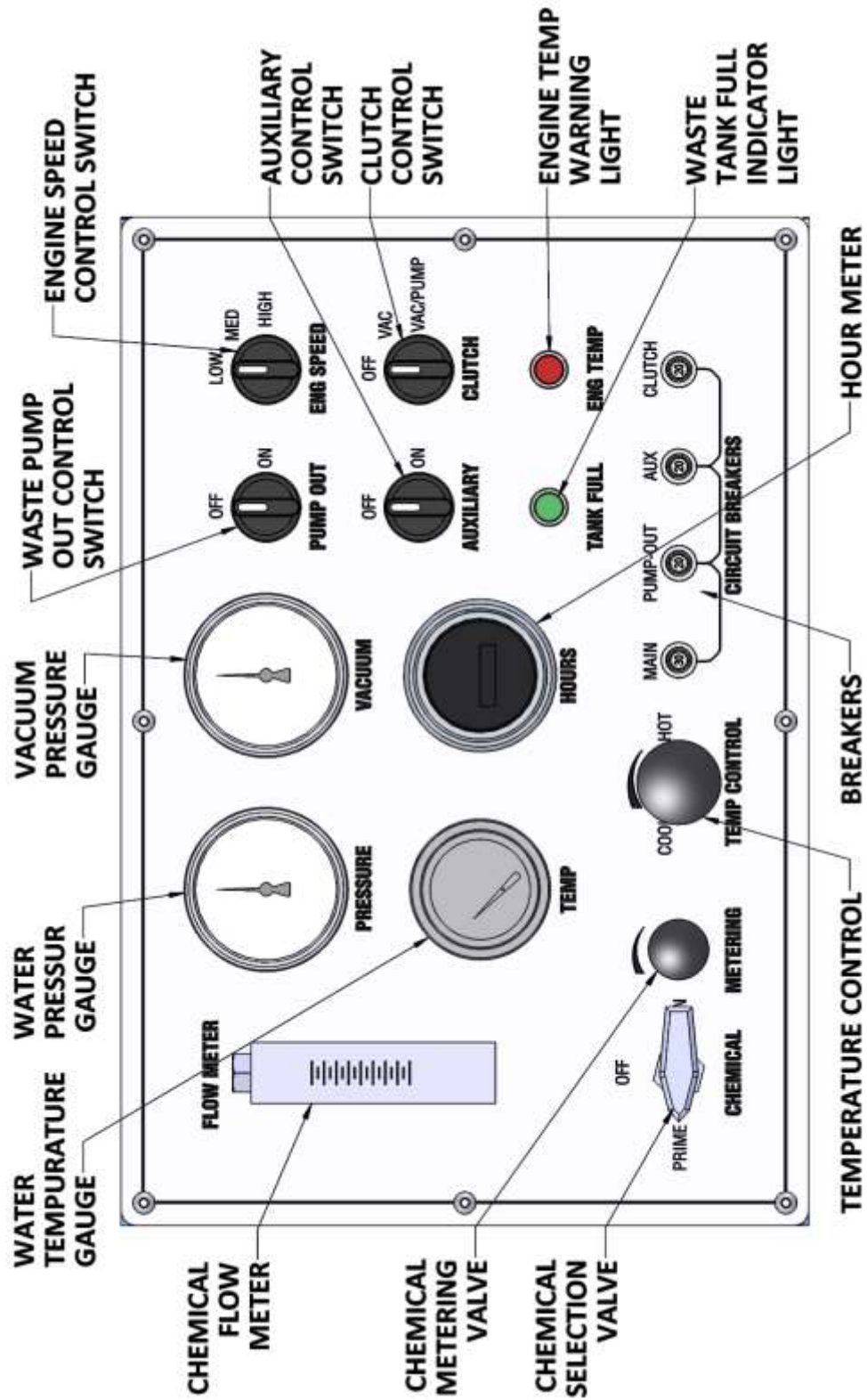


**NEVER** operate the unit with the waste tank air filter removed, damaged or not properly installed.

LOWER FRONT PANEL AND PREFILTER BOX



INSTRUMENT PANEL





## **STARTING THE UNIT**

1. Make sure van is in Park, parking brake is set and heater and A/C are off. The accelerator pedal or brake pedal cannot be engaged. Start the vehicle.
2. The engine must be running and idling at the low RPM setting.
3. The vehicle cannot sense motion.
4. Make sure the pressure hoses are connected properly and valves are open or closed as needed.
5. Connect the vacuum hose(s) to the vacuum inlet connection(s) on the pre-filter box. Connect the opposite end of the vacuum hose(s) to the desired tool(s).
6. Set the **clutch control switch** to the desired operation. Use the vacuum position for water recovery only or the pressure/vacuum position for cleaning operations.
7. Set the **engine speed control switch** to the desired operating speed.

**NOTE:** Water is under pressure, be sure that hoses are secured before turning the pump on.

8. Depress the cleaning tool trigger and observe the water pressure gauge reading. Set pressure to 450 PSI or as needed for the job being performed. To adjust the pressure, turn the unloader handle clockwise to increase pressure and counterclockwise to decrease pressure.

**NOTE:** If the unit does not build water pressure after 5 seconds, check for adequate water supply. See the troubleshooting section of this manual for more information.

9. Depress the cleaning tool trigger and read the face panel temperature gauge. Set the output water temperature by adjusting the temperature control valve which is located on the instrument panel. When the valve is closed, the temperature will be at maximum. Open the valve to reduce temperature.

**NOTE:** Let the unit run for a few minutes with the vacuum inlets partially blocked off to warm up the cleaning solution.

## **PRIMING THE CHEMICAL PUMP**

**NOTE:** **SAPPHIRE SCIENTIFIC** recommends that the chemical pump be primed whenever the water pump is turned on. This eliminates possible pressure fluctuations and damage to the chemical pump.

1. Turn the chemical selector valve located on the instrument panel to the **PRIME** position. The chemical will then flow from the chemical container through the chemical prime tube into the vacuum system.
2. Momentarily obstruct the vacuum port to create a load.



**To reduce the risk of injury: NEVER obstruct a vacuum port with your hand or other body part. Keep hair, loose clothing and all body parts away from vacuum port openings while unit is in operation.**

3. When the chemical flows with no air bubbles, priming has been achieved.
4. Turn the chemical selector valve from **PRIME** to **ON**.
5. With the cleaning tool open, check the flow meter and adjust the chemical metering valve until the desired rate of chemical flow is achieved.

**NOTE:** When inserting the chemical tube into the chemical container, ensure that it stays submerged, as the chemical pump will not function if air is allowed to enter the inlet line.

## **CHEMICALS**

### **CARPET CLEANING**

Always use a good quality emulsifier which is recommended for use in truck mount equipment. Mix emulsifier thoroughly in accordance with the manufacturer's recommendations.

**NOTE:** Combining two or more chemicals, inadequately dissolving powders or using inferior quality materials can cause sediment to build and clog your equipment. Serious damage can result from using improper chemicals or mixtures.

### **UPHOLSTERY CLEANING**

Use only chemicals recommended for wet cleaning of upholstery fabrics.

## **AUTOMATIC WASTE PUMP**

If your unit is equipped with an **optional** automatic waste pump:

1. Connect one end of the 5/8 in. or larger garden hose to the pump-out connection and the other end to an acceptable waste disposal.
2. Turn the pump-out switch located on the front console control panel to the **ON** position. The waste pump will now operate automatically throughout the cleaning period.

**DO NOT** use an outlet hose that is smaller than 5/8" I.D.

**NEVER** use a waste pump hose as a water inlet hose.



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

## **OPERATION**

After you have completed the previous steps, proceed with the cleaning or restoration operation. Set the engine control speed to the desired position for the job. A float shut-off switch is located inside of the waste tank. It will automatically shut down the unit if the tank reaches its full capacity. If this occurs, empty the waste tank before continuing. When doing water extraction, the clutch control switch should be set to the VAC position.

## **CARPET CLEANING**

While cleaning, please observe the following guidelines:

1. Before cleaning, ensure that wand nozzles are functioning properly.
  - a. Hold the wand approximately one foot above the surface to be cleaned and open the wand valve. A full, even spray should emit from the cleaning nozzles.
  - b. If the nozzles are not showing a full, even spray pattern, adjust, clean or replace the nozzles as required.
2. Usually chemical solution is applied during the push stroke of the wand during cleaning, and extraction is done on the pull stroke. For heavily soiled carpets, the wand may be used in a scrubbing action, with chemical solution applied in both strokes, provided that the final stroke is a pull stroke with no chemical injection.



Do not leave wand with suction head against the carpet when not in use. Turn the wand on its side when leaving unattended.

## **UPHOLSTERY AND STAIR TOOL CLEANING**

When cleaning upholstery, run the unit on low speed. Upholstery tools have a lower flow rate and smaller orifices. Only use chemicals recommended for wet cleaning of upholstery fabrics. Consult the factory for specific instructions.

## **FLOOD RESTORATION/EXTRACTION**

1. Set the engine speed control switch to **HIGH** on the instrument panel. Make certain that the clutch control switch is set to **VAC** for VACUUM ONLY. This disengages the water pump clutch to prevent pump damage. Proceed into the extraction process.



**NEVER** set the clutch control switch to VAC/PUMP without the water inlet being hooked up and open to a continuous water supply. Running the water pump dry will damage the pump.

2. Connect the vacuum hose directly to the pre-filter box vacuum port. Do not use an active live vacuum hose reel or excessive vacuum loss will occur.
3. Drain recovery tank as needed. Return machine to normal settings when done.

## **DUAL WAND OPERATION**

The direct drive Pro-1200 SE has sufficient capacity for dual wand operation with minimal pressure loss at each wand. The pump pressure and temperature can remain at the same levels as for single wand operation. The chemical flow rate may be set slightly higher than for single wand operation.

Always use the **LOWEST** flow rate that properly cleans the affected areas. Excessive chemicals can cause damage to the items being cleaned.

## **GAUGE READINGS AND SETTINGS**

### **VACUUM GAUGE**

The vacuum gauge should read near zero with vacuum hoses disconnected from the pre-filter box. If the gauge shows a reading, check the filter in the waste tank and the strainer baskets in both the waste tank and pre-filter box for debris. With vacuum ports sealed, and machine running at high speed, the vacuum gauge should read 11 to 13 inches of mercury (in. Hg). This is preset by the factory for the maximum safe operation.



DO NOT exceed 13 in. Hg vacuum pressure. This can cause damage to the drive clutch.

### **TEMPERATURE GAUGE**

The low speed setting is for upholstery and delicate cleaning. Set the machine to medium speed for single wand operation. The high speed setting is for dual wand operation or the use of a powered cleaning tool, such as the Sapphire Scientific HOSS. If a lower temperature is desired, open the temperature control valve on the instrument panel until the desired temperature is obtained. The highest temperatures will be achieved with the valve closed.

### **WATER PRESSURE GAUGE**

Water pressure is set by adjusting the unloader valve for the desired water pressure. Normal settings are as follows:

- 200 PSI for upholstery cleaning
- 450 PSI for carpet cleaning
- UP TO 1200 PSI maximum

If an upholstery tool is designed for truck mount operation, the pressure for upholstery cleaning can be set at the same level as for carpet cleaning.

### **HOURLY METER**

The hour meter records the operating time of the machine. This information is used to calculate the water pump and vacuum pump oil change intervals as well as machine maintenance periods.

### **FLOW METER**

The flow meter reads the flow rate from the chemical jug while the chemical is being drawn. The chemical adjustment should normally be set at 1 or 2 GPH for a normal job and at 2 or 3 GPH for an extremely dirty job.

**NOTE:** The setting is also dependent on the type of chemical used and the concentration ratio of chemical to water.

Always use the LOWEST flow rate that properly cleans the affected areas. Excessive chemicals can cause damage to the items being cleaned.

## **SHUT DOWN AND DAILY MAINTENANCE**

### **CAUTION**

When you turn your machine off, the electronic throttle control does not immediately turn off. It will continue to slowly idle the engine down to standard idle. Once the vehicle engine has reached the target idle speed, the throttle control module will hand back engine speed control to the vehicle computer. Interrupting this change-over by not obeying the following can trigger the check engine light or engine shut down.

1. Turn the clutch control switch to the **VAC** position for vacuum only.
2. Trigger the cleaning tool to relieve pressure on the hoses, then remove as much moisture from the vacuum hoses as possible. This will prevent spillage of waste water in your vehicle when returning hoses.
3. Disconnect the vacuum hoses from the unit, leaving the vacuum port(s) open.
4. Set engine speed control switch to the **LOW** position and allow idle to drop.
5. Turn the chemical selector valve to the **OFF** position. Flush out the chemical system with fresh water to remove any chemical residue.
6. Turn the clutch control switch to the **VAC** position.
7. Allow the unit to run for at least 3 minutes. This will also help to remove any excess moisture from the vacuum pump and cool the unit down.

**NOTE: If shutting down for the day** – plug the vacuum inlet and set the engine speed control switch to HIGH. Spray a water displacement/lubricant into the vacuum lubrication cup located on the lower front panel for 10 seconds.

8. Ensure that all appropriate switches are in the **OFF** position. This will prevent a drain on the battery.
9. Turn off the water supply. Loosen the water supply hose at the water supply to bleed off any pressure, then disconnect the water hose from the water inlet fitting.
10. Activate valves on all cleaning tools to relieve any remaining pressure. Disconnect the cleaning tools from the solution hoses and return them to the vehicle.

### **CAUTION**

Wait 2 minutes before doing any of the following:

- Shifting the vehicle out of Park.
- Turning the vehicle engine off.
- Pressing the accelerator pedal.

11. Make sure the waste tank is drained into an approved source.

### **WARNING**

**NEVER** dispose of wastewater in a storm drain, water way or on ground areas. Always dispose of waste in accordance with Local, State, and Federal laws.

## SECTION TWO – OPERATION

12. Remove the strainer baskets from the filter boxes and clean thoroughly before replacing.
13. Check the waste tank filter for debris.

**NOTE:** To remove the vacuum inlet filter, grip the plastic hexagon section of the filter. Gripping the filter by the screen will collapse or destroy the filter. After cleaning, grease the threads on the filter and replace the filter. Tighten the filter until hand tight and then loosen  $\frac{1}{4}$  turn. This will make the filter easier to remove when cleaning or replacement is required.



NEVER operate this unit with the filter removed, damaged or improperly installed.

At the end of the work day, rinse out the waste tank with fresh water.

Clean the vehicle interior, unit, tools, hoses etc., as needed. Inspect **ALL** equipment and accessories for any damage, leaks, wear, etc.

### **AUTOMATIC SHUT DOWNS**

There are two reasons the unit will automatically shut down:

1. When the waste tank is full, the machine will shut down and a green indicator light will illuminate on the instrument panel. If this happens, turn the clutch control switch to the OFF position and empty the waste tank into an approved source to resume operation.
2. A red high temperature light will illuminate along with machine shut down if the engine coolant temperature reaches 240 degrees.



## FREEZE PROTECTION



If the unit is exposed to freezing weather conditions, the water inside of the unit may freeze, resulting in **SERIOUS DAMAGE** to the unit. Water freezes at 32° F and 0° C. The following is recommended to prevent this from occurring during the cold weather season:

1. If possible, park the unit in a heated building when not in use.
2. While out in operation, avoid long periods of shut down as the unit generates heat while running. Keep the unit running just prior to leaving for the next job.
3. If a heated building is not available, winterize the unit with antifreeze.

### **WINTERIZING YOUR UNIT WITH ANTIFREEZE:**

1. Shut off the water supply to the unit and disconnect the water inlet hose from the unit.
2. Connect all solution hoses and a tool to the unit.
3. Attach a hose to the water inlet and into the antifreeze source.
4. Start the unit with the engine speed control switch in the LOW position and the clutch control switch in the **VAC/PUMP** position.
5. Open a valve on the connected tool until antifreeze comes out of the tool. Repeat with all remaining tools and hoses.
6. After the tools and solution hoses have been filled with antifreeze, disconnect and store them.

**NOTE:** Recover all antifreeze that comes out of the tools and hoses. ALWAYS re-use or recycle antifreeze.

**NOTE:** Remove as much water as possible from the hoses before storing in cold winter. If needed, use air to blow out any remaining water.

7. Prime the chemical injection system with 100% glycol based antifreeze. Insert the chemical inlet tube into the antifreeze container. Turn the chemical valve to **PRIME** until antifreeze is observed for 5 seconds in the flow meter. Turn the chemical valve to **ON**. Ensure that the flow meter indicates flow while the attached tools solution valves are open. After 25 seconds, turn the chemical valve to the **OFF** position.

## **REMOVING ANTIFREEZE FROM THE UNIT:**

1. Connect a water hose to the water supply and flush out any debris from the faucet and hose. Connect to water supply inlet. Turn on the water supply.
2. Connect a pressure hose to the solution outlet and make sure the valve is in the open position.
3. Connect the hose to a tool.
4. Start the unit with the engine speed in the **LOW** position.
5. Submerge the chemical hose into fresh water. Turn the chemical valve to the **PRIME** position until the water runs clear through the flow meter.
6. Set the chemical selection valve to **ON**. Turn the clutch control switch to the **VAC/PUMP** position. Open the tool valve to release the antifreeze from the unit into an approved container.

After all of the anti-freeze has been removed, the unit is ready to operate.

The anti-freeze in your approved storage container will eventually become diluted with water. When the anti-freeze level drops below 70% of the total mixture, properly dispose of it and start over with fresh 100% anti-freeze.

**NOTE: Be sure to remove antifreeze from ALL your tools and hoses as necessary.**



**DO NOT** drain used anti-freeze on the ground or into storm drains. Dispose of anti-freeze only in an approved location. Observe Local, State and Federal laws when disposing of antifreeze.

## SECTION THREE: SERVICE AND MAINTENANCE

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## PRO-1200 SE MAINTENANCE CHART

### DAILY MAINTENANCE

Vacuum Pump	Check vacuum pump oil level. Fill to proper level. Do not overfill. (1)
Vacuum Pump	Spray WD-40 (or Equivalent) into the lubrication cup for 10 seconds.
Water Pump	Check water pump oil level. (2) Fill to proper level.
Vacuum Inlet Filter	Inspect filter, clean and or replace if required. (1)
Strainer Baskets	Empty and clean stainless steel baskets in the waste tank and pre-filter box.
Vacuum Hoses	Rinse with fresh water.
Waste Pump-Out	Inspect and remove any debris or sediment. (1)
Engine Oil	Check oil level in vehicle, fill as needed.

### WEEKLY MAINTENANCE

Float Switch(es)	Clean and inspect float switch(es) in the waste tank.
Chemical System	Flush chemical system with 50/50 water and vinegar solution.
Visual Inspection	Check for leaks around the unit and vehicle.

### MONTHLY MAINTENANCE

Wye Strainer	Clean and remove any debris. (1, 3)
Inlet Pressure Regulator	Clean and remove any debris. (1, 3)
Engine Air Cleaner	Check vehicle engine air cleaner. Clean or replace as necessary.
Battery Terminals	Check vehicle battery terminals. Clean as needed.
Wiring Harness	Check wiring throughout for signs of chafing or wear.
Check fasteners	Check fastener tightness on all components. Tighten as needed.
Engine RPM	Check vehicle engine RPM on tachometer.

### YEARLY MAINTENANCE

Check-Valve	Check seat for abnormal wear or debris. Replace as needed.
Vehicle	Complete service on vehicle.
Engine Coolant System	Flush the vehicle cooling system. Add new antifreeze.

To maximize the operating life and performance, use only recommended oils, filters and greases.

- (1) Or as often as required.
- (2) Change water pump crankcase oil after **first 50 hours** of operation.
- (3) Inspect after **first week** of operation, and remove any debris present. Inspect again after **2 to 4 weeks**.

## SECTION THREE – SERVICE AND MAINTENANCE

### SERVICE INTERVALS – EVERY 50 HOURS

High Pressure Hoses	Inspect hoses for wear, damage or impending rupture. Replace if damaged.
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### SERVICE INTERVALS – EVERY 100 HOURS

Vacuum Relief Valve	Check and adjust vacuum relief valve up to 13" Hg if needed.
Pressure Regulator	Lubricate o-rings. Use only o-ring lubricant (Sapphire Scientific P/N 13-003)
Belts	Re-tension all belts (1)

### SERVICE INTERVALS – EVERY 250 HOURS

Chemical Metering	Inspect packing nut on selector and metering valves. Adjust as needed.
Drive Shaft	Grease u-joints, splines and zerks. Use only Mystik® JT-6® Hi-Temp No. 2 grease.

### SERVICE INTERVALS – EVERY 500 HOURS

Water Pump	Change crankcase oil (2)
Pulleys and Hubs	Check pulleys and hubs for proper torque. (3)

### SERVICE INTERVALS – EVERY 1000 HOURS

Belts	Replace all belts.
Vacuum Pump	Drain, flush and replace oil. (4)

### SERVICE INTERVALS – AS NEEDED

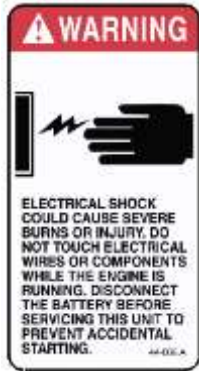
Chemical Pump	Inspect/Replace
Engine Oil and Filter	Change engine oil and filter every 2000 miles.

To maximize the operating life and performance, use only recommended oils, filters and greases.

- (1) Re-tension belts after **first 25 hours**, then every **100 hours** of operation after.
- (2) Change water pump crankcase oil after **first 50 hours** of operation.
- (3) Check pulley and hub set screws after **first 50 hours** of operation, and again at **100 hours** of operation.
- (4) Every **1000 hours** or **yearly**, whichever comes first.

## MAINTENANCE

This section of the operator’s manual contains the service and maintenance information for the Pro-1200 SE unit. A planned preventative maintenance program will ensure that your Pro-1200 SE has optimum performance, long operating life, and a minimum amount of down time.



### **WARNING**

**DO NOT** attempt to service this unit while it is running. High speed parts as well as high temperature components may result in severe injury, severed limbs, or fatality.

