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The SealVac System is protected by US and International patents, including: US 5117876, US 6860300, US 7171990 B2.

TECHNICAL MANUAL

SealVac Plus + 400 and 600 Gallon Capacity

Spokane Industries
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**IMPORTANT**

YOU MUST READ THIS MANUAL IN ITS ENTIRETY BEFORE OPERATING, SHIPPING OR PERFORMING MAINTENANCE PROCEDURES. FLAMMABLE AND COMBUSTIBLE VAPORS CAN CAUSE FIRE, AND/OR EXPLOSION AND CAN LEAD TO SERIOUS INJURY OR DEATH.

The instructions in this manual cover the operation and maintenance of the Tank, Trailer Mounted, Recoverable Aviation Turbine Fuel 400 and 600 Gallon SealVac Plus+, model numbers SVP 400(S), and SVP 600(S) manufactured by Spokane Industries, Inc. of Spokane Valley, Washington.

The SealVac Plus+ is also a Trademark of Spokane Industries and the SealVac Plus + Vacuum Drain Fuel System is protected by the following US patents: US 5,117,876, US 6,860,300 B1, US 6,896,013 B2, and 7,171,990 B2.

1.1 DESCRIPTION

The parts and components that make the SealVac Plus+ an effective fuel drain system that allows for reutilization of recovered fuel.

The **Full Vacuum Tank Assembly** collects and stores fluid. The tank weldment has an integrated sediment chamber to collect foreign object damage/debris. The tank weldment also has an outer wrap that serves as secondary containment in the event that a leak occurs.

The **Vacuum System Assembly** creates the vacuum inside of the tank weldment using compressed air, provides the vacuum suction to the drain tools and controls the tank operation.

The **Vacuum Governor** protects the airframe fuel cell from damage by limiting the vacuum suction level.

The **Auto Shut Off Assembly** prevents the tank from being overfilled by shutting off the vacuum when the tank is 90 percent full.

The **Drain Tools** drain the bottom sumps

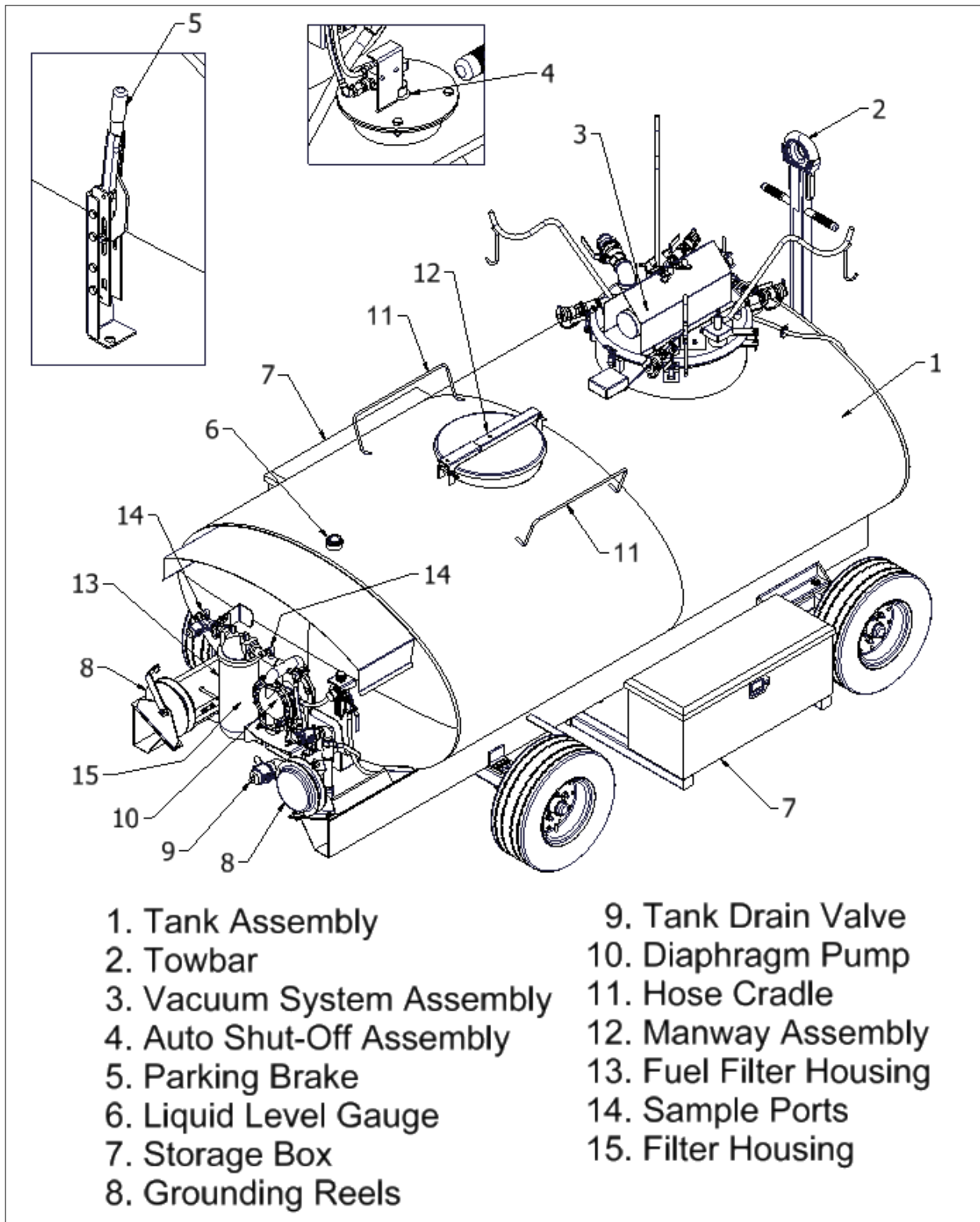
without leaking. These tools use vacuum suction to adhere to the surface surrounding the sump. A fuel probe locks into the Drain Tool while opening the pump's drain valve. Vacuum suction applied to the fuel cell allows for draining.