**NOTE:** Refer to the hour meter as a guide for coordinating a maintenance schedule.

## **VACUUM PUMP**

**NOTE:** Refer to the provided Vacuum Pump Operation and Service Manual for specific instructions.

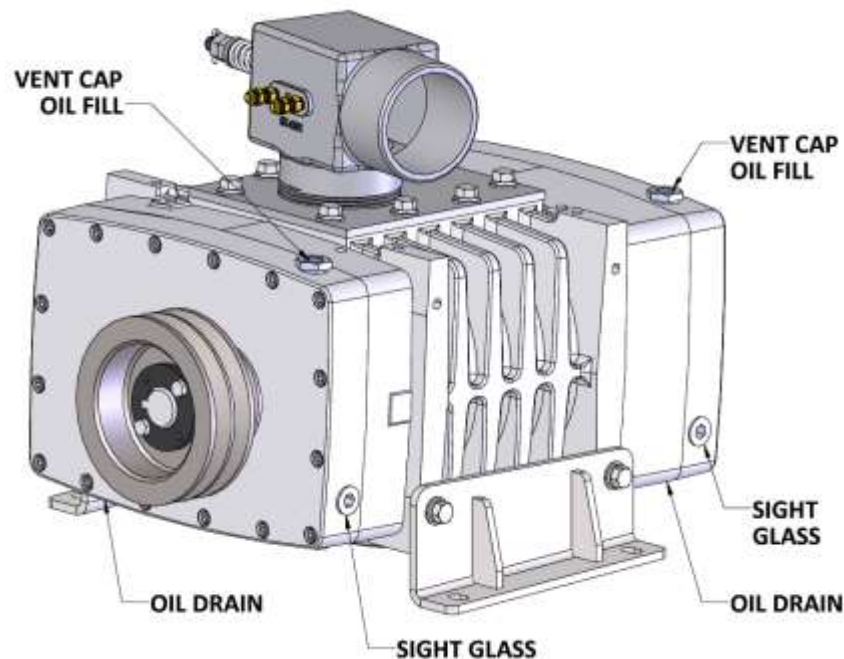
**Lubrication:** Sapphire Scientific *requires* that you use only AEON PD-XD Synthetic vacuum pump Lubricant in both sides of the vacuum pump for all operating temperatures. AEON PD-XD is formulated specifically for positive displacement vacuum pump service to provide maximum vacuum pump protection at any temperature.

**NOTE:** AEON PD-XD (Part # 13-004) is the only oil that Sapphire Scientific puts in the vacuum pump at the factory. Adding petroleum oil to synthetic oil is **NOT** recommended.

Check the oil level **daily** on both sides to ensure they are at the proper level. Too little oil will damage and ruin the bearings and gears. Too much oil will result in overheating.

**NOTE:** Two drains are on your vacuum pump. Ensure that **BOTH** sides of the vacuum pump are filled to their proper level when servicing.

The shaft end capacity is approximately 1.25 pints. The gear end capacity is approximately 2.0 pints.



A lubrication cup has been provided at the front of the console, to prevent rust from building up inside of the vacuum pump.

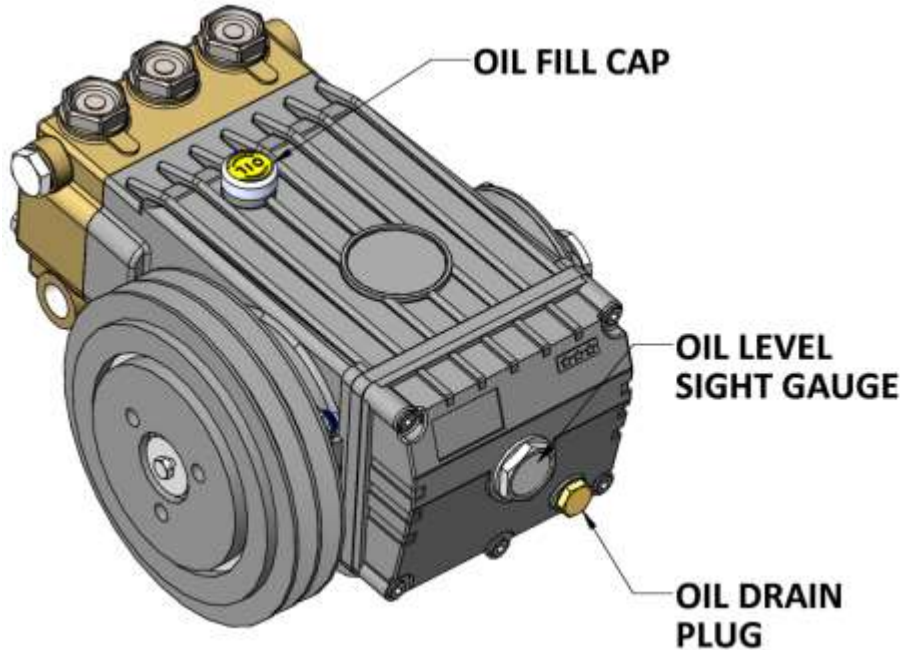
Plug the vacuum ports and spray a water displacement/lubricant into the vacuum lubrication cup for 10 seconds. This procedure should be done at the end of **every working day**.

Drain, flush and replace the oil every 1000 **hours or yearly, whichever comes first**.

## **WATER PUMP**

Check the crankcase oil level **daily** to ensure the proper level. If the level has dropped, check for the source of leakage and repair.

After the first **50 hours** of operation, change the crankcase oil with General Water Pump Oil, (Part # 13-030). Change the crankcase oil every **500 hours** thereafter. Oil capacity is 40.6 oz.



## **VACUUM INLET FILTER**

The vacuum inlet filter in the waste tank should be inspected and cleaned **daily**.

### **CAUTION**

When removing the vacuum inlet filter, grip the plastic hexagon section of the filter. Grasping filter by the screen will damage or destroy the filter. Applying grease to the threads will allow easier removal of filter when cleaning or replacement is required.



## **DRIVE BELTS, PULLEYS AND HUBS**

Check pulley set screws and hub screws after the first **25 hours** of operation and again at **100 hours**. Re-torque these screws with a torque wrench. Follow the torque values on the following table. Check pulley set screws and hub screws every **500 hours** thereafter.

**NOTE:** Ensure belts are properly tensioned after checking the torque values. Use Gates EPDM belts.



Ensure that when you re-torque the screws, you use a clockwise pattern and continue until the proper torque is achieved.

TORQUE VALUES		
Component	Inch/lbs	Foot/lbs
Vacuum Pump Hub #38-032	180	15

## **PRE-FILTER BOX AND WASTE TANK STRAINER BASKETS**

Any strainer baskets used in the system should be emptied and cleaned on a **daily** basis.

## **CHECK VALVE STRAINER (SOLUTION MANIFOLD)**

Unscrew the screen and inspect the strainer after the first **week** of operation. Remove any debris present. Inspect again after **2** and **4 weeks**.

Thereafter, inspect the strainer and screen at least **monthly**. If a frequent build-up of debris is noticed, inspect and clean more frequently.

## **CHEMICAL METERING SYSTEM**

Check and inspect the chemical selector and metering valves every **200 hours**. This will prevent leaks and add to the overall life of the valves.

## **VACUUM HOSES**

To ensure maximum hose life, Sapphire Scientific recommends that you wash out the hoses with fresh water **daily**.

## **HIGH PRESSURE SOLUTION HOSES**

Inspect your high-pressure solution hoses for wear after the first **100 hours**. Thereafter, inspect every **25 hours**. If the hoses show any signs of damage or impending rupture, replace the hoses.



**NEVER** attempt to repair high-pressure solution hoses. Repairing high-pressure solution hoses may result in severe burns and serious injury.

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

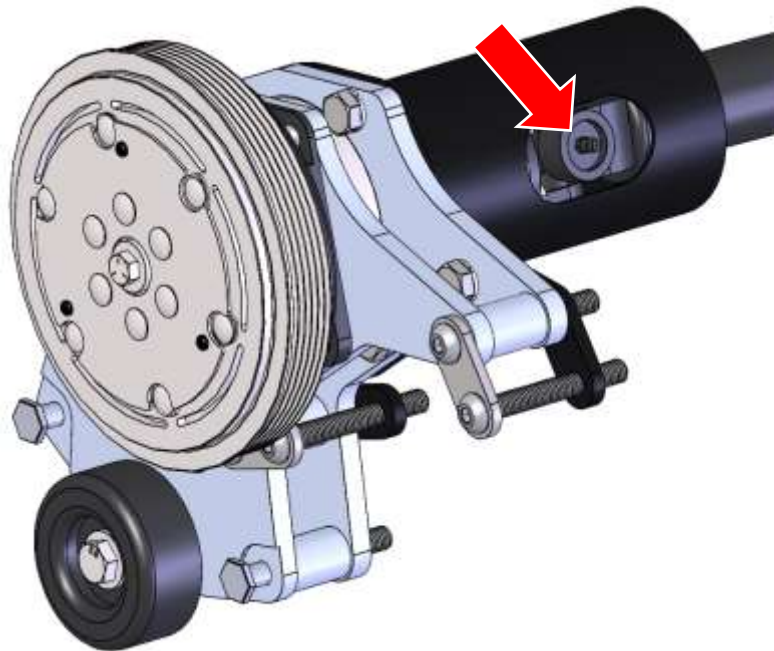
## **DRIVE SHAFT MAINTENANCE**

Apply lubricating grease to your Pro-1200 SE drive shaft zerk fittings at both ends of the shaft **every 250 hours**.

Use only Mystik® JT-6® Hi-Temp Grease No. 2. Mystik® JT-6® is a high-temperature lithium-complex grease rated to 550° F. Do not mix with other lubricants. A tube of Mystik® JT-6® No. 2 is included with your Pro-1200 SE.

### **GREASE THE CLUTCH-SIDE ZERK FITTINGS (2):**

1. Remove the shaft guard and clipboard holder.
2. Rotate shaft until zerk fitting is visible in the clutch side guard window (as shown).
3. Grease each u-joint fitting until the new grease begins to purge from all four cross bearing seals.
4. Rotate shaft to reveal zerk on opposite side.

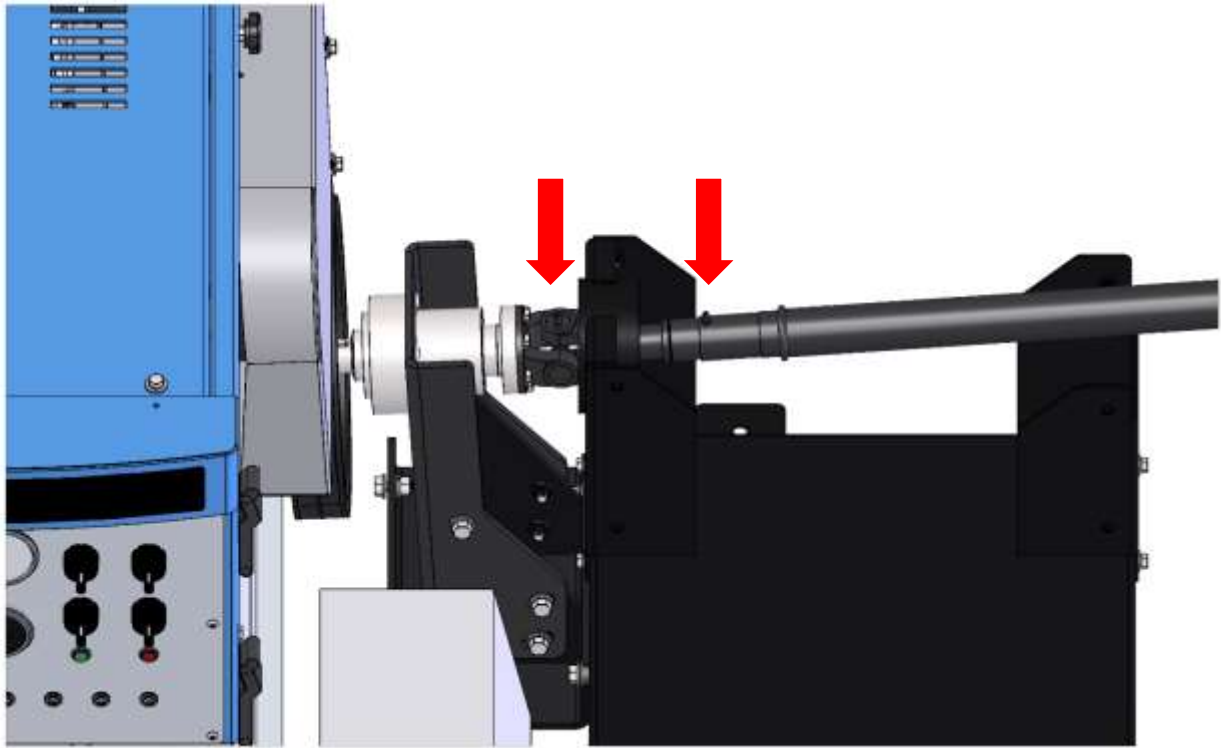


For easier application of grease under the hood without having to remove parts, a right-angle low-profile coupler like the one shown below is included with your Pro-1200 SE.



**GREASE THE REAR SIDE ZERK FITTINGS (3):**

Locate the three (3) zerk fittings. Apply grease at the u-joint fittings until the new grease begins to purge from all four cross bearing seals. Apply the grease gun to the slip yoke fitting until the new grease appears at the pressure relief hole. Cover the pressure relief hole and continue to apply grease until new grease appears at the slip yoke seal.



The drive shaft splines should also be lubricated with the same grease as the zerk fittings.

## GENERAL SERVICE ADJUSTMENTS



**DO NOT attempt to service this unit while it is running. High speed parts as well as high temperature components may result in severe injury, severed limbs, or fatality.**

### **VACUUM RELIEF VALVE**

With the unit running at high speed, block off the airflow at the vacuum inlet port and read the vacuum gauge. If adjustment is required, shut the unit down and adjust the locking nut tension on the vacuum relief valve. Re-start the unit and read the vacuum gauge. Repeat this process until the vacuum relief valve opens at 13" Hg. Always ensure the lock nut is retightened and the cotter pin is replaced.



**To reduce the risk of injury: NEVER obstruct the vacuum port with your hand or other body part. Keep hair, loose clothing and all body parts away from vacuum port openings while unit is in operation.**

### **VACUUM PUMP DRIVE BELTS**

To tighten the vacuum pump belt:

1. Remove the panel on the front face of the lower belt guard.
2. Adjust the position of the belt tensioning adjusting bolt until the proper belt tension is achieved (1/2" deflection in the center of the belts, half way between the pulleys).
3. To check the alignment of the belts, the entire lower belt guard must be removed.

### **WATER PUMP DRIVE BELTS**

To tighten the water pump belts:

1. Loosen the four bolts, which hold the water pump base to the frame.
2. Adjust the position of the belt tensioning adjusting bolt until the proper belt tension is achieved (1/2" deflection in the center of the belts, half way between the pulleys).
3. While checking the alignment, tighten the nuts that hold the water pump to the base.

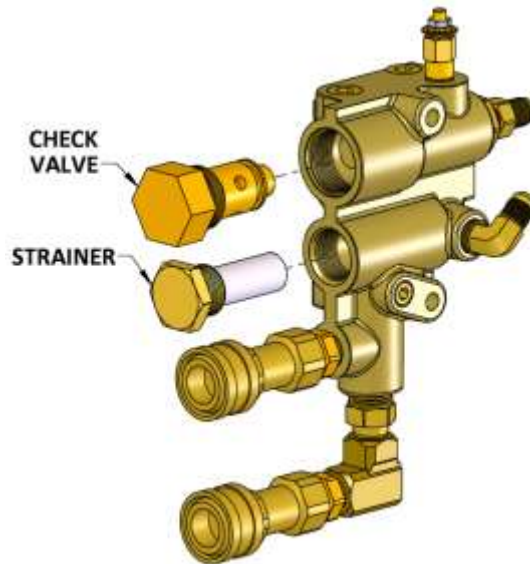


**Over tightening of belts may cause damage to pump casing, causing it to fail.**

## **SOLUTION MANIFOLD CHECK VALVE AND STRAINER**

Inspect the check valve and solution manifold strainer whenever performing service on the chemical pump or if flow problems are occurring in the chemical system.

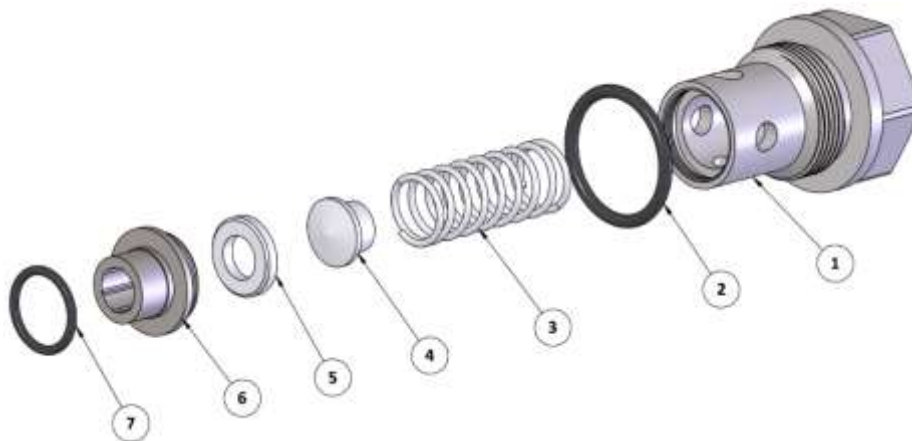
1. Shut down Unit.
2. Remove and clean strainer mesh.
3. Remove the check valve, ensuring that the small o-ring on the seat comes out with it.
4. Next, remove the seat using a 5/16 in. Allen wrench.
5. Check the seat for wear or debris. Clean and replace the seat if necessary.
6. Inspect the poppet and the spring for wear or damage. Clean and replace as necessary.



**NOTE:** New o-rings must be installed **anytime** the check valve is removed.

7. Re-assemble the check valve. Thread the seat by hand until snug. Then tighten with a 5/16 in Allen wrench. **DO NOT** over-tighten.
8. Lubricate the new o-rings with o-ring lubricant (Part # 13-003) and re-install.

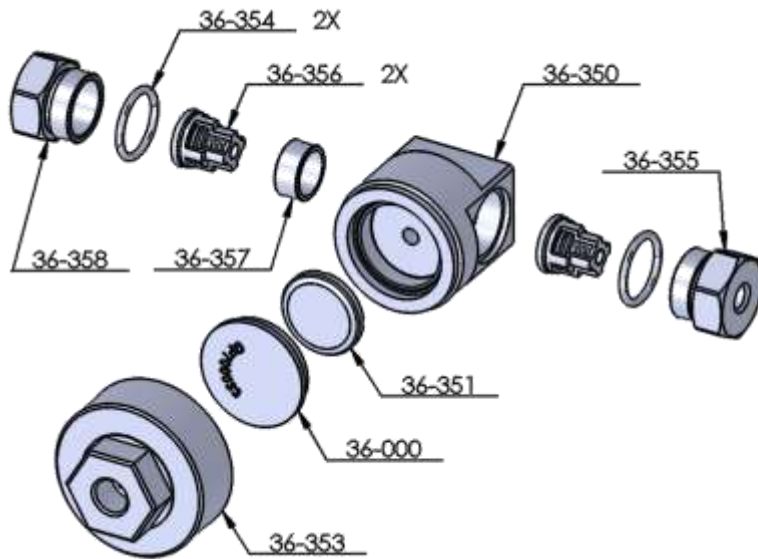
**NOTE:** Improper seating of the check valve seat, poppet, damaged spring or o-rings will result in poor performance of the chemical system.



**23-063 ASSEMBLY, CHECK VALVE MANIFOLD**

Item #	P/N	Qty.	Description
1	27-009	1	CAP, CHECK VALVE ASSY. SS
2	41-007	1	ORING, 7/8 ID X 1-1/16 OD
3	15-007	1	SPRING, CHECK VALVE ASSY.
4	27-010	1	POPPET, CHECK VALVE ASSY
5	27-004	1	INSERT, SEAT-CHK VLV ASSY TM
6	27-011	1	SEAT, CHECK VALVE ASSY.
7	41-008	1	ORING, 1/2 ID 5/8 OD

**CHEMICAL PUMP**



1	36-350	BODY, PULSE PUMP
1	36-351	DISC, PLASTIC
1	36-000	DIAPHRAGM, RUBBER
1	36-353	COVER, INLET
2	36-354	O-RING, 70 DURO
1	36-355	VALVE CAP, 303SS 520195
2	36-356	ASSY, VALVE KIT
1	36-357	SPACER, 303SS RING
1	36-358	VALVE CAP, 303SS 520196
QTY	PART NO.	DESCRIPTION

The chemical pump should be rebuilt every **500 hours**. This involves changing the diaphragm and plastic disc, check valves, and inspecting the disk. **DO NOT** attempt to reuse O-rings after the check valves have been removed. Replace all O-rings when servicing check valves.

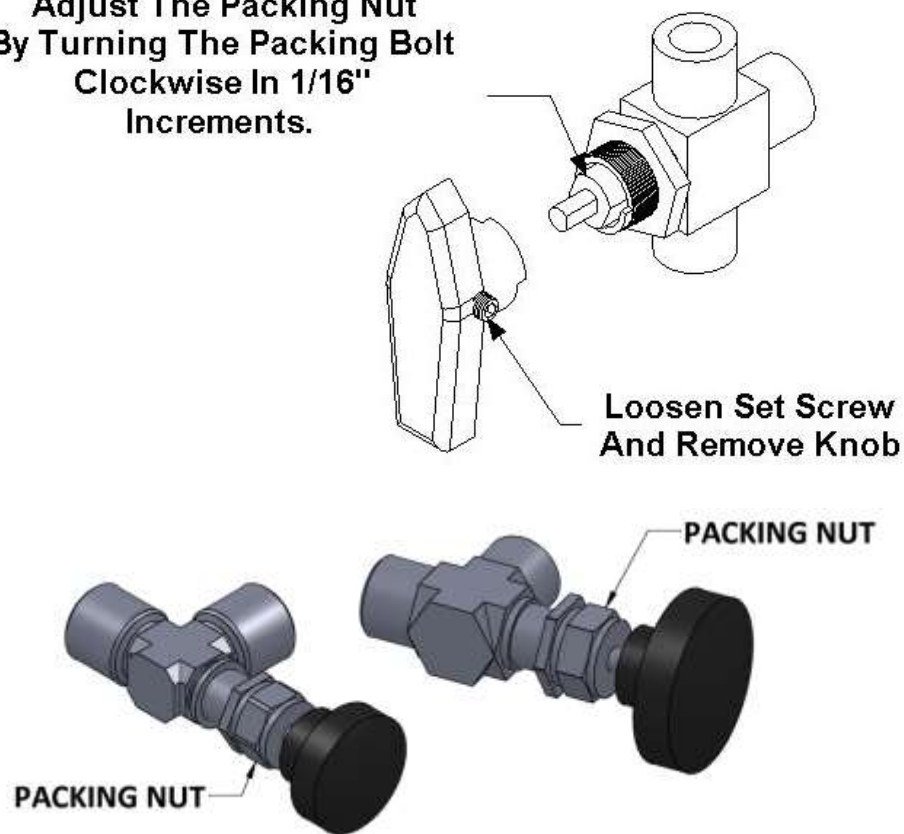
## **PACKING NUT ADJUSTMENT**

Four items on the Pro-1200 SE have a packing nut.

1. The chemical selector.
2. The chemical metering valve.
3. The temperature control knob.
4. The hot water knob.

Inspect the packing nut for proper tension on the chemical metering and chemical selector valves every **200 hours**. When turning the knob, there should be some resistance. If not, slightly tighten the packing nut. **DO NOT** over tighten. Keeping the packing properly adjusted will eliminate possible leaks and will add to the overall life of the valves.

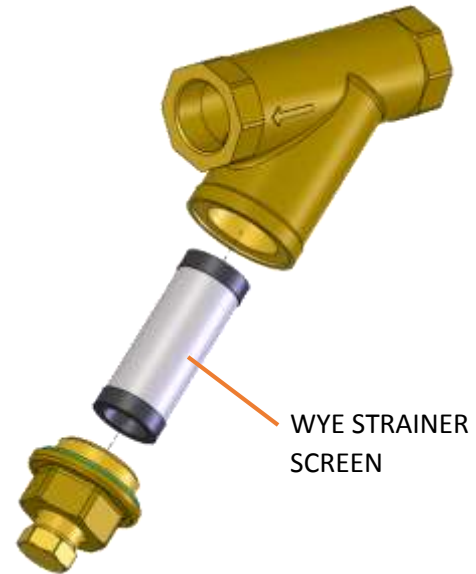
**Adjust The Packing Nut  
By Turning The Packing Bolt  
Clockwise In 1/16"  
Increments.**



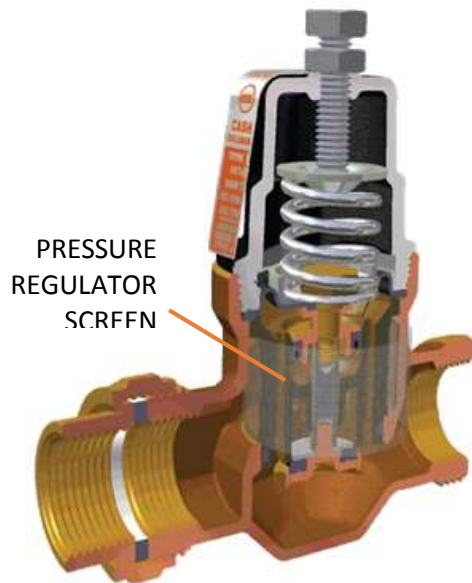


## **WYE STRAINER**

Incoming water is filtered through two stainless steel mesh screens. The first screen is located in the wye strainer, located directly behind the water inlet. The wye strainer captures incoming debris and will restrict water flow when clogged. Inspect and clean at least once a month or as needed. Hard water deposits can build and reduce water flow.



## **INLET PRESSURE REGULATOR**



The second stainless steel mesh screen is located inside the inlet pressure regulator. Inspect and clean at least once a month. Hard water deposits can build and reduce water flow.

The inlet pressure regulator comes pre-set at the factory.

## **PRESSURE REGULATING UNLOADER**

The pressure regulating unloader holds water pressure at a preset point and bypasses the excess water.

### **To adjust:**

With the unit running, with the cleaning tool valve closed, the pressure gauge should read 0.

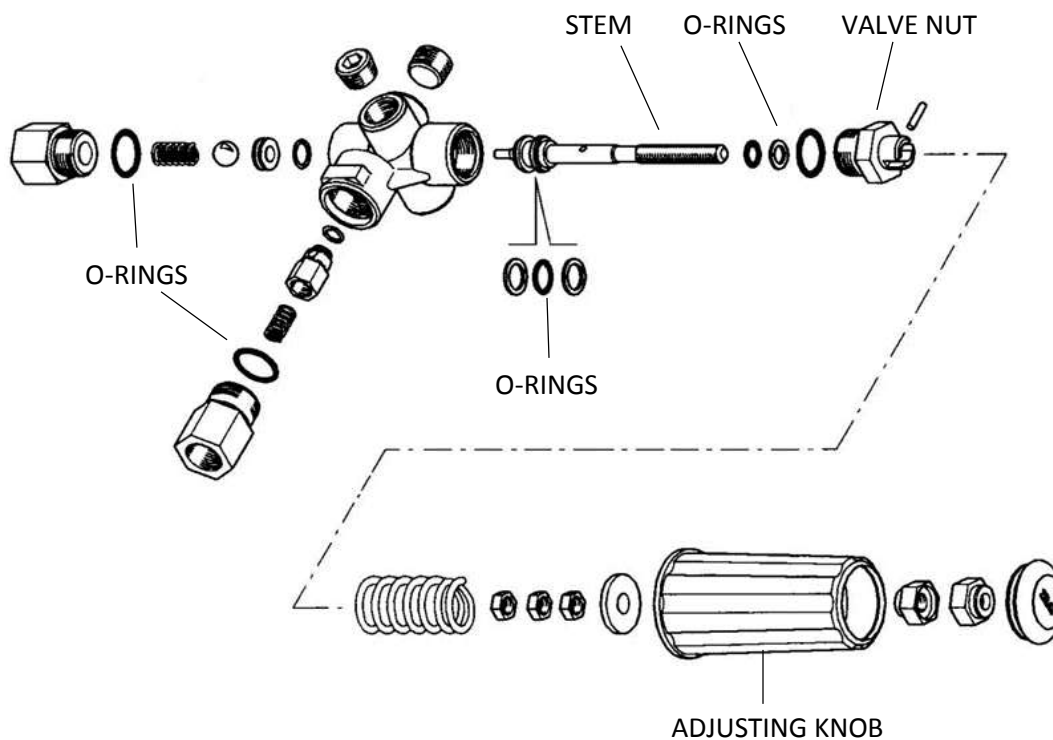
With the tool valve open, adjust the pressure by turning the adjusting knob so that the pressure gauge reads between 400 - 1200 PSI.



**DO NOT** loosen the adjusting body (cap) all the way (counterclockwise) or remove it while the unit is running.

We recommend that you lubricate the unloader o-rings every **100 hours** or whenever required. If you do not, the stem may become seized due to inadequate lubrication. If this occurs:

1. Shutdown the unit.
2. Relieve all pressure from the water system.
3. Remove the adjusting cap from the unloader, loosen the valve nut and remove the stem with long nose pliers.
4. Clean and lubricate stem.
5. Reassemble the unloader.



## TROUBLESHOOTING



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

This section of the operator's manual describes how to look for and repair malfunctions, which may occur. Accurate troubleshooting is based on a thorough and complete understanding of the **WATER, CHEMICAL, VACCUM, HEAT TRANSFER, SAFETY** and **WIRING** systems featured in this unit.

If there are malfunctions occurring on this unit which you do not understand, refer back to the **OPERATION** section of this manual and review **SYSTEM**.

**HEAT ISSUES/MISCELLANEOUS TROUBLESHOOTING****EXCESSIVE HEATING**

<b>PROBABLE CAUSE</b>	<b>SOLUTION</b>
Not enough water flow.	Check jet size of tool.
Engine speed too high for job/tool.	Reduce engine speed.
Temperature control valve closed.	Open temperature control valve to reduce temperature.
Flow restriction caused by hard water scaling.	Descale unit, repair or replace damaged plumbing components as necessary. Install water softener.

**HEAT EXCHANGER LEAKS**

<b>PROBABLE CAUSE</b>	<b>SOLUTION</b>
Coolant or Vacuum exhaust heat exchanger is damaged from frozen water or defective.	Inspect heat exchanger for leaks. Visually inspect for damage. Pressure check after removing from unit (maximum test pressure 1200 PSI). Replace if defective.

**LOSS OF TEMPERATURE (HEAT OUTPUT IS LESS THAN NORMAL)**

<b>PROBABLE CAUSE</b>	<b>SOLUTION</b>
No vacuum hose connected.	Connect vacuum hose to the vacuum inlet.
Engine RPM is low.	Adjust engine speed.
Vacuum relief is set too low.	With vacuum fully blocked and engine speed set to HIGH, adjust the vacuum relief to 12-13" Hg.
Heat control valve open.	Close valve.
Defective temperature gauge.	Test gauge and sensor. Replace failed component.

**WASTE PUMP OUT IS MALFUNCTIONING**

<b>PROBABLE CAUSE</b>	<b>SOLUTION</b>
Defective waste pump float switch.	Replace float switch.
Broken diaphragm(s) in pump.	Replace diaphragm(s).
Pump out circuit breaker on instrument panel has tripped.	After inspecting waste pump to determine the cause of the overloaded circuit, press reset button.
Check valve dirty or damaged.	Clean or replace as necessary.

**VACUUM PUMP TROUBLESHOOTING****LOSS OF VACUUM** (while cleaning, engine RPM is normal but vacuum is lower than expected)

<b>PROBABLE CAUSE</b>	<b>SOLUTION</b>
Vacuum gauge is giving an improper reading.	Examine the tubing between the vacuum relief valve and the vacuum gauge and remove any blockage.
Vacuum hose(s) is damaged, causing a suction leak.	Inspect hose(s), repair or replace.
Waste tank gaskets not sealing properly, not positioned properly.	Inspect the gasket. Repair seal or replace Re-position lid(s).
Plugged vacuum hose or vacuum plumbing between vacuum inlet and strainer basket.	Unplug vacuum hose or inlet plumbing.
Waste tank filter or strainer basket is plugged.	Clean or replace filter. Clean strainer basket.
Loose vacuum pump drive belts.	Tighten the drive belts.
Waste tank drain valve is damaged or left open, causing a vacuum leak.	Drain the waste tank. Close drain valve, if open. Replace valve if defective.
Vacuum relief valve requires adjustment or has a vacuum leak due to damaged diaphragm.	Re-adjust the vacuum relief valve. If the vacuum does not increase, remove and inspect the relief valve diaphragm. If damaged, replace.
Vacuum exhaust heat exchanger plugged.	Remove and clean.
Vacuum pump is worn out.	Replace the vacuum pump.
Vacuum relief valve requires adjustment.	Readjust the vacuum relief valve. With vacuum fully blocked and speed set to high, set vacuum break to 13-14 in. Hg.

**WATER PUMP (PRESSURE) TROUBLESHOOTING****LOSS OF PRESSURE** (with cleaning tool open, pressure gauge reads below normal operating pressure)

<b>PROBABLE CAUSE</b>	<b>SOLUTION</b>
Water supply is turned off .	Turn the water supply on or up. Check for kinks in the water supply hose.
Solution pump inlet supply line is plugged or drawing air.	Examine the water inlet pressure regulator strainer. Remove accumulated debris and replace if required. Check for suction leaks and loose clamps or fittings. Tighten any loose fittings or clamps. Replace any ruptured hose(s).
Improper engine speed.	Using a tachometer, check the engine speed.
Pressure unloader O-rings are dry.	Lubricate O-rings, using O-ring lubricant.
Pressure unloader has worn O-rings .	Check O-rings. If necessary, replace.
Pressure unloader is dirty, stuck open, or improperly adjusted.	Clean or repair regulator. Adjust to working pressure. Lubricate O-rings, using O-ring lubricant.
Low pump volume.	Examine the check valves, plunger cups, and cylinder head on the water pump. Repair, whenever required.
Defective water pressure gauge.	Replace gauge.
Orifice (spray nozzle) in the cleaning tool is worn, defective, or wrong size.	Replace Nozzle or change nozzle size.
Debris clogging water lines or water inlet disconnect, Y strainer.	Clean or replace as needed.
Belts loose or broken.	Re-tension or replace as needed.

**LOSS OF SOLUTION VOLUME** (at cleaning tool orifice, pressure gauge reads normal)

<b>PROBABLE CAUSE</b>	<b>SOLUTION</b>
Plugged screen in the cleaning tool.	Unplug or replace screen
Internal block between the pressure regulator manifold and the outlet manifold, or the solution screen is clogged.	Inspect all lines, remove accumulated debris which is blocking proper flow. Replace any defective hoses. Remove, inspect, and clean the solution screen. De-scale unit and install a water softener, if necessary.
Outlet check valve is plugged.	Examine the check valve, remove any debris.
Defective quick-connect on one or more of the high pressure hoses.	Replace defective quick-connects(s) on high pressure hoses(s).
Cleaning tool valve is malfunctioning.	Repair or replace valve.
Hose inner lining is constricted.	Remove restriction or replace hose.
Air leak in chemical supply line, priming valve or metering valve.	Check for air leaks. Replace faulty parts.

**CHEMICAL SYSTEM TROUBLESHOOTING****CHEMICAL FLOW METER INDICATES FLOW WITH THE TOOL VALVE CLOSED**

PROBABLE CAUSE	SOLUTION
External leak in chemical piping.	Tighten fittings. Re-apply thread sealant where required. If any fittings are damaged, replace.
Outlet check valve is full of debris or damaged, not allowing it to close properly.	Close the chemical valve on the instrument panel. If the flow meter does not indicate flow, remove debris or replace check valve, if necessary.

**CHEMICAL FLOW METER INDICATES FLOW WITH THE TOOL VALVE OPEN**

PROBABLE CAUSE	SOLUTION
Chemical pump diaphragm is ruptured.	Close the chemical valve on the instrument panel. If the flow meter still indicates flow, replace the chemical pump diaphragm and plastic disc.
Internal leak in chemical valve causing continual flow through prime tube returning to container.	Tighten valve packing nut (see “General Service Adjustments” section in this manual). Replace valve, if necessary.

**SOLUTION PUMP DOES NOT ENGAGE**

PROBABLE CAUSE	SOLUTION
Solution pump circuit breaker has been tripped.	Check the solution pump circuit breaker on the control panel. Press the circuit breaker reset button.
Defective electrical connection in the console wiring or defective switch.	Examine switch, electrical connections, and wiring. Repair any defective connections. If there is power going to the switch but not going out, replace the defective switch.
Solution pump has not been activated.	Turn solution pump switch to on.
Defective solution pump clutch.	If there is power in the switch, but not power at the clutch, replace the defective wire. If there is power at the clutch, replace the defective switch.
Loose or broken solution pump belts.	Tighten or replace belts.

**LOSS OF CHEMICAL WITH TOOL VALVE CLOSED**

PROBABLE CAUSE	SOLUTION
Chemical pump is improperly primed.	Refer to chemical pump priming instructions.
The strainer at the inlet end of the chemical inlet line is clogged.	Unclog the strainer. If damaged, replace.
Chemical pump check valve(s) is clogged.	Remove any debris from the chemical check valve(s). Replace chemical check valve(s) or seals, if necessary.
Chemical prime/on-off valve or chemical metering valve is defective.	Replace valve(s).
Chemical pump diaphragm is ruptured.	Disassemble the chemical pump and replace the damaged diaphragm and plastic disc.
Defective cylinder in the water pump.	Measure the pump volume. If the pump volume is less than normal, refer to “Loss of Pump Volume” in the Troubleshooting section in this manual.

SECTION THREE – SERVICE AND MAINTENANCE

**CHEMICAL FLOW LOWER THAN 6 GPH**

<b>PROBABLE CAUSE</b>	<b>SOLUTION</b>
Inlet water pressure too high.	In areas with inlet water pressure in excess of 60 PSI the addition of an RV inlet water pressure regulator may be needed.



## SECTION FOUR: PARTS AND ACCESSORIES

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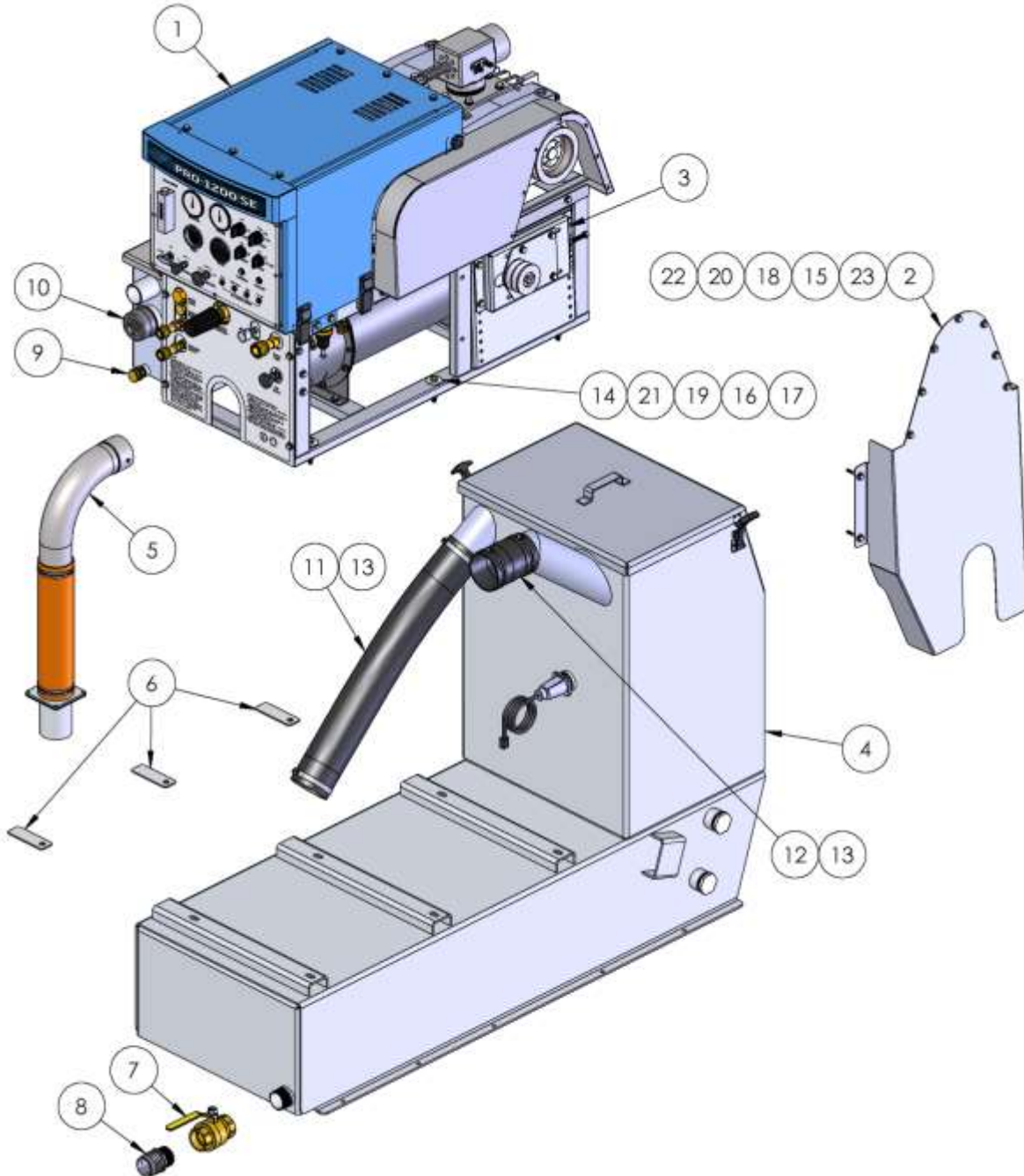
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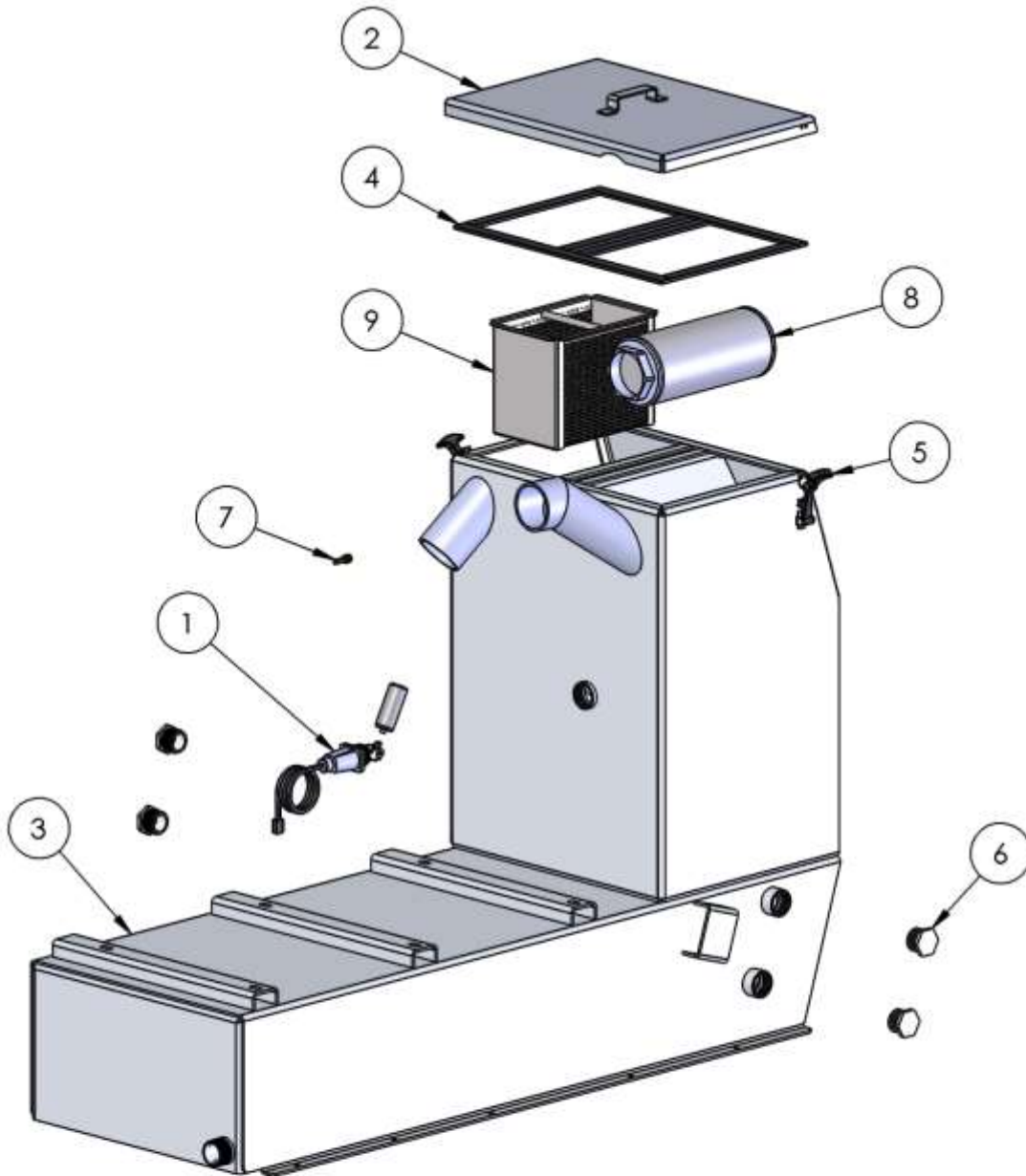
**71-1200SM15, KIT, CONSOLE PRO-1200 SE**



**71-1200SM15, KIT, CONSOLE PRO-1200 SE (BOM)**

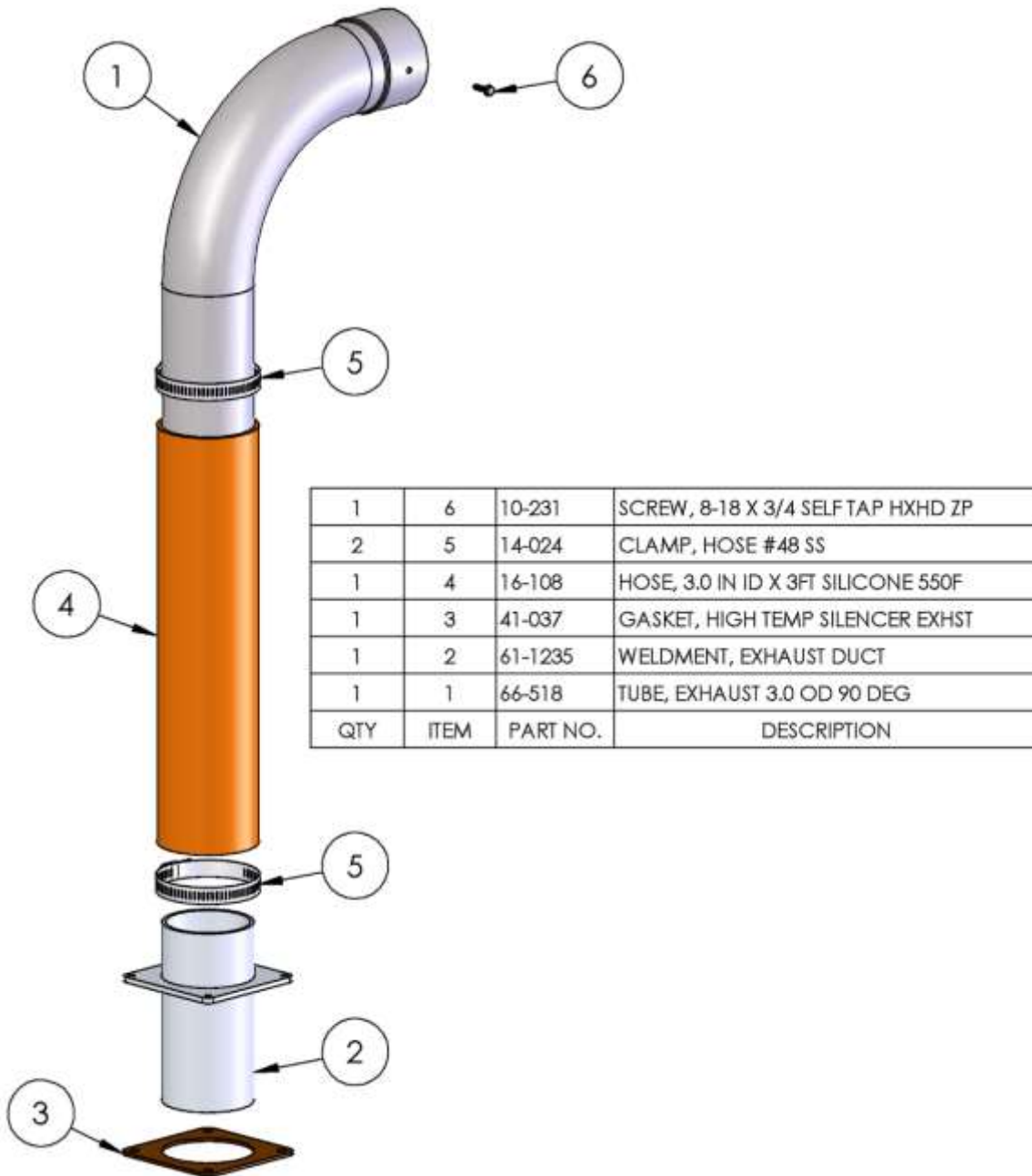
7	23	10-006	SCREW, MACH 1/4-20 X 1/2 HEXHD
2	22	10-028	SCREW, MACH 1/4-20 X 2-3/4 HXHD
6	21	10-096	BOLT, 3/8-16 X 2-1/4 HHCS SS
2	20	10-170	SCREW, MACH, 3/8-16 X 2-3/4 HH G5
3	19	11-006	NUT, 3/8-16 ZINC
11	18	12-012	WASHER, FLAT 1/4 USS
3	17	12-013	WASHER, FLAT 3/8 SAE
6	16	12-014	LKWSR, 3/8 ZINC
11	15	12-015	LKWSR, 1/4 ZINC
6	14	12-049	WASHER, 3/8 X 1-1/2 FENDER ZINC
4	13	14-050	CLAMP, HOSE 4 1/2 TO 2 1/2 HD SS
1	12	16-014-01	HOSE, INT VAC 3-1/2 IN 5 IN
1	11	16-014-02	HOSE, INT VAC 3-1/2 X 27 IN
1	10	19-013	CAP, 2-1/2 IN RUBBER
1	9	21-071	CAP, GARDEN HOSE 3/4 BRASS
1	8	21-094	FTTG, 1-1/2 P X 2H DRAIN
1	7	23-050	VLV, 1-1/2 IN BRASS BALL
3	6	61-1188	WELDMENT, MOUNTING NUT PLATE
1	5	68-371	KIT, 90 DEG 3 IN THRU STEP EXHAUST
1	4	69-648	ASSY, SUBMOUNT WASTE TANK
1	3	69-757	ASSY, BELT TENSIONER
1	2	69-795	ASSY, LOWER BELT GUARD
1	1	70-1200SM15	CONSOLE, SAPPHIRE 1200SM15
QTY	ITEM	PART NO.	DESCRIPTION

**69-648, ASSY, SUBMOUNT WASTE TANK**

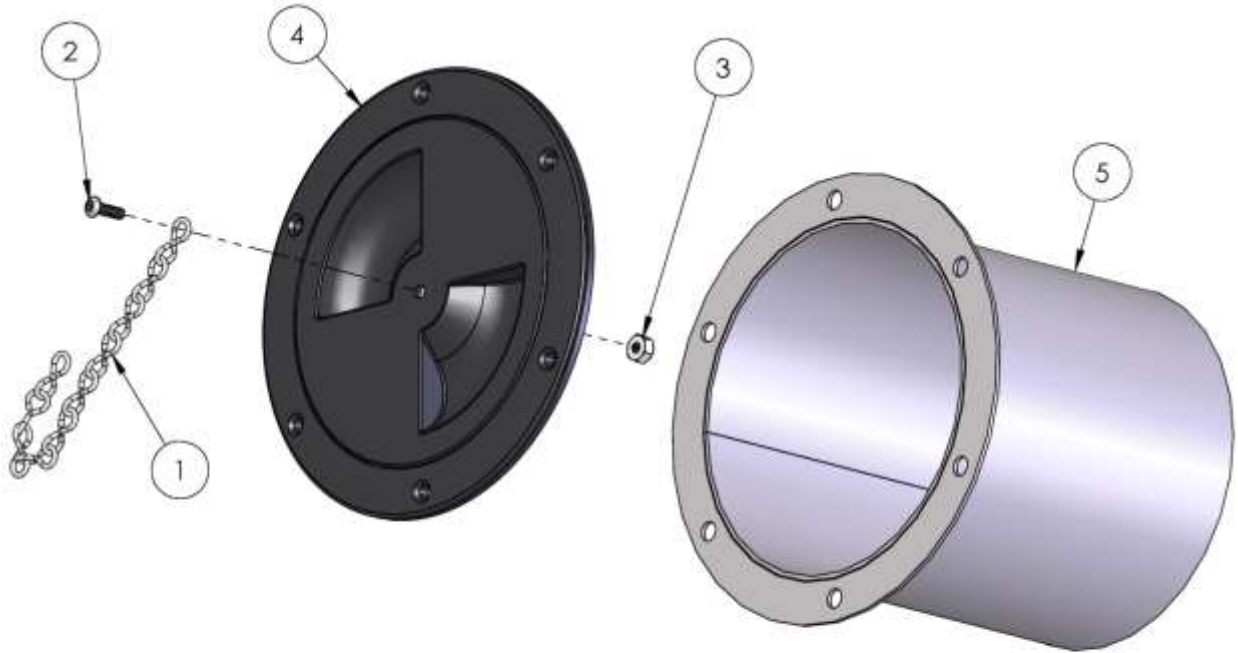


1	9	61-002	WELDMENT, STRAINER BASKET
1	8	20-021	STRAINER, FILTER 3" 100 MESH
1	7	21-006	FTG, BRB 1/4 PX5/16 H BRASS
4	6	21-097	PLUG, 1-1/4 IN PVC
2	5	40-003	LATCH, PRE-FILTER BOX
92.5 IN	4	41-018	GASKET, SPONGE 1 IN X 45 FT
1	3	61-1128	WELDMENT, SUBMOUNT WASTE TANK
1	2	61-1176	WELDMENT, SUBMOUNT TANK LID
1	1	69-000	FLOAT SWITCH
QTY	ITEM	PART NO.	DESCRIPTION

**68-371, KIT, 90 DEG THRU-STEP EXHAUST**

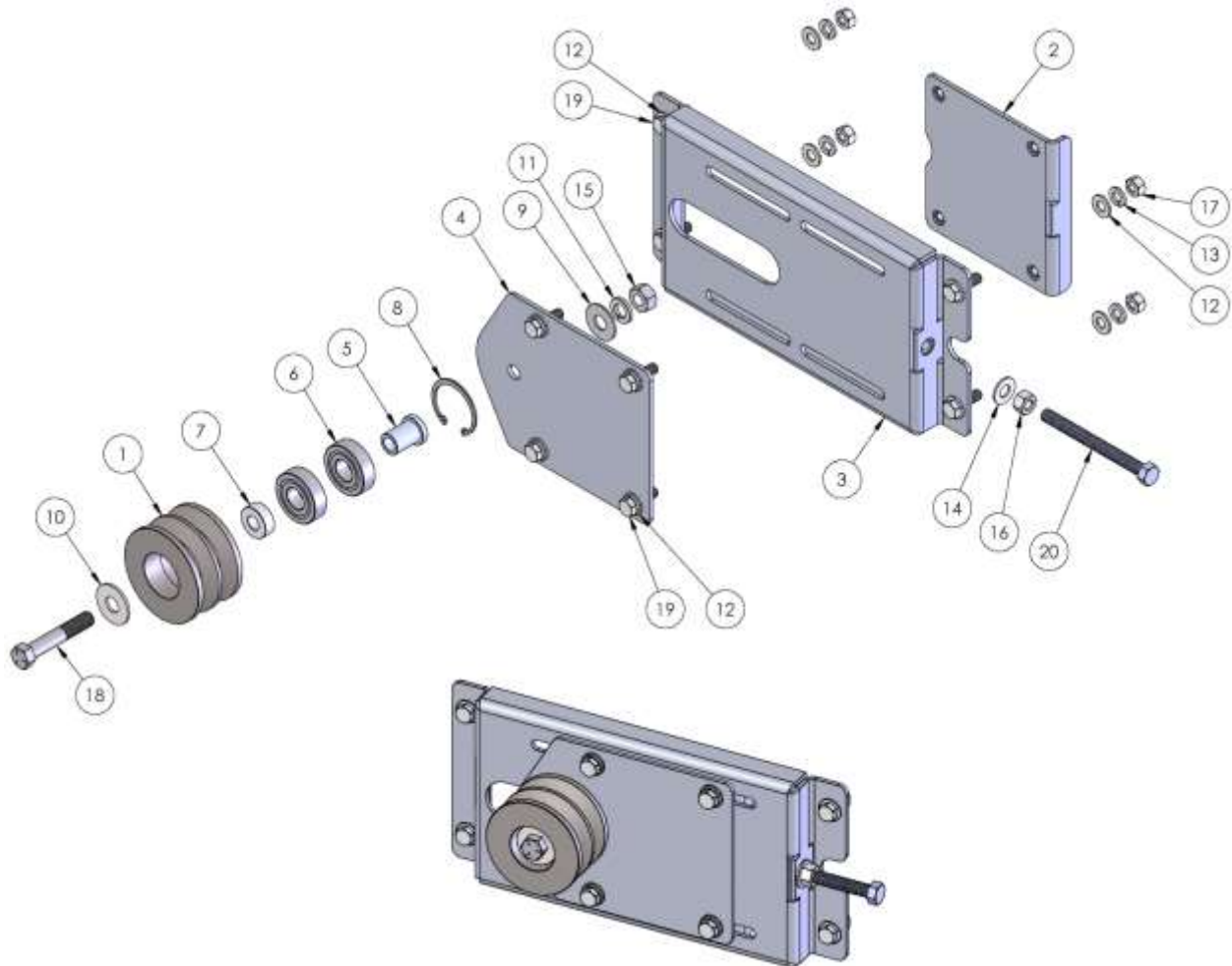


**69-733, ASSEMBLY, VACUUM HOSE PORT**



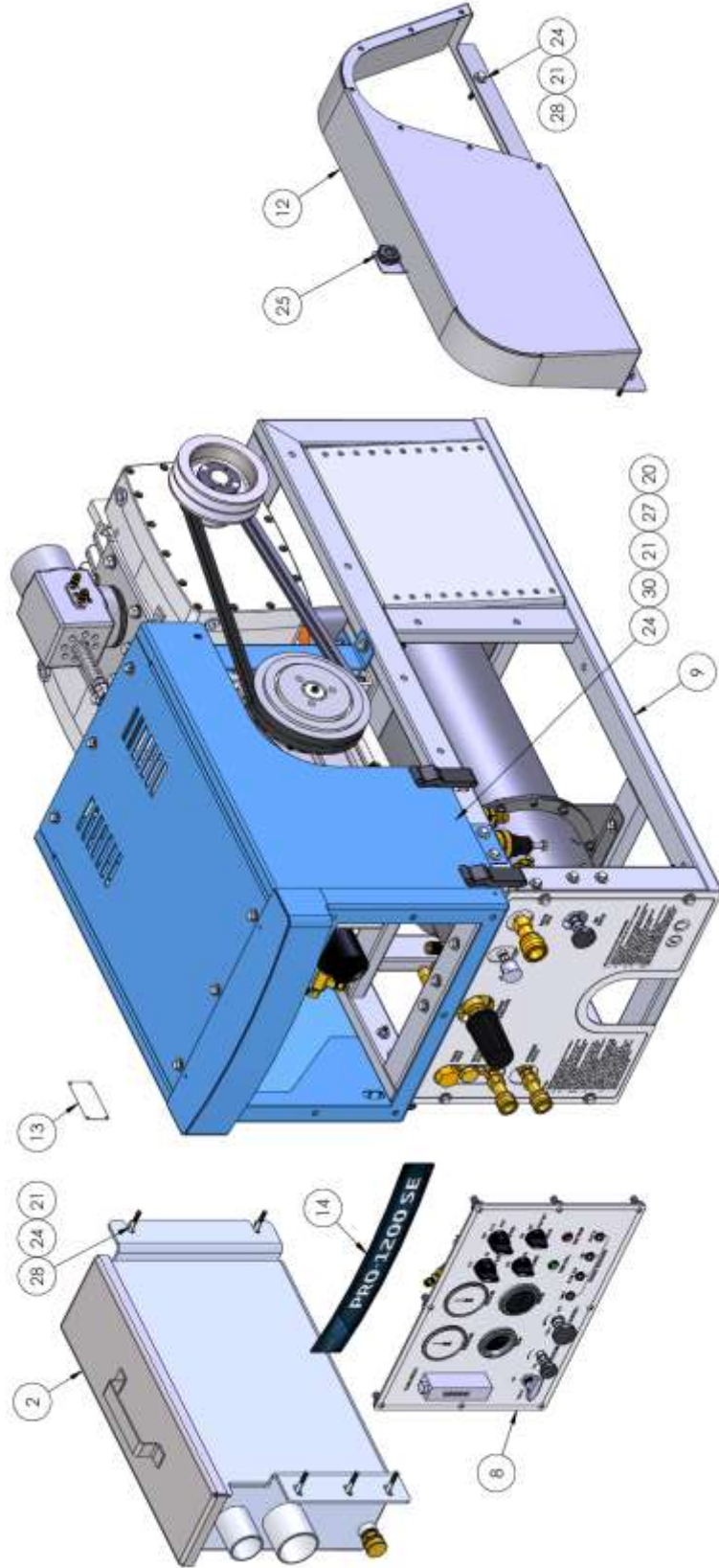
1	5	61-1316	WELDMENT, HOSE PORT
1	4	21-539	DECK PLATE, 4 IN BLK SCREW-IN
1	3	11-021	NUT, 6-32 NYLON
1	2	10-113	SCREW, MACH 6-32 X 1/2 BHSCS SS
6.50 IN	1	50-024	CHAIN, JACK #16 ZPS
QTY	ITEM	PART NO.	DESCRIPTION

**69-757, ASSEMBLY, BELT TENSIONER**



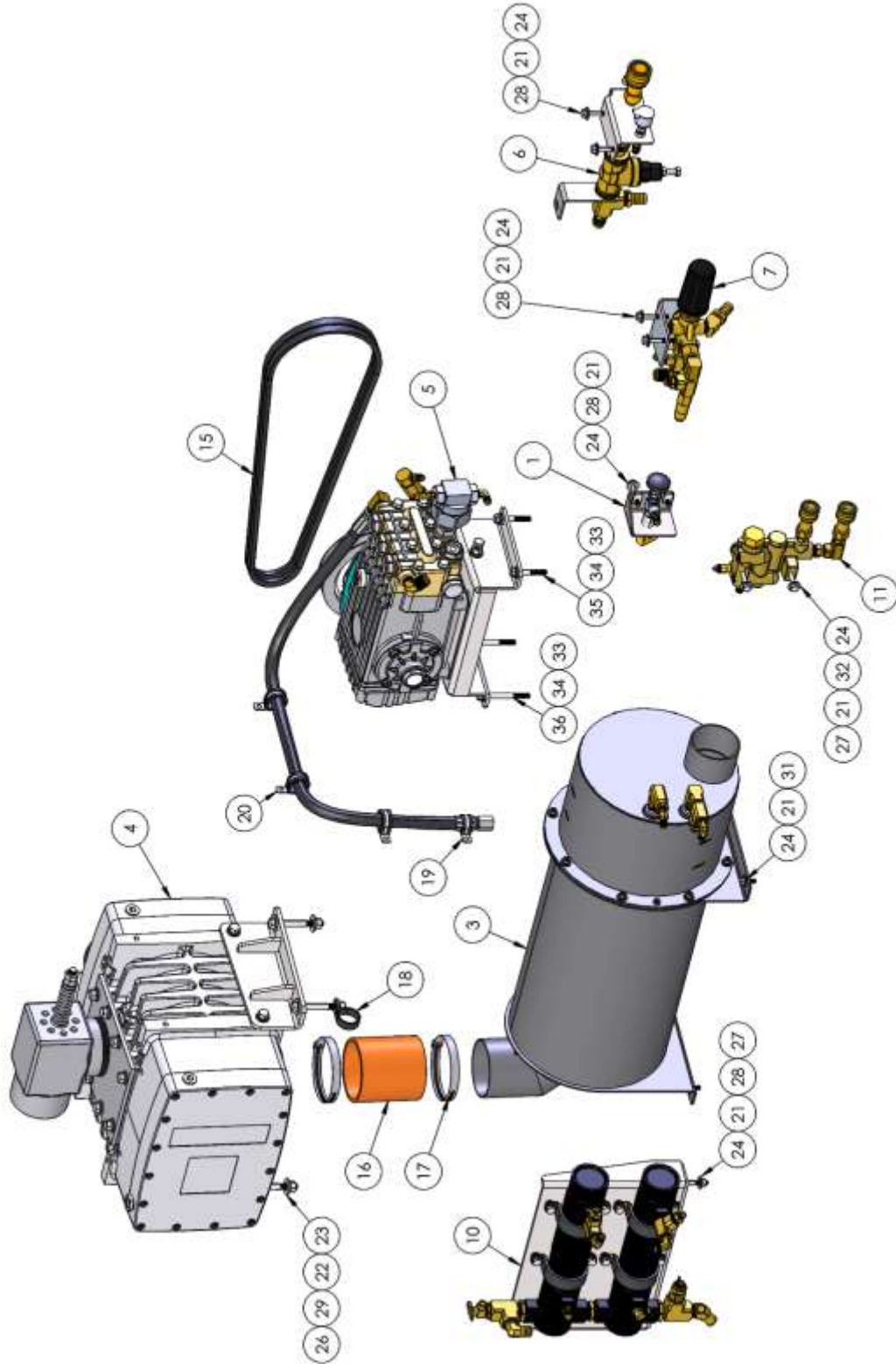
1	20	10-010	BOLT, TAP 3/8-16 X 4 GR 5
8	19	10-106	BOLT, 5/16-18 X 1 HHCS Z5
1	18	10-355	SCREW, MACH .44-14 X 2.50 HXHD ZP
4	17	11-005	NUT, 5/16-18 ZINC
1	16	11-006	NUT, 3/8-16 ZINC
1	15	11-012	NUT, 7/16-14 ZP
1	14	12-013	WASHER, FLAT 3/8 SAE
8	13	12-016	LKWSR, 5/16 ZINC
12	12	12-017	WASHER, FLAT 5/16 SAE ZINC
1	11	12-020	LKWSR, 7/16 ZINC
1	10	12-021	WASHER, FLAT, 7/16 ZINC
1	9	12-021	WASHER, FLAT 7/16 ZINC
1	8	15-039	SNAP RING, 1-9/16 INTERNAL
1	7	38-088	SPACER, IDLER PULLEY
2	6	39-048	BEARING, IDLER PULLEY
1	5	39-054	BEARING, 7-16 DOUBLE BUSHING
1	4	58-844	PLATE, IDLER PULLEY SLIDE
1	3	61-1274	WELDMENT, TENSIONER BASE
1	2	61-1276	WELDMENT, IDLER SLIDE MOUNT
1	1	66-356	PULLEY, DOUBLE IDLER 3.0
QTY	ITEM	PART NO.	DESCRIPTION

**70-1200SM15, ASSEMBLY, CONSOLE, DETAIL 1**





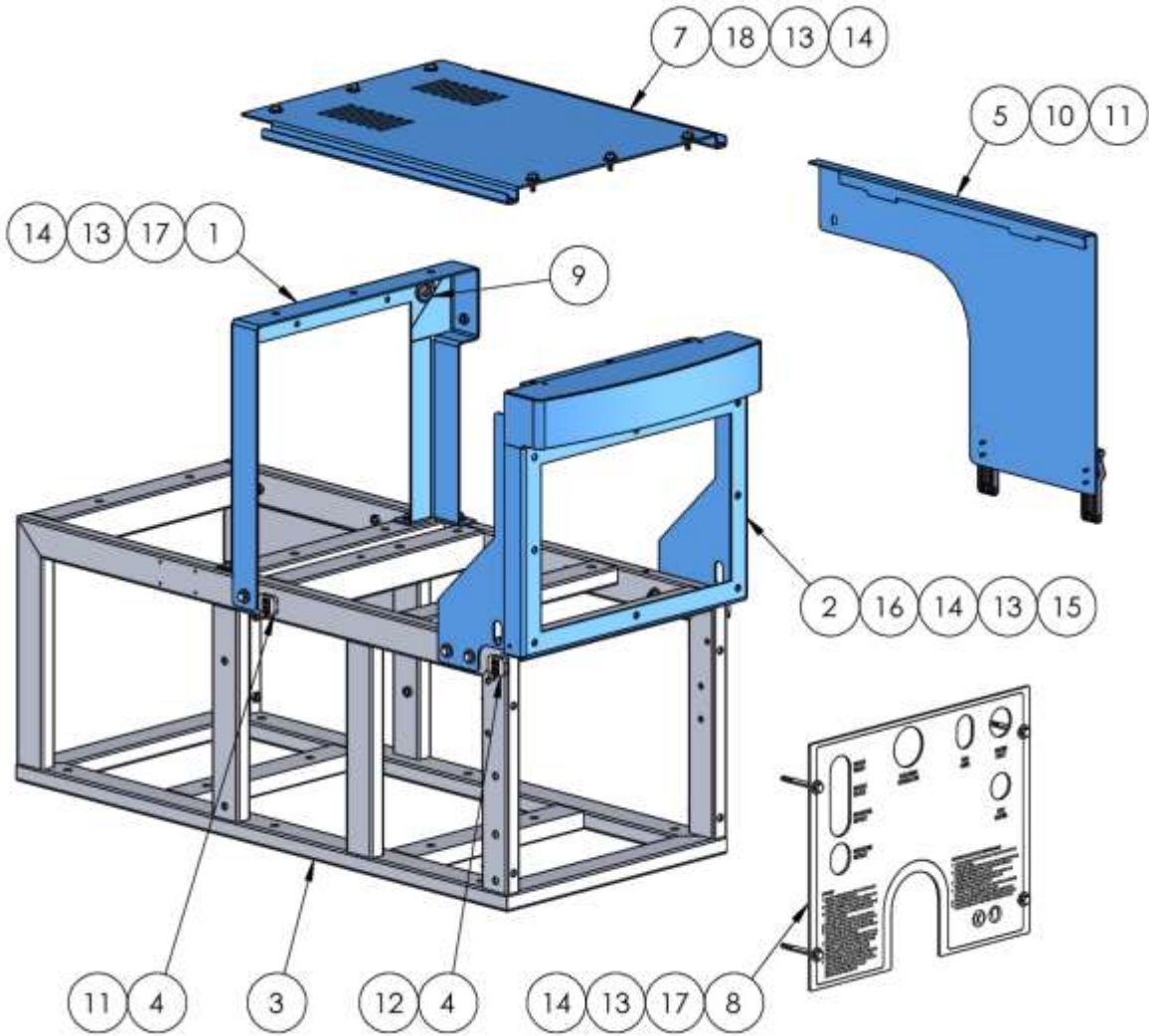
**70-1200SM15, ASSEMBLY, CONSOLE DETAIL 2**



**70-1200SM15, ASSEMBLY, CONSOLE - BOM TABLE**

2	36	10-174	SCREW, MACH 5/16-18 X 3 HXHD
2	35	10-037	SCREW, MACH 5/16-18 X 2 HXHD
4	34	12-017	WASHER, FLAT 5/16 SAE ZINC
4	33	12-016	LKWSR, 5/16 ZINC
2	32	10-003	BOLT, 1/4-20 X 3 1/2 HH ZP
8	31	10-025	SCREW, MACH 1/4-20 X 3/4 HXHD GRD5
2	30	10-028	SCREW, MACH 1/4-20 X 2-3/4 HXHD
4	29	10-030	SCREW, MACH 3/8-16 X 3 HXHD
18	28	10-170	SCREW, MACH, 3/8-16 X 2-3/4 HH G5
10	27	11-004	NUT, 1/4-20 ZINC
4	26	11-006	NUT, 3/8-16 ZINC
1	25	11-007	NUT, THUMB 1/4-20 FLWR. HEAD KNOB
40	24	12-012	WASHER, FLAT 1/4 USS
8	23	12-013	WASHER, FLAT 3/8 SAE
4	22	12-014	LKWSR, 3/8 ZINC
30	21	12-015	LKWSR, 1/4 ZINC
4	20	14-003	CLAMP,WIRE CUSHION 1.00 ID X 1/4 BOLT
1	19	14-004	CLAMP,WIRE CUSHION 3/4 ID X 1/4 BOLT
2	18	14-022	CLAMP, 1-1/4 ID VINYL COVERED
2	17	14-084	CLAMP, HOSE 4 TO 3 HD SS
1	16	16-121	HOSE, 3.5 IN ID X 3FT SILICONE
2	15	37-102	BELT, AX47 GATES EPDM
1	14	44-250	DECAL, PRODUCT PRO-1200 SE
1	13	44-252	PLATE, SERIAL PRO-1200 SE
1	12	61-1172	WELDMENT, PUMP BELT GUARD
1	11	69-352	ASSEMBLY, MANIFOLD BLOCK
1	10	69-644	ASSY, HEAT EXCHANGER ENGINE COOLANT
1	9	69-646	ASSY, FRAME & ENCLOSURES
1	8	69-647	ASSY, INSTRUMENT PANEL
1	7	69-675	ASSY, PRESSURE REGULATOR
1	6	69-678	ASSY, QD & LUBE BRACKET
1	5	69-679	ASSY, GENERAL WATER PUMP
1	4	69-680	ASSY, VACUUM PUMP
1	3	69-682	ASSY, THERMAL WELL
1	2	69-714	ASSY, PREFILTER BOX 1200
1	1	69-721	ASSY, HOT WATER VALVE
QTY	ITEM	PART NO.	DESCRIPTION

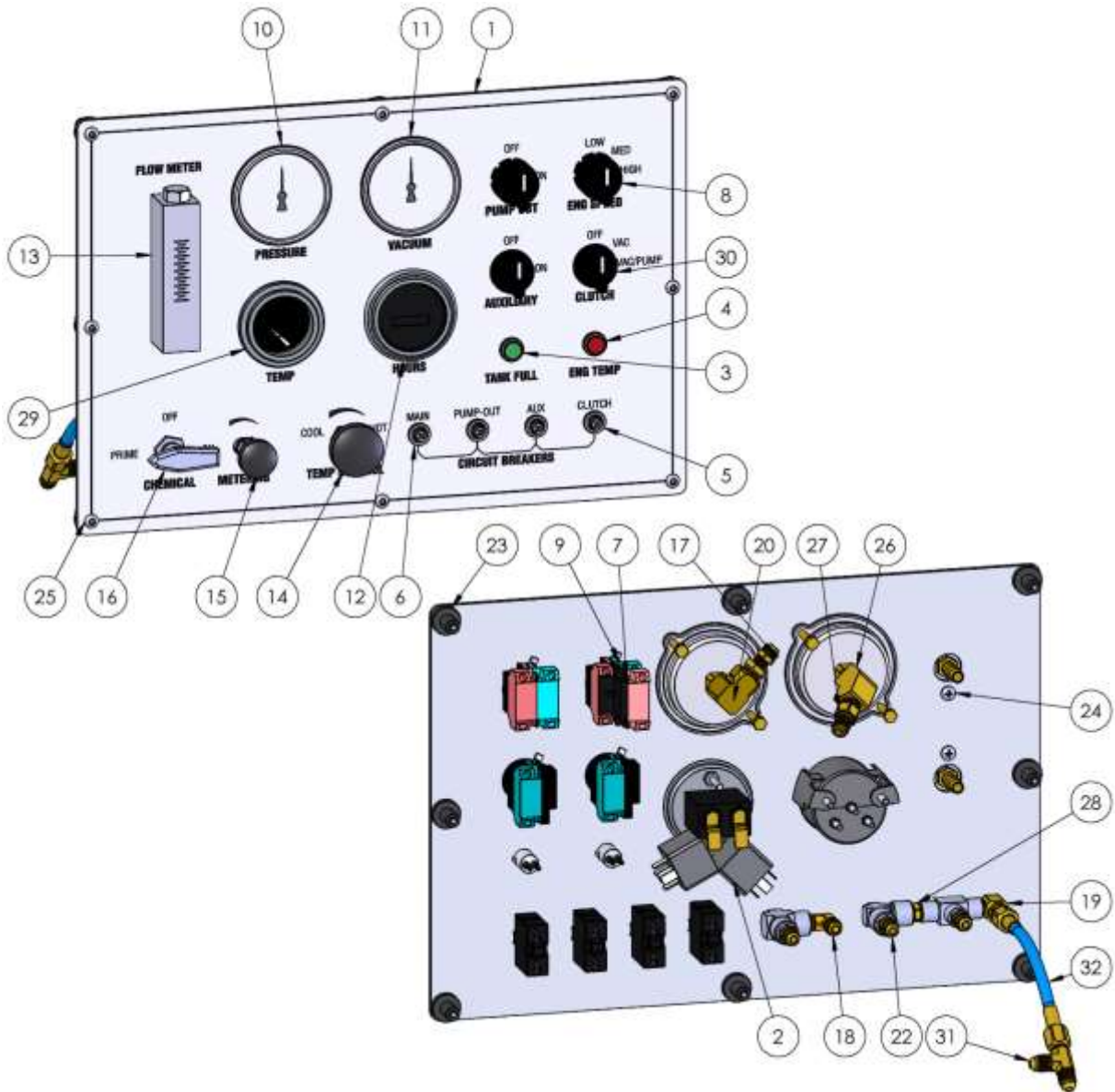
**69-646, ASSEMBLY, FRAME AND ENCLOSURES**



**69-646, ASSEMBLY, FRAME AND ENCLOSURES - BOM TABLE**

6	18	10-025	SCREW, MACH 1/4-20 X 3/4 HXHD GRD5
7	17	10-028	SCREW, MACH 1/4-20 X 2-3/4 HXHD
5	16	10-170	SCREW, MACH, 3/8-16 X 2-3/4 HH G5
4	15	11-004	NUT, 1/4-20 ZINC
22	14	12-012	WASHER, FLAT 1/4 USS
18	13	12-015	LKWSR, 1/4 ZINC
6	12	14-085	RIVET, 5/32 X .312 HD .251-.375 GRIP SS
10	11	14-086	RIVET, 5/32 X .312 HD .062-.125 GRIP SS
4	10	40-034	LATCH, DRAW SS CONCEALED MOUNT
1	9	41-071	GROMMET, 1-3/8" OD X 3/4" ID X 1/8" PANEL
1	8	58-745	PANEL, LOWER FRONT
1	7	58-780	PANEL, TOP
1	6	58-781	PANEL, LS
1	5	58-782	PANEL, RS
4	4	60-2134	PLATE, KEEPER MOUNT
1	3	61-1126	WELDMENT, FRAME
1	2	61-1127	WELDMENT, STEPPED FRONT BEZEL
1	1	61-1171	WELDMENT, REAR BRACE
QTY	ITEM	PART NO.	DESCRIPTION

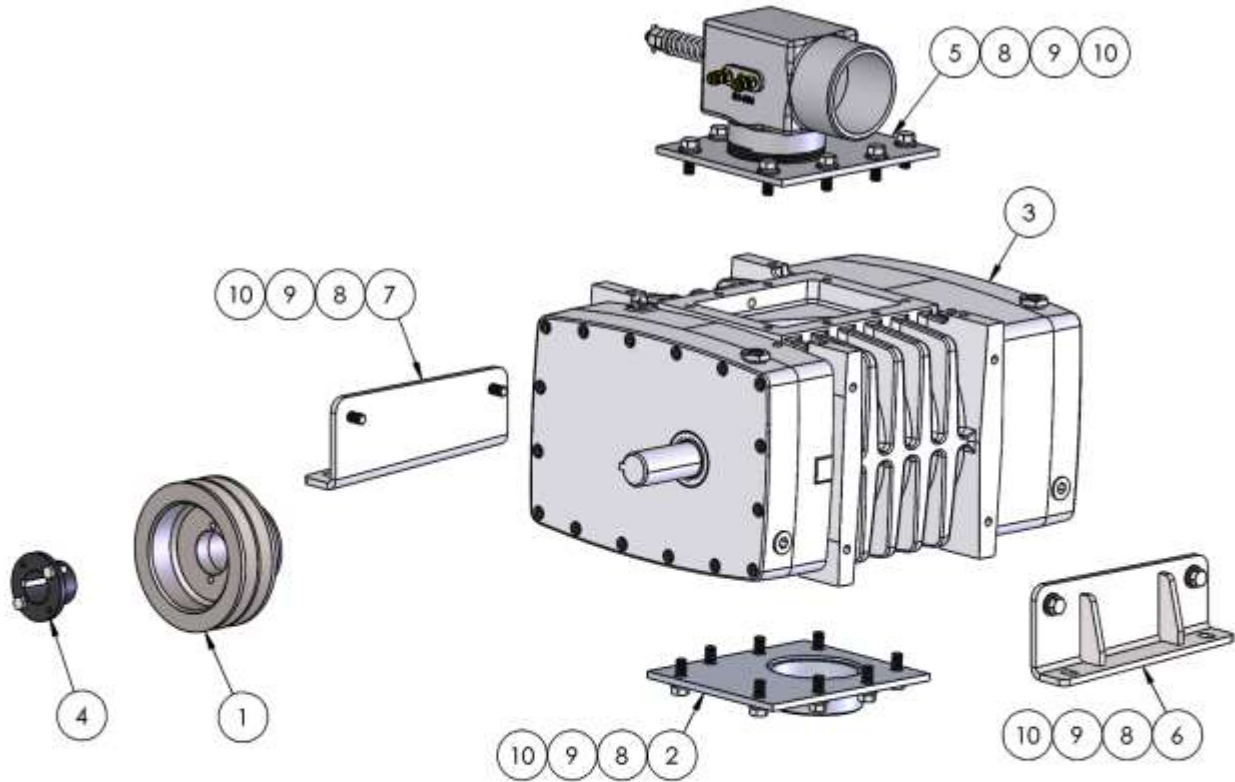
**69-647, ASSEMBLY, INSTRUMENT PANEL**



**69-647, ASSEMBLY, INSTRUMENT PANEL – BOM TABLE**

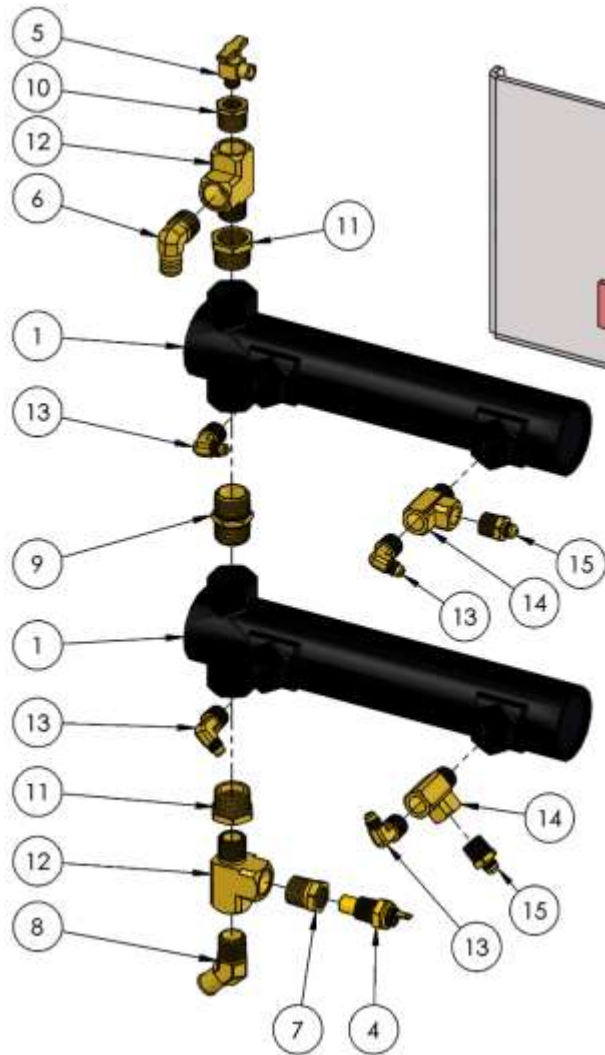
1	32	18-215-19	HOSE ASSY, 3/16 ID X 04 FJIC X 04 FJIC X 7.00L W/SS & CVR
1	31	21-566	TEE, 1/4 JIC MALE BR
2	30	29-016	SWITCH, ROTARY NON-ILLUMINATED
1	29	26-049	GAUGE, WTR TEMP CHROME 280 DEG.
1	28	21-045	NIP, 1/8 IN HEX BRASS
1	27	21-050	CONN, 1/4 NPT X 1/4 JIC BRASS
1	26	21-432	ELL, 1/4 FP X 45 DEG BRASS
8	25	10-016	SCREW, MACHINE 10-32 X 1 SOCHD SS
2	24	10-150	SCREW - 10-32 X .500 PHP ZP
8	23	11-002	NUT, WELL G 10-32
4	22	21-001	CONN, 1/8 P X 1/4 T BR
2	21	21-007	FTTG, BRB 1/8 P X 5/16 H BR
1	20	21-037	ELL, 1/4 IN. BRASS
1	19	21-038	ELL, STREET 1/8 IN BRASS
1	18	21-054	ELL, 1-8P X 1-4 T BRASS
1	17	21-433	CONN, 1/4 P X 1/4 POLY
1	16	23-027	VALVE, 3-WAY BALL 1/8 FP SS
1	15	23-028	VLV, MET 1/8 FP (CHEM) RT ANG SS
1	14	23-118	VALVE, METERING 1/8FP RT ANGLE SS
1	13	26-003	FLOWMETER, 1/8 FP
1	12	26-033	HOURMETER, HOBBS CHROME BEZEL
1	11	26-044	GAUGE, VACUUM 2.5 IN 0-30 IN/HG
1	10	26-045	GAUGE, PRESSURE 2.5 IN 0-1500 PSI
1	9	29-024	SWITCH, THROTTLE CONTROL 3 POS
1	8	29-057	SWITCH, CLUTCH CONTROL 3 POS
1	7	29-059	DUMMY BLOCK
1	6	30-007	BREAKER, 30 AMP
3	5	30-008	BREAKER, 20 AMP
1	4	30-073	LIGHT, IND LAMP 12V RED
1	3	30-074	LIGHT, IND LAMP 12V GREEN
2	2	34-010	RELAY, ENG.SHTDWN12V20/30AMP
1	1	58-744	PANEL, INSTRUMENT
QTY	ITEM	PART NO.	DESCRIPTION

**69-680, ASSEMBLY, VACUUM PUMP**



20	10	10-029	SCREW, MACH 3/8-16 X 1 HXHD
20	9	12-014	LKWSR, 3/8 ZINC
20	8	12-013	WASHER, FLAT 3/8 SAE
1	7	61-1219	WELDMENT, BLOWER MOUNT LS
1	6	61-1220	WELDMENT, BLOWER MOUNT RS
1	5	69-703	ASSY, VACUUM INLET
1	4	66-544	HUB, H X 1-1/4 W/SET SCREW
1	3	46-058	VACUUM PUMP, HELI FLOW HF408 HORZ RH CW
1	2	61-1198	WELDMENT, BLOWER OUTLET
1	1	66-388	PULLEY, 4 GROOVE
QTY	ITEM	PART NO.	DESCRIPTION

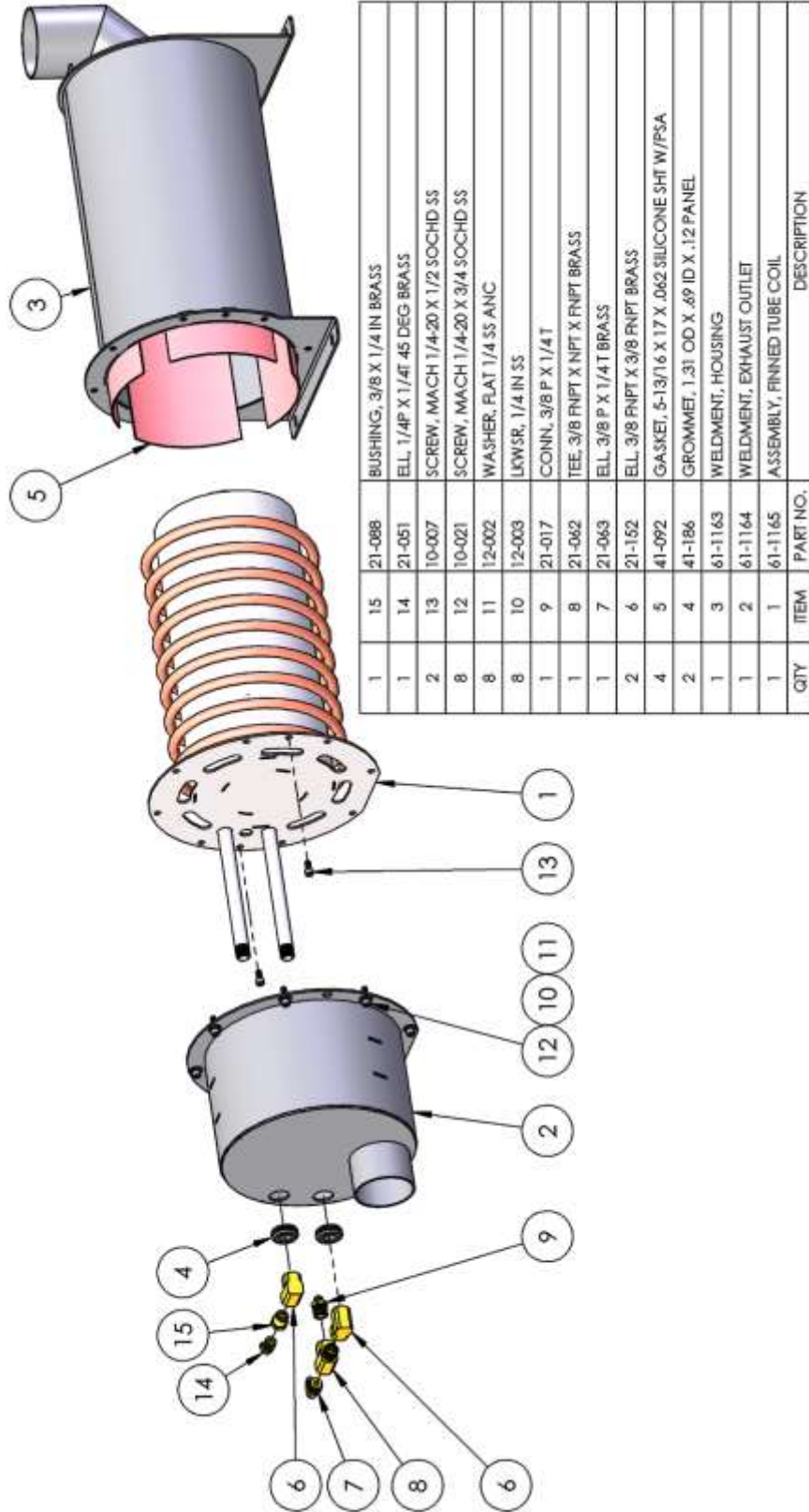
**69-644, ASSEMBLY, HEAT EXCHANGER ENGINE COOLANT**



8	19	10-106	BOLT, 5/16-18 X 1 HHCS Z5
8	18	12-016	LKWSR, 5/16 ZINC
8	17	12-017	WASHER, FLAT 5/16 SAE ZINC
4	16	14-037	CLAMP, 2 IN VINYL COATED SPIN
2	15	21-017	CONN, 3/8 P X 1/4 T
2	14	21-062	TEE, 3/8 FNPT X NPT X FNPT BRASS
4	13	21-063	ELL, 3/8 P X 1/4 T BRASS
2	12	21-111	TEE, STREET 1/2 NPT BRASS
2	11	21-131	BUSHING, 3/4M X 1/2F BRASS
1	10	21-233	BUSHING, 1/2 NPT X 1/4 FNPT
1	9	21-237	NIPPLE, 3/4 NPT HEX BRASS
1	8	21-324	ELL, 1/2P X 5/8H 45 DEG BRASS
1	7	21-371	BUSHING, 1/2 NPT X 3/8 NPT HEX BRASS
1	6	21-476	ELBOW, 1/2 P X 5/8 H BARB 90DEG BRASS
1	5	23-008	COCK, DRN 1/4P X 1/4H ELL BRASS
1	4	34-035	SWITCH, TEMP STANDARD 2SD TS-B1
1	3	41-091	PAD, 1/4 SILICONE SPONGE 1-1/2W X 1.6-1/2L
1	2	61-1124	WELDMENT, HEAT EXCHANGER MFG BRKT
2	1	63-220	HEAT EXCHANGER, ENGINE COOLANT
QTY	ITEM	PART NO.	DESCRIPTION

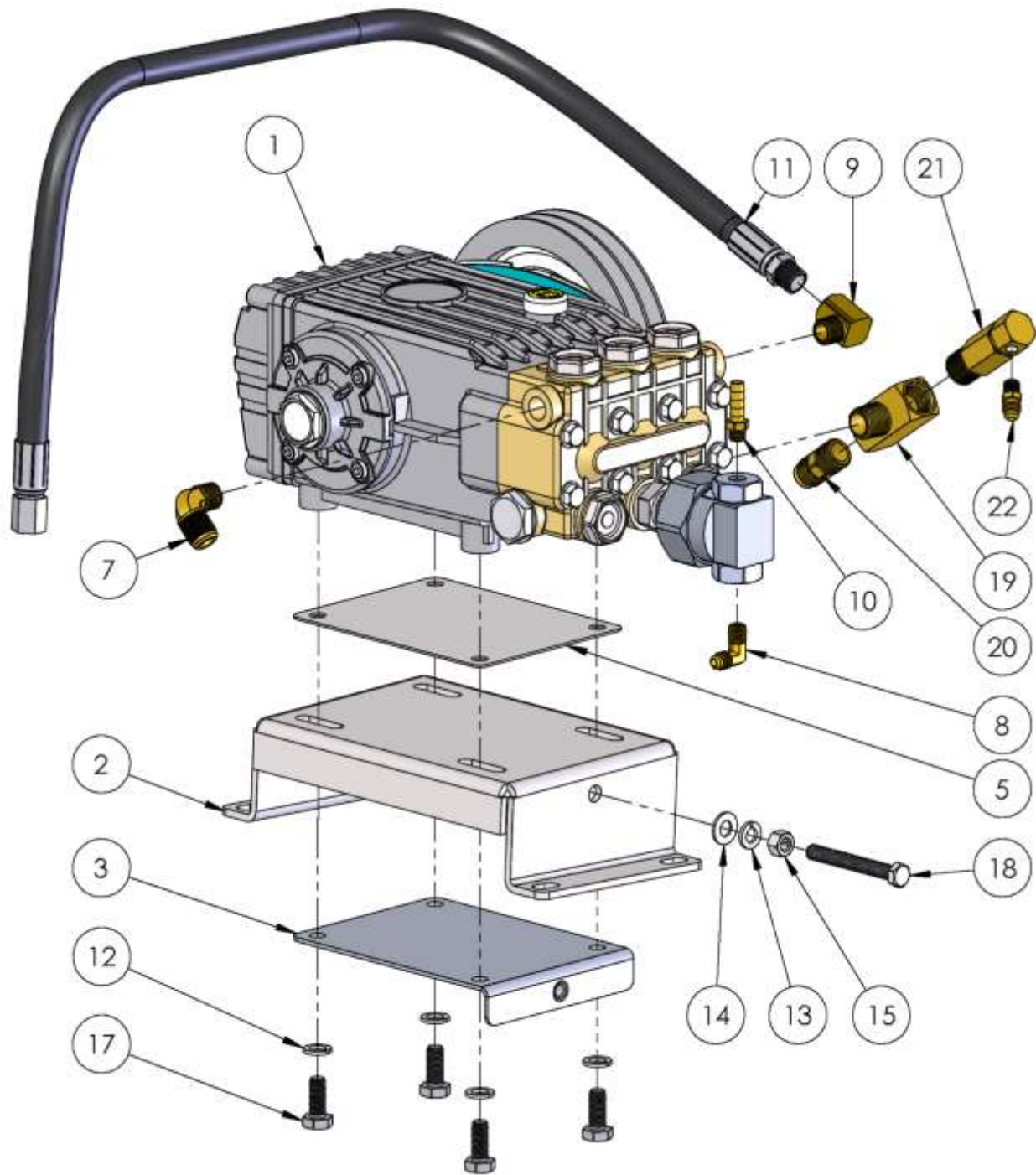


**69-682, ASSEMBLY, HEAT EXCHANGER**



QTY	ITEM	PART NO.	DESCRIPTION
1	15	21-088	BUSHING, 3/8 X 1/4 IN BRASS
1	14	21-051	ELL, 1/4P X 1/4T 45 DEG BRASS
2	13	10-007	SCREW, MACH 1/4-20 X 1/2 SOCHD SS
8	12	10-021	SCREW, MACH 1/4-20 X 3/4 SOCHD SS
8	11	12-002	WASHER, FLAT 1/4 SS ANC
8	10	12-003	LWWSR, 1/4 IN SS
1	9	21-017	CONN, 3/8 P X 1/4 T
1	8	21-062	TEE, 3/8 FNPT X NPT X FNPT BRASS
1	7	21-063	ELL, 3/8 P X 1/4T BRASS
2	6	21-152	ELL, 3/8 FNPT X 3/8 FNPT BRASS
4	5	41-092	GASKET, 5-13/16 X 17 X .062 SILICONE SHT W/PSA
2	4	41-186	GROMMET, 1.31 OD X .69 ID X .12 PANEL
1	3	61-1163	WELDMENT, HOUSING
1	2	61-1164	WELDMENT, EXHAUST OUTLET
1	1	61-1165	ASSEMBLY, FINNED TUBE COIL

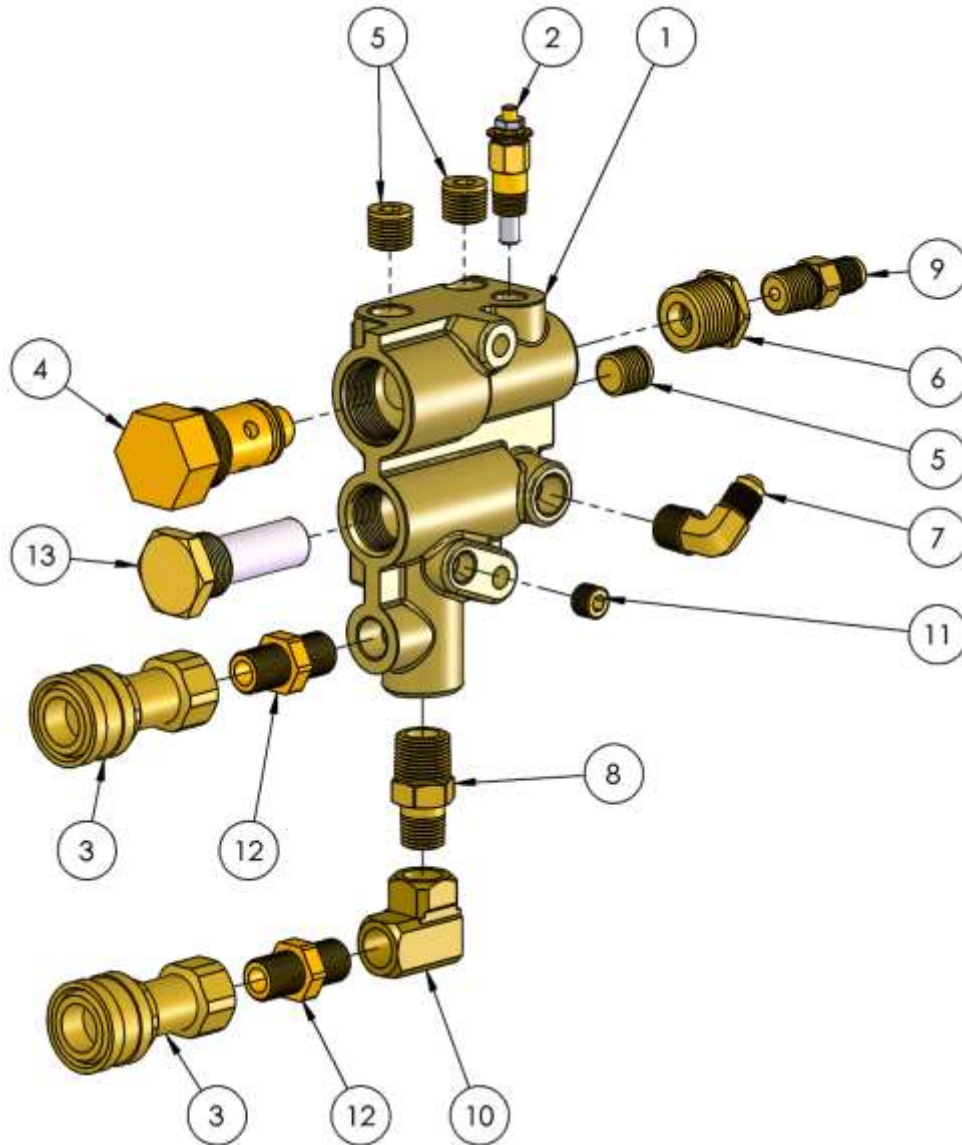
**69-679, ASSEMBLY, GENERAL WATER PUMP**



**69-679, ASSEMBLY, GENERAL WATER PUMP BOM TABLE**

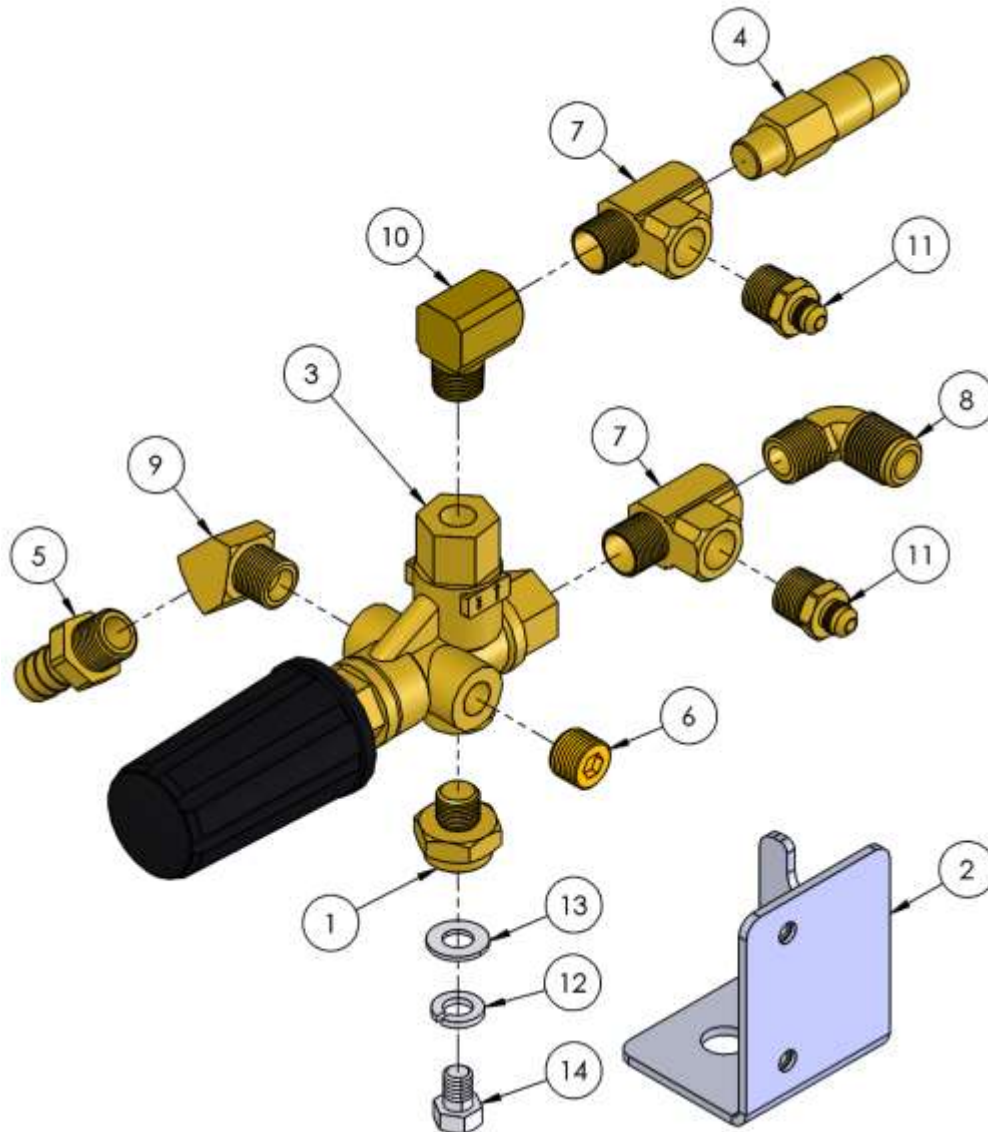
1	22	21-001	CONN, 1/8 P X 1/4 T BR
1	21	23-033	VALVE, 165 DEG THERMAL CAT 7145
1	20	21-012	CONN, 1/2 NPT X 1/2 T BRASS
1	19	21-442	TEE, .50 FP X .50 MP X .50 FP BRASS
1	18	10-057	BOLT, TAP 3/8-16 X 3 GR 5
4	17	10-208	SCREW, M10-1.5 X 30MM HCS Z GR8.8
1	16	10-249	SCREW, MACH M6-1.0 X 20MM SOCHD BLK
1	15	11-006	NUT, 3/8-16 ZINC
1	14	12-013	WASHER, FLAT 3/8 SAE
1	13	12-014	LKWSR, 3/8 ZINC
4	12	12-024	LKWSR, 10MM ZINC
1	11	18-199	HOSE, PULSE 3/8 S 36 IN
1	10	21-007	FTTG, BRB 1/8 P X 5/16 H BR
1	9	24-00508	FITTING - ELBOW STREET 3/8 IN BRASS
1	8	21-054	ELL, 1-8P X 1-4 T BRASS
1	7	21-061	ELL, 3/8 P X 1/2 T BRASS
10 IN	6	32-025	LOOM, HI HEAT .250 DIA. BLACK
1	5	58-619	PLATE, GEN HTS2016SR SHIM .060 THK
1	4	58-624	WASHER, .255 X 1.20 X 7GA
1	3	61-1161	WELDMENT, PRESSURE PUMP ADJUST
1	2	61-1200	WELDMENT, PRESSURE PUMP BRKT
1	1	68-180	ASSY, PRESSURE PUMP
QTY	ITEM	PART NO.	DESCRIPTION

**69-352, ASSEMBLY, SOLUTION MANIFOLD**



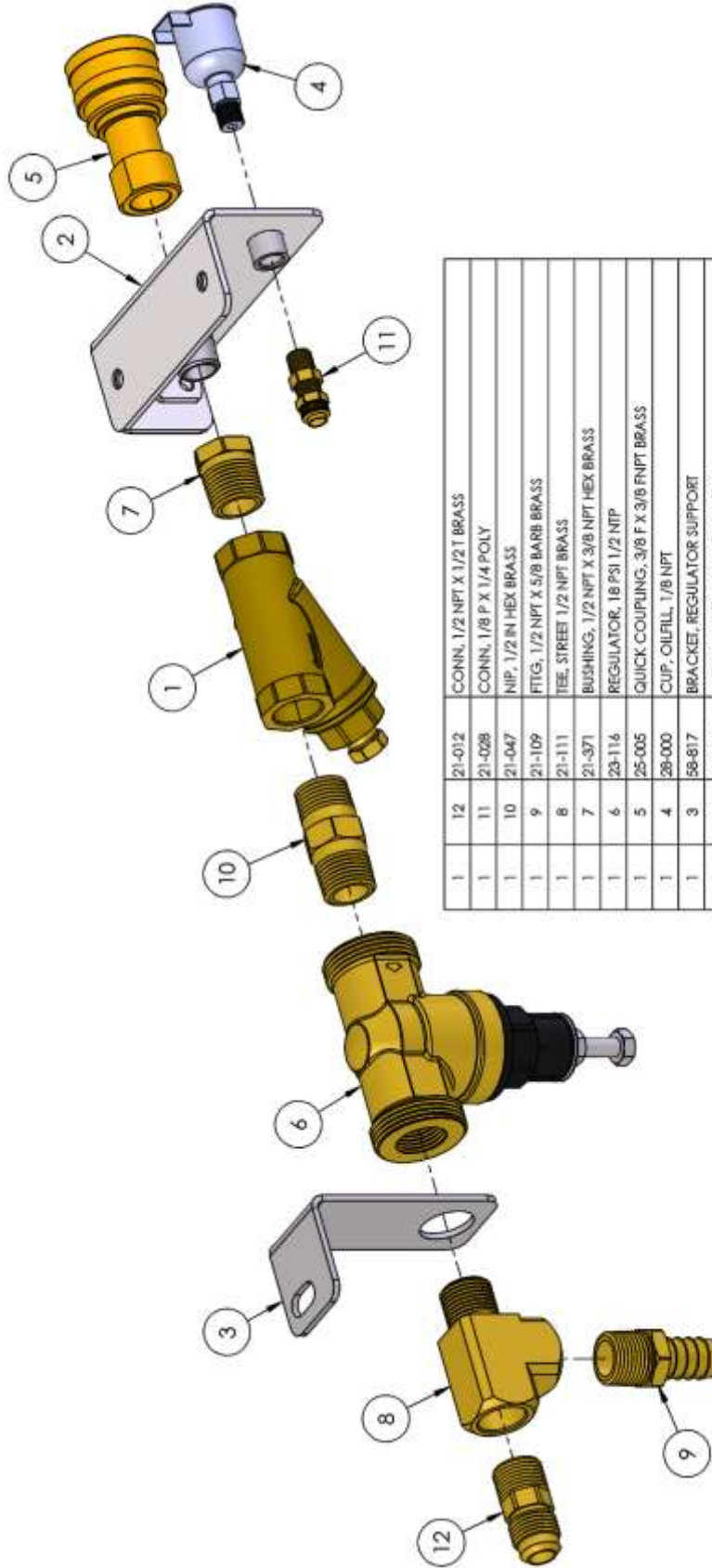
1	13	20-018	SCREEN, CHECK VALVE MANIFOLD
2	12	21-026	NIP, 1/4 HEX BRASS
1	11	21-029	PLUG, 1/8 NPT SOCKET HD BRASS
1	10	21-037	ELL, 1/4 IN. BRASS
1	9	21-050	CONN, 1/4 NPT X 1/4 JIC BRASS
1	8	21-052	NIP, 3/8 X 1/4 HEX BRASS
1	7	21-064	ELL, 1/4 P X 1/4 T BRASS
1	6	21-233	BUSHING, 1/2 NPT X 1/4 FNPT
3	5	21-264	PLUG, 1/4 NPT BRASS
1	4	23-063	CHECK VALVE MANIFOLD
2	3	25-001	DSC, 1/4F X 1/4FP BRASS
1	2	34-000	SENER, TEMP, 140-320 DEGREE
1	1	66-205	MANIFOLD BLOCK
QTY	ITEM	PART NO.	DESCRIPTION

**69-675, ASSEMBLY, PRESSURE REGULATOR BRACKET**



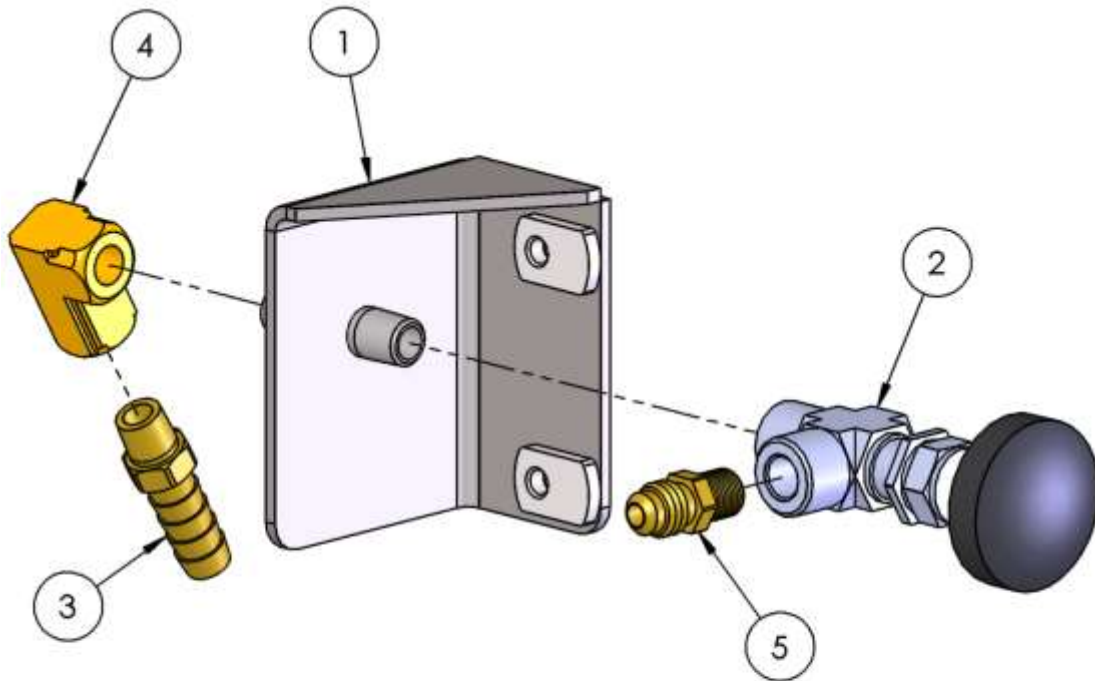
1	14	10-157	SCREW, MACH 3/8-16 X 1/2 HH ZP
1	13	12-013	WASHER, FLAT 3/8 SAE
1	12	12-014	LKWSR, 3/8 ZINC
2	11	21-017	CONN, 3/8 P X 1/4 T
1	10	21-040	ELL, STREET 3/8 IN BRASS
1	9	21-043	ELL, STREET 3/8 IN 45 DEG BRASS
1	8	21-061	ELL, 3/8 P X 1/2 T BRASS
2	7	21-062	TEE, 3/8 FNPT X NPT X FNPT BRASS
1	6	21-146	PLUG, 3/8 NPT BRASS
1	5	21-261	FITTING, 5/8 HOSE BARB X 3/8 NPT BRASS
1	4	23-077	VALVE, POP-OFF 3/8 NPT
1	3	23-079	UNLOADER, CAT #7670
1	2	61-1158	WELDMENT, PRESSURE REGULATOR BRACKET
1	1	66-340	FITTING, 3/8 NPT M X 3/8-16 F STANDOFF
QTY	ITEM	PART NO.	DESCRIPTION

**69-678, ASSEMBLY, WATER INLET AND VACUUM LUBE BRACKET**



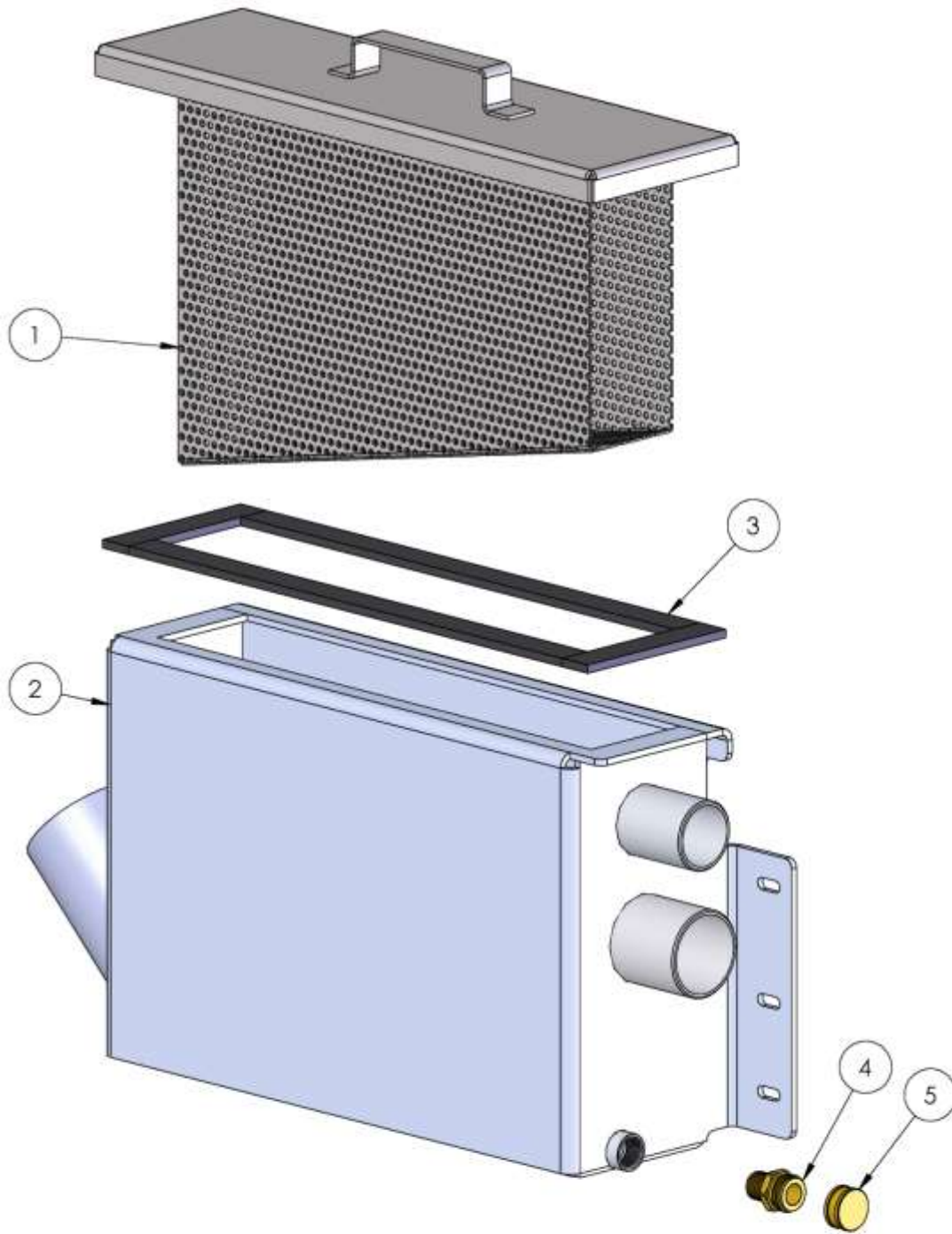
QTY	ITEM	PART NO.	DESCRIPTION
1	12	21-012	CONN, 1/2 NPT X 1/2 T BRASS
1	11	21-028	CONN, 1/8 P X 1/4 POLY
1	10	21-047	NIP, 1/2 IN HEX BRASS
1	9	21-109	FITG, 1/2 NPT X 5/8 BARB BRASS
1	8	21-111	TEE, STREET 1/2 NPT BRASS
1	7	21-371	BUSHING, 1/2 NPT X 3/8 NPT HEX BRASS
1	6	23-116	REGULATOR, 18 PSI 1/2 NTP
1	5	25-005	QUICK COUPLING, 3/8 F X 3/8 FNPT BRASS
1	4	28-000	CUP, OILFILL, 1/8 NPT
1	3	58-817	BRACKET, REGULATOR SUPPORT
1	2	61-1160	WELDMENT, QD & LUBE BRACKET
1	1	69-505	ASSY, 1/2 WYE STRAINER

**69-721, ASSEMBLY, HOT WATER VALVE**



1	5	21-001	CONN, 1/8 P X 1/4 T BR
1	4	21-090	ELL, 1/8 FNPT X 1/8 FNPT BRASS
1	3	21-170	FITG, BARB 1/8 MNPT X 3/8 H BRASS
1	2	23-118	VALVE, METERING 1/8FP RT ANGLE SS
1	1	61-1222	WELDMENT, HOT WATER BRACKET
QTY	ITEM	PART NO.	DESCRIPTION

**69-714, ASSEMBLY, PREFILTER BOX**



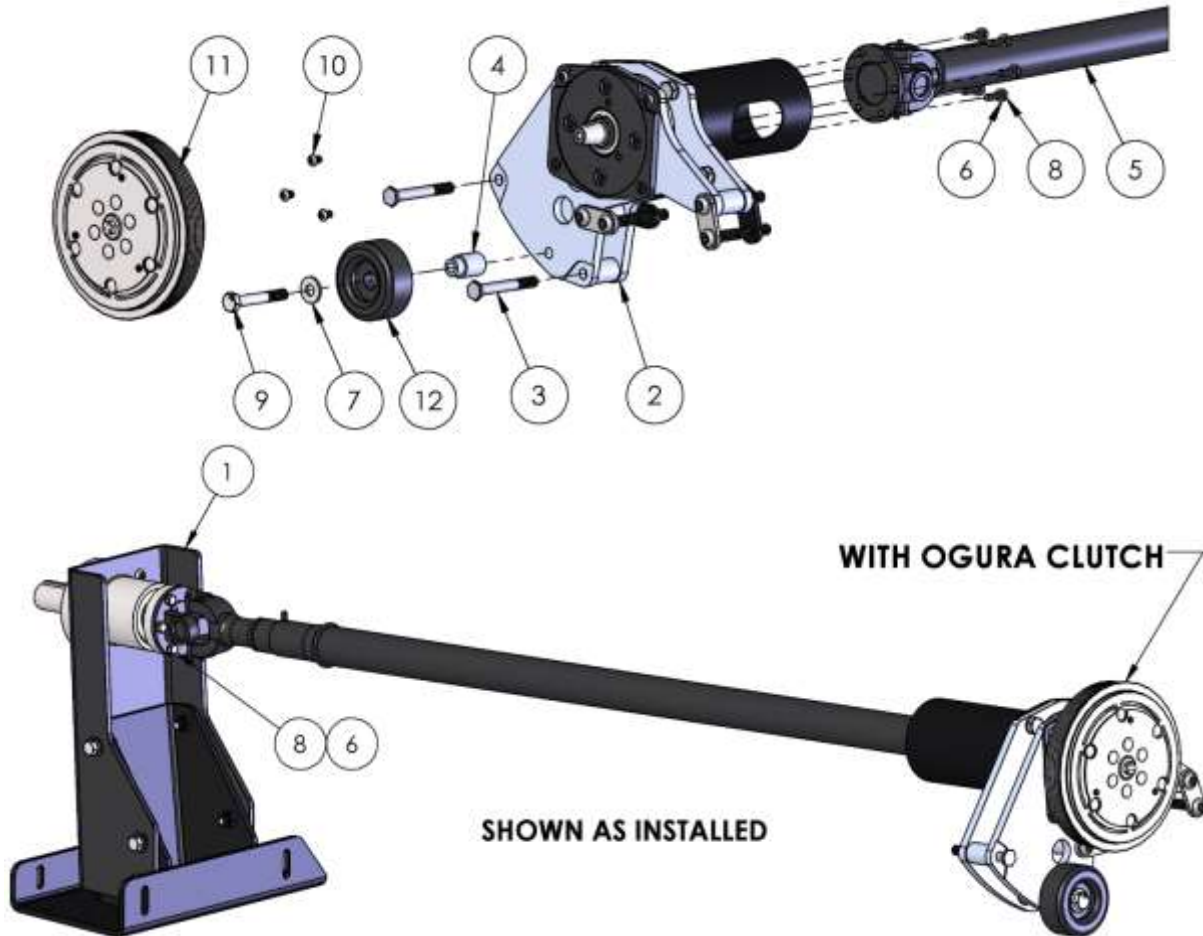
1	5	21-071	CAP, GARDEN HOSE 3/4 BRASS
1	4	21-398	FTG, GRDN HOSE 1/2 P X 3/4 H
44.52 IN	3	41-018	GASKET, SPONGE 1 IN X 45 FT
1	2	61-1214	WELDMENT, PREFILTER BOX
1	1	61-1215	WELDMENT, FILTER BOX LID
QTY	ITEM	PART NO.	DESCRIPTION





**68-370, KIT, SM FRONT END GM**

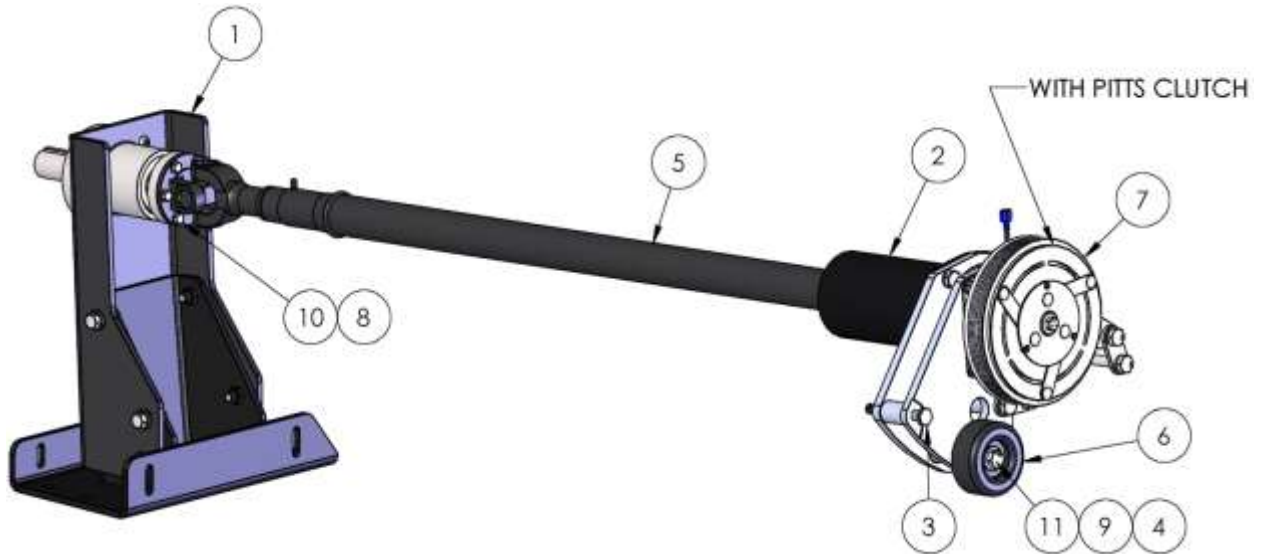
**WITH OGURA CLUTCH**  
 SERIAL NUMBER 171 AND HIGHER



2	12	38-078	PULLEY, TENSIONER 76MM FLAT
1	11	66-552	CLUTCH, 7 IN MODIFIED OGURA 8 GRV - 6 GRV
3	10	10-365	SCREW, 1/4-20 X 3/8 BO BHSCS W-NYLON PATCH
1	9	10-187	SCREW, M10-1.5 X 70MM Z HXHD G8.8
12	8	10-325	SCREW, M6-1.0 X 20MM 8.8 HXHD ZP
1	7	12-013	WASHER, FLAT 3/8 SAE
12	6	12-063	WASHER, LOCK M6 ZP
1	5	42-023	DRIVELINE, ELBE SERIES 107 FLGD
1	4	66-517	SPACER, IDLER PULLEY
2	3	66-519	BOLT, 10MM X 80MM REDUCED HEAD HEIGHT
1	2	69-722	ASSY, CLUTCH SHAFT HOUSING MOUNT
1	1	69-726	ASSY, PULLEY SHAFT HOUSING MOUNT
QTY	ITEM	PART NO.	DESCRIPTION

**68-370, KIT, SM FRONT END GM**

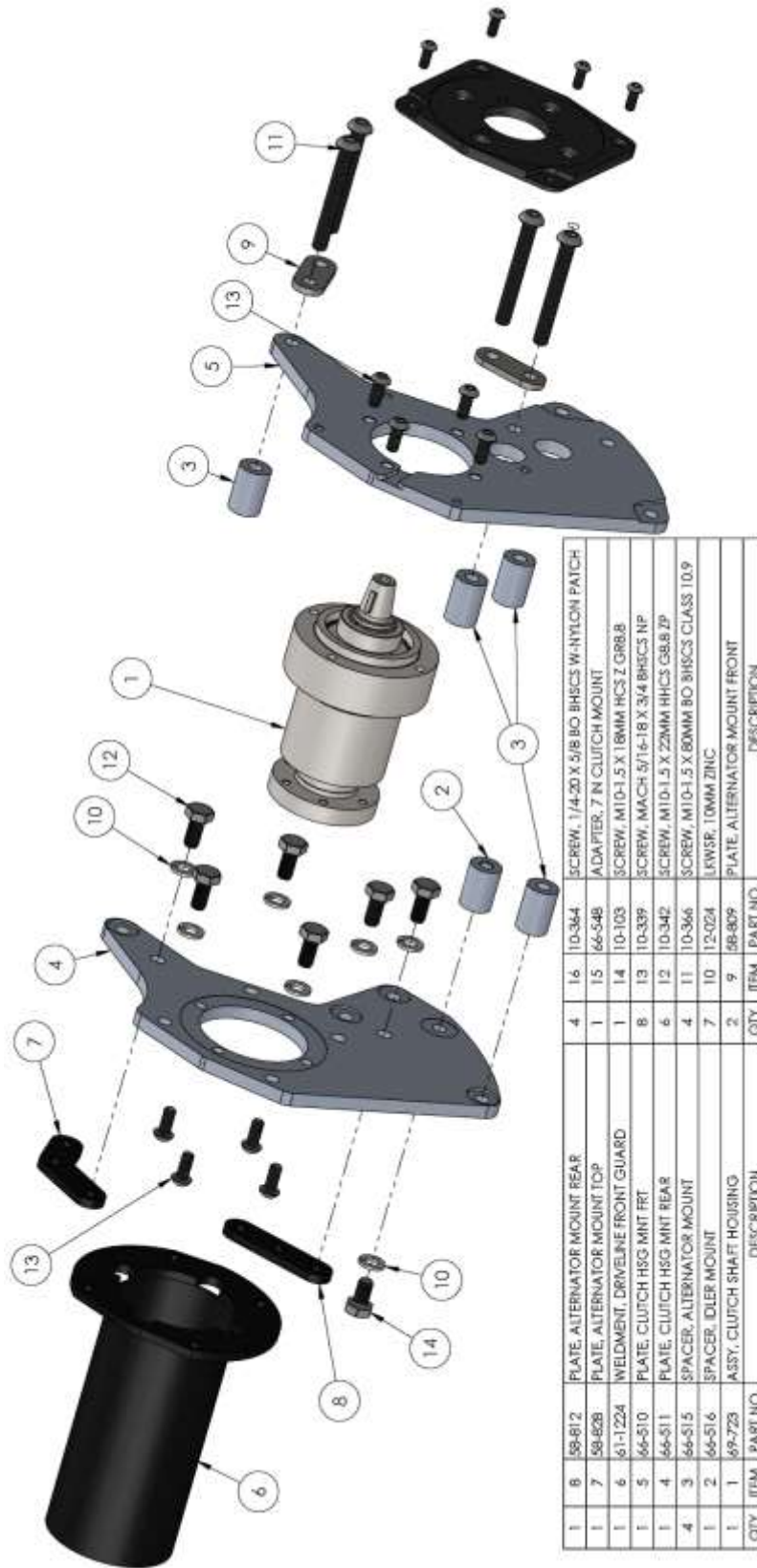
**WITH PITTS CLUTCH**  
 SERIAL NUMBER 101 – 170



1	11	10-187	SCREW, M10-1.5 X 70MM Z HXHD G8.8
12	10	10-325	SCREW, M6-1.0 X 20MM 8.8 HXHD ZP
1	9	12-013	WASHER, FLAT 3/8 SAE
12	8	12-063	WASHER, LOCK M6 ZP
1	7	35-031	ASSY, 7 IN DIA CLUTCH 6K GRV
1	6	38-078	PULLEY, 76MM FLAT
1	5	42-023	DRIVELINE, ELBE SERIES 107 FLGD
1	4	66-517	SPACER, IDLER PULLEY
2	3	66-519	BOLT, 10MM X 80MM REDUCED HEAD HEIGHT
1	2	69-722	ASSY, CLUTCH SHAFT HOUSING MOUNT
1	1	69-726	ASSY, PULLEY SHAFT HOUSING MOUNT
QTY	ITEM	PART NO.	DESCRIPTION

**69-722, ASSEMBLY, CLUTCH SHAFT HOUSING MOUNT**

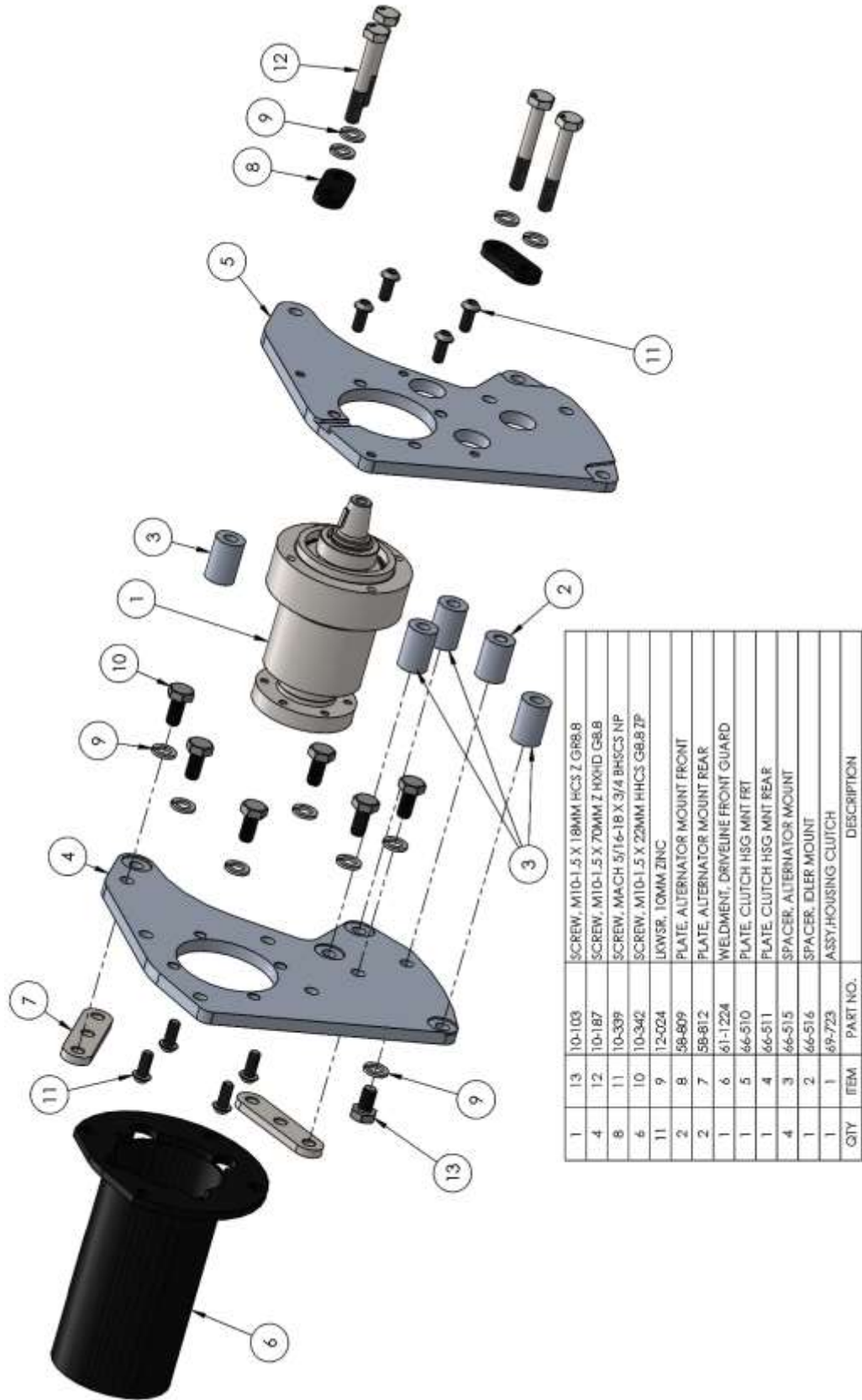
SERIAL NUMBERS 171 AND HIGHER – FOR OGURA CLUTCH



QTY	ITEM	DESCRIPTION	QTY	ITEM	PART NO.	DESCRIPTION
1	8	PLATE, ALTERNATOR MOUNT REAR	4	16	10-344	SCREW, 1/4-20 X 5/8 BO BHCS W-NYLON PATCH
1	7	PLATE, ALTERNATOR MOUNT TOP	1	15	66-548	ADAPTER, 7 IN CLUTCH MOUNT
1	6	WELDMENT, DRIVELINE FRONT GUARD	1	14	10-103	SCREW, M10-1.5 X 18MM HCS Z ORB.8
1	5	PLATE, CLUTCH HSG MNT FRNT	8	13	10-339	SCREW, MACH 5/16-18 X 3/4 BHCS NP
1	4	PLATE, CLUTCH HSG MNT REAR	6	12	10-342	SCREW, M10-1.5 X 22MM HHCS GB.8 ZP
4	3	SPACER, ALTERNATOR MOUNT	4	11	10-366	SCREW, M10-1.5 X 80MM BO BHCS CLASS 10.9
1	2	SPACER, IDLER MOUNT	7	10	12-024	LEWSP, 10MM ZINC
1	1	69-722 ASY, CLUTCH SHAFT HOUSING	2	9	58-809	PLATE, ALTERNATOR MOUNT FRONT
QTY	ITEM	DESCRIPTION	QTY	ITEM	PART NO.	DESCRIPTION

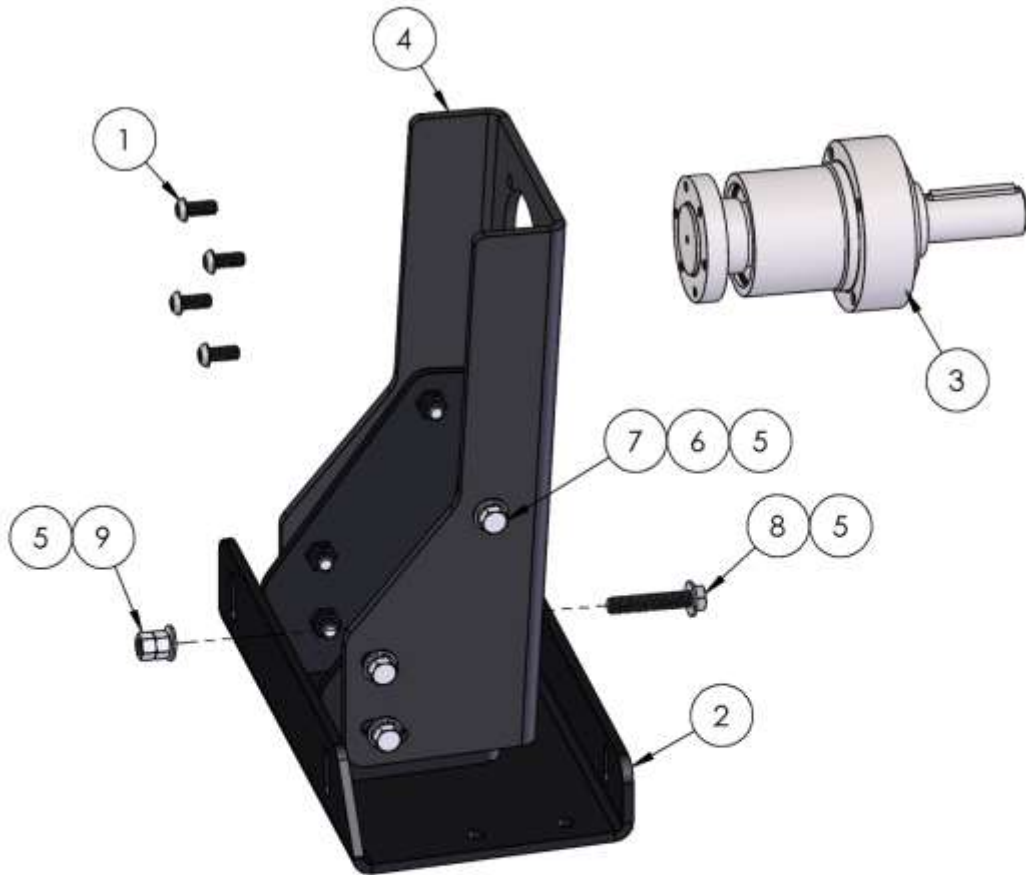
**69-722, ASSEMBLY, CLUTCH SHAFT HOUSING MOUNT**

SERIAL NUMBERS 101-170 – FOR PITTS CLUTCH



QTY	ITEM	PART NO.	DESCRIPTION
1	13	10-103	SCREW, M10-1.5 X 18MM HCS Z GR8.8
4	12	10-187	SCREW, M10-1.5 X 70MM Z HXHD GB&B
8	11	10-339	SCREW, MACH 5/16-18 X 3/4 BHCS NP
6	10	10-342	SCREW, M10-1.5 X 22MM HHCS GB.8 ZP
11	9	12-024	LWNSR, 10MM ZINC
2	8	58-809	PLATE, ALTERNATOR MOUNT FRONT
2	7	58-812	PLATE, ALTERNATOR MOUNT REAR
1	6	61-1224	WELDMENT, DRIVELINE FRONT GUARD
1	5	66-510	PLATE, CLUTCH HSG MNT FR
1	4	66-511	PLATE, CLUTCH HSG MNT REAR
4	3	66-515	SPACER, ALTERNATOR MOUNT
1	2	66-516	SPACER, IDLER MOUNT
1	1	69-723	ASSY, HOUSING CLUTCH

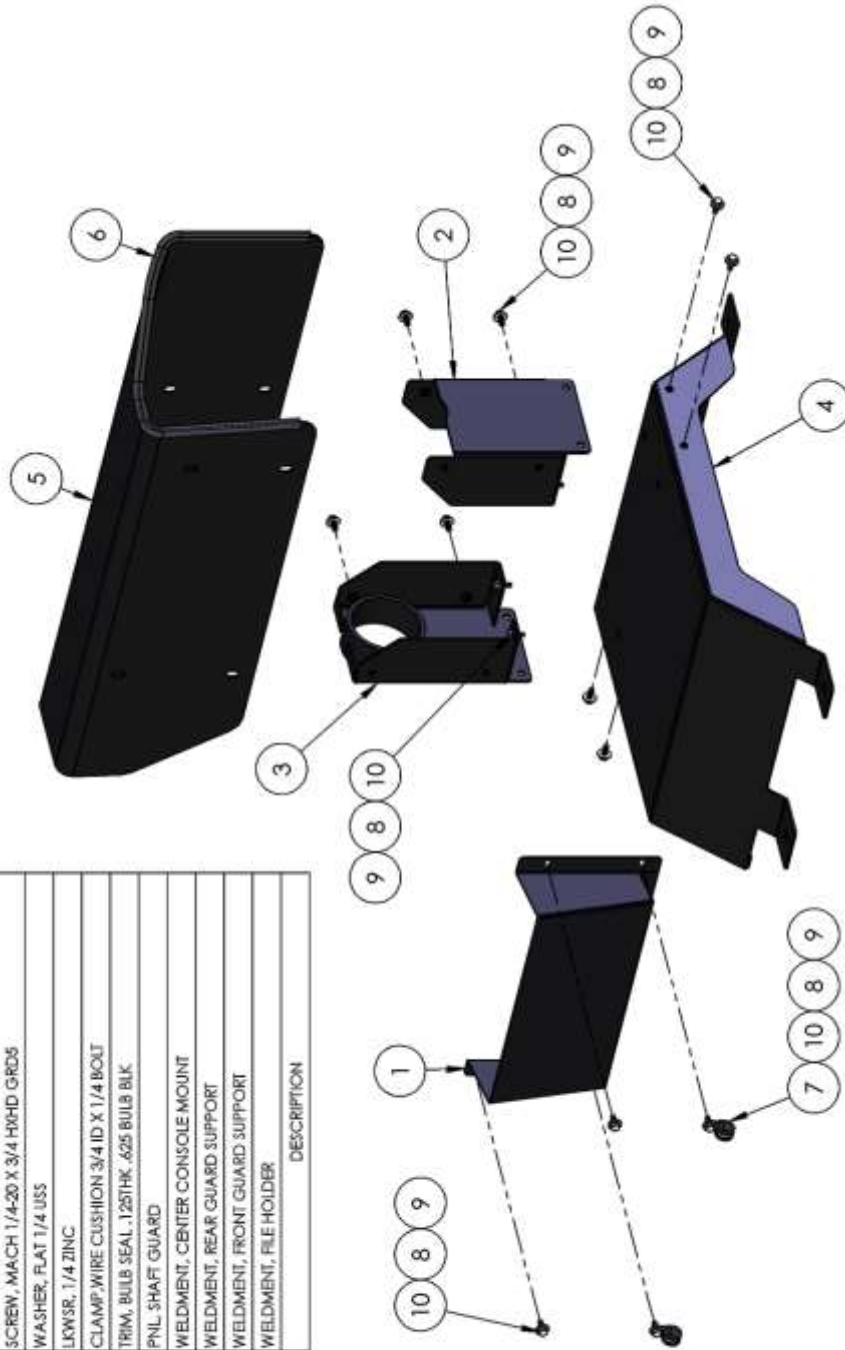
**69-726, ASSEMBLY, PULLEY SHAFT HOUSING**



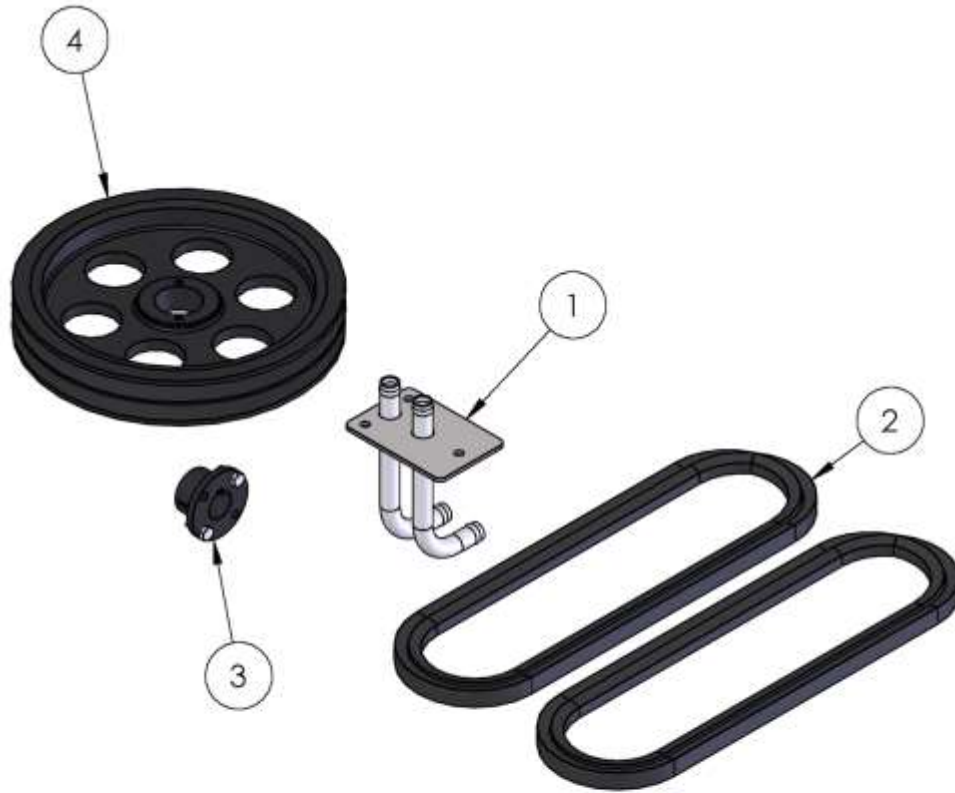
2	9	11-006	NUT, 3/8-16 ZINC
1	8	10-347	BOLT, TAP 3/8-16 X 2 HXHD ZP
6	7	10-004	SCREW, MACH 3/8-16 X 1-1/4 HEXHD
6	6	12-014	LKWSR, 3/8 ZINC
8	5	12-013	WASHER, FLAT 3/8 SAE
1	4	60-2504	PANEL, PULLEY SHAFT HSG MNT SUPPORT
1	3	69-724	ASSY, PULLEY SHAFT HOUSING
1	2	61-1226	WELDMNT, PULLEY SHAFT HSG MNT
4	1	10-339	SCREW, MACH 5/16-18 X 3/4 BHSCS NP
QTY	ITEM	PART NO.	DESCRIPTION

**69-729, CENTER CONSOLE**

QTY	ITEM	PART NO.	DESCRIPTION
16	10	10-025	SCREW, MACH 1/4-20 X 3/4 HXHD GRD5
16	9	12-012	WASHER, FLAT 1/4 USS
16	8	12-015	LKWSR, 1/4 ZINC
2	7	14-004	CLAMP,WIRE CUSHION 3/4 ID X 1/4 BOLT
28 IN	6	41-190	TRIM, BULB SEAL, 1.25THK, .625 BULB BLK
1	5	58-815	PNL SHAFT GUARD
1	4	61-1225	WELDMENT, CENTER CONSOLE MOUNT
1	3	61-1228	WELDMENT, REAR GUARD SUPPORT
1	2	61-1229	WELDMENT, FRONT GUARD SUPPORT
1	1	61-1230	WELDMENT, FILE HOLDER



**MISCELLANEOUS COMPONENTS**



1	4	38-111	PULLEY, BROWNING 2BK110H
1	3	38-052	BUSHING, BROWNING H X 1.125
2	2	37-104	BELT, BX68 GATES EPDM
1	1	61-1232	WELDMENT, FLOOR HOSE MANIFOLD
QTY	ITEM	PART NO.	DESCRIPTION





**69-728, INSTALL KIT COMPONENTS - BOM TABLE**

1	36	10-025	SCREW, MACH 1/4-20 X 3/4 HXHD GRD5
2	35	10-029	SCREW, MACH 3/8-16 X 1 HXHD
10	34	10-057	BOLT, TAP 3/8-16 X 3 GR 5
11	33	10-205	SCREW, SELF DRILL 1/4-14 X 1-1/4 HXHD
2	32	10-289	SCREW, MACH M6-1.0 X 12 MM BHSCS ZP
2	31	10-347	BOLT, TAP 3/8-16 X 2 HXHD ZP
2	30	10-348	BOLT, TAP 3/8-16 X 5 HXHD ZP
5	29	10-350	SCREW, SELF-DRILL PHFH #6-20 X 1.50 SS
1	28	10-351	SCREW, SELF-DRILL PHFH #6-20 X 1.50 SS
2	27	11-006	NUT, 3/8-16 ZINC
1	26	12-012	WASHER, FLAT 1/4 USS
4	25	12-013	WASHER, FLAT 3/8 SAE
2	24	12-014	LKWSR, 3/8 ZINC
1	23	12-015	LKWSR, 1/4 ZINC
2	22	12-063	WASHER, LOCK M6 ZP
6	21	14-005	CLAMP,WIRE CUSHION 5/8 ID X 1/4 BOLT
1	20	14-010	CLAMP, HOSE #32
7	19	14-012	CLAMP, HOSE #8
1	18	14-022	CLAMP, 1-1/4 ID VINYL COVERED
1	17	14-037	CLAMP, 2' #26 VINYL COATED SPIN
1	16	14-058	CLAMP, WIRE CUSHION 2-1/4 X 1/4 BOLT
3	15	14-109	CLAMP, HOSE 1.125 WIRE SPRING
20 FT	14	16-005	HOSE, WTR 5/8 IN HZN500 FT BULK
20 FT	13	16-135	HOSE, WTR 5/8 IN HZN500 FT BULK RED
1	12	21-100	WASHER, FLAT #6 ZP
1	11	21-418	COUPLING, 5/8 BARB BRASS
1	10	21-538	TEE, 3/4 H BARB NYLON
1	9	31-041	TERM, INS PSH ON 16016 GA. BLUE MALE
2	8	31-234	MOUNTING BOLT, BATTERY CABLE
1	7	41-108	GROMMET, PUSH IN 11/16 ID
14	6	58-055	PLATE, MACHINE MOUNTING
1	5	58-816	PLT, POST MOUNTING
1	4	58-829	PLATE, DOGHOUSE TEMPLATE
1	3	58-843	PANEL, CUTOUT COVER
1	2	66-551	PLUG, RESONATOR FOR GM16
1	1	69-733	ASSY, VACUUM HOSE PORT
QTY	ITEM	PART NO.	DESCRIPTION

1	EA	34-033-1	MODULE, ELEC CHEVY THROTTLE
1	EA	34-049	MODULE, OFF-DELAY TIMER
1	EA	47-102	HARNESS, FRONT END KIT GM
1	EA	47-148	HARNESS, ALTERNATOR EXTENSION
QTY	U/M	PART NO.	DESCRIPTION
<b>ITEMS NOT SHOWN IN DRAWING VIEWS</b>			

**DECALS**



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

44-055 A

44-066, WARNING,  
ELECTRICAL SHOCK



**READ THE OPERATOR'S MANUAL  
BEFORE INSTALLING OR  
STARTING THIS UNIT. FAILURE TO  
ADHERE TO INSTRUCTIONS CAN  
RESULT IN SEVERE PERSONAL  
INJURY OR COULD BE FATAL.  
REPLACEMENT  
MANUALS CAN BE PURCHASED  
FROM:  
Sapphire Scientific  
2604 Liberator  
Prescott, AZ 86301**

44-067 A

44-067, WARNING, READ MANUAL



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

44-083 A

44-083, WARNING, HIGH  
PRESSURE



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

44-085 A

44-085, WARNING,  
ROTATING MACHINERY

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



**DO NOT MODIFY  
UNIT WITHOUT  
WRITTEN  
PERMISSION  
FROM  
MANUFACTURER**

44-082 A

44-082, DANGER, ROTATING  
MACHINERY



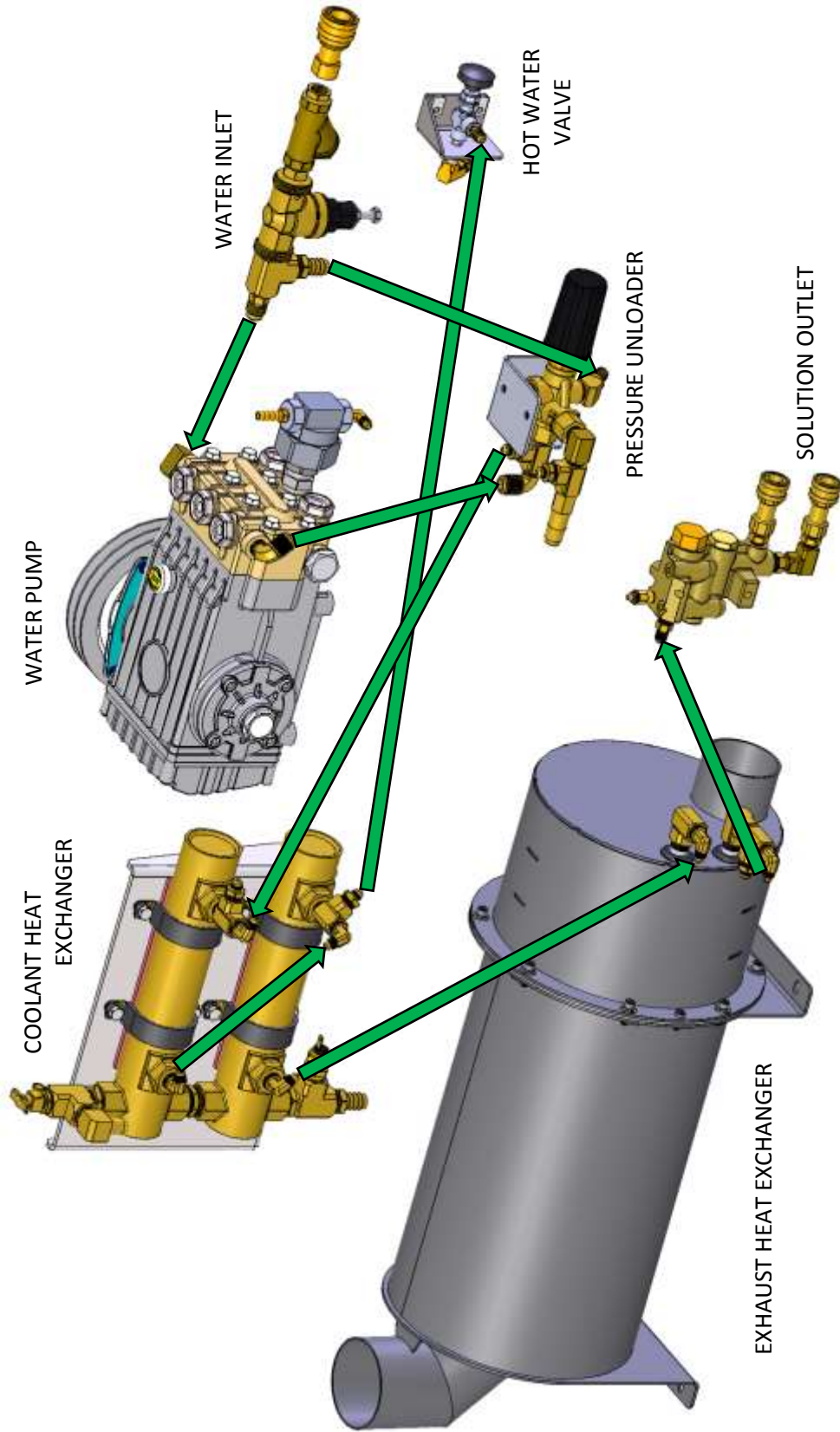
44-084 A

44-084, CAUTION, HOT SURFACE

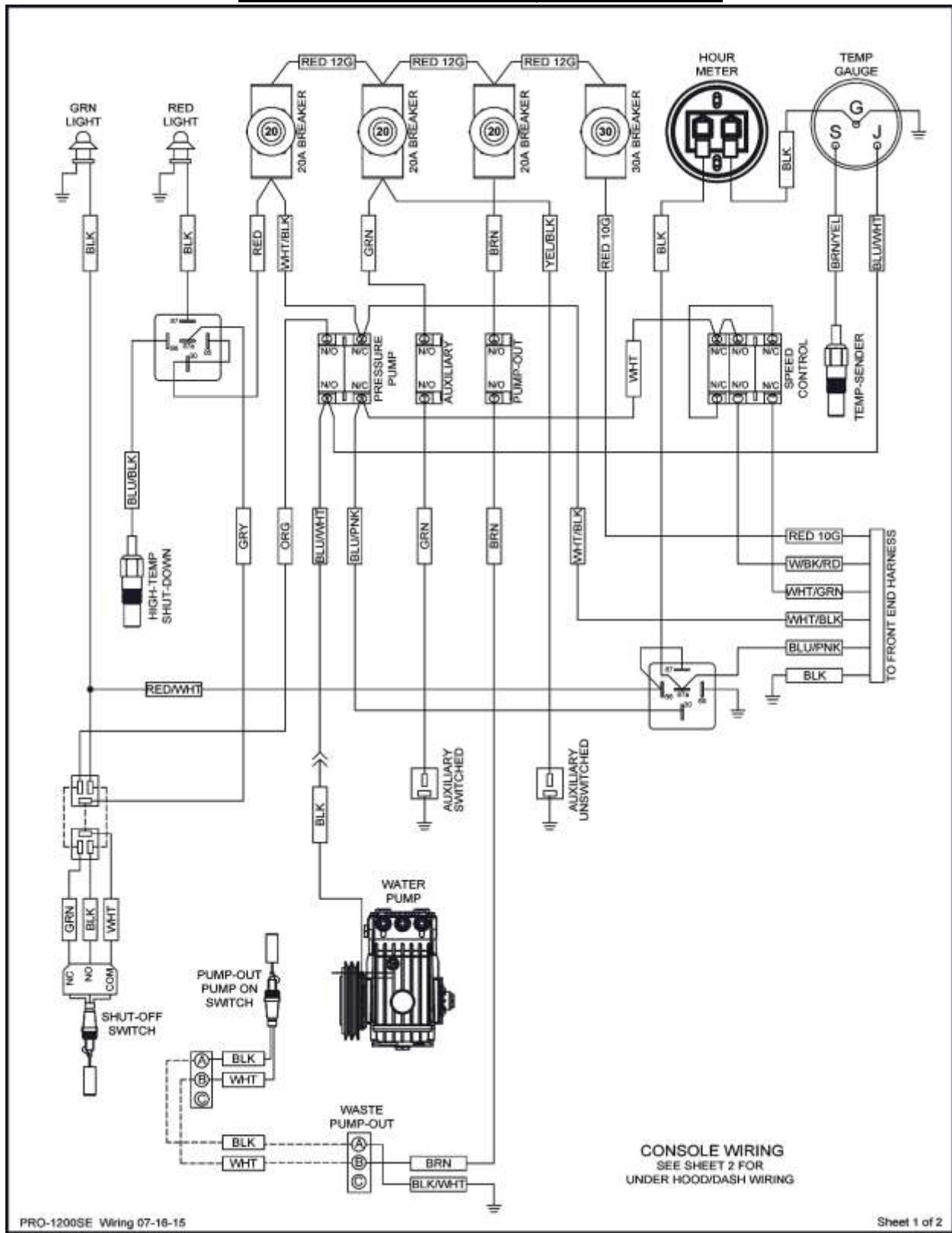


44-250, DECAL, PRODUCT PRO-1200 SE

**WATER FLOW DIAGRAM**



**ELECTRICAL DIAGRAM, SHEET 1 OF 2**



**ELECTRICAL DIAGRAM, SHEET 2 OF 2**