The **Drain Tool Vacuum Group** provides the vacuum suction to the Drain Tools. The Drain Tool Vacuum Group is separate from the Tank Vacuum Group, and provides a stronger vacuum suction that is not dependent on tank fluid level and is not affected by the Auto Shut-Off feature.

An **Aviation Grade Coalescing Filter Element** is part of a filtering system that removes particulates and water from fuel making it recyclable and reusable.

There is an optional fuel drying monitor type secondary filtration system also available if cleaner fuel is desired.

There is a rear mounted multi-use pneumatic diaphragm pump that operates off the same air source as the SealVac Plus+ vacuum head. The diaphragm pump makes it possible to transfer fuel into equipment or another tank with or without the SealVac Plus+ Vacuum Drain System in operation .



1.2

Figure 1-1 Component Identification

1.3 Specifications for the SeaVac Plus+ 400 Gallon

Tank Volume:

Nominal Capacity.....	400-gallons
Max Capacity	440-gallons

Equipment Dimensions:

Length (Tow bar down)	187-inches
(Tow bar up)	128-inches
Width (Tire to tire)	76-inches
(Box to box).....	82-inches
Height (Tow bar down)	42-inches
(Tow bar up)	72-inches
Weight (Empty).....	1,700-pounds
(Full, at nominal capacity with fuel).....	4,695-pounds
Telescoping Funnel Height (Fully collapsed)	42-inches
(Fully extended).....	234-inches
Ground Clearance (At tow bar).....	6-inches
(At axle).....	8-inches

Environmental Conditions:

Operating Temperature Range	-25°F to 110°F
Storage Temperature Range	-40°F to 150°F

Supply Air Requirements:

Supply Air Pressure (Maximum)	100-PSIG
(Minimum).....	45-PSIG

Supply Air Flow Rate (Maximum).....	Not established
(Minimum)	68-SCFM

Operational Characteristics:

Tank Vacuum Pressure	8-inches Hg
Tank Vacuum Flow.....	89-SCFM
Drain Tool (Adherence Vacuum pressure)	17-inches Hg
(Adherence Vacuum flow)	2.1-SCFM
(Length).....	35-feet
(Diameter, inner).....	3/4-inch
Depuddling Hose (Length).....	35 or 50-feet
(Diameter, inner)	1-inch

Towing Characteristics:

Speed, Forward Direction	15-MPH
Speed, Backward Direction.....	(hand push/pull only)
Turning Radius (Curb to curb).....	372-inches

Wheels and Tires:

Tire Size	20.5 x 8.0-10
E Range Tire Pressure (Cold) (See Sidewall)	90-PSIG
Lug Nut Torque.....	100ft.-lbs.
Split Rim Nut Torque.....	75 ft.-lbs.

Other Characteristics:

Double Wall Construction	Yes
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1.3 Specifications for the SeaVac Plus+ 600 Gallon

Tank Volume:

Nominal Capacity	600-gallons
Max Capacity	660-gallons

Equipment Dimensions:

Length (Tow bar down)	187-inches
(Tow bar up)	128-inches
Width (Tire to tire).....	76-inches
(Box to box)	89-inches
Height (Tow bar down).....	62-inches
(Tow bar up)	72-inches
Weight (Empty).....	2,135-pounds
(Full, at nominal capacity with fuel)	6,695-pounds
Telescoping Funnel Height (Fully collapsed).....	62-inches
(Fully extended).....	254-inches
Ground Clearance (At tow bar)	6-inches
(At axle).....	8-inches

Environmental Conditions:

Operating Temperature Range	-25°F to 110°F
Storage Temperature Range	-40°F to 150°F

Supply Air Requirements:

Supply Air Pressure (Maximum).....	100-PSIG
(Minimum)	45-PSIG

Supply Air Flow Rate (Maximum).....	Not established
(Minimum).....	68-SCFM

Operational Characteristics:

Tank Vacuum Pressure	8-inches Hg
Tank Vacuum Flow	89-SCFM
Drain Tool (Adherence Vacuum pressure).....	17-inches Hg
(Adherence Vacuum flow)	2.1-SCFM
(Length).....	35-feet
(Diameter, inner)	3/4-inch
Depuddling Hose (Length).....	35 or 50-feet
(Diameter, inner).....	1-inch

Towing Characteristics:

Speed, Forward Direction.....	15-MPH
Speed, Backward Direction	(hand push/pull only)
Turning Radius (Curb to curb)	372-inches

Wheels and Tires:

Tire Size	20.5 x 8.0-10
E Range Tire Pressure (Cold) (See Sidewall)	90-PSIG
Lug Nut Torque.....	100ft.-lbs.
Split Rim Nut Torque	75 ft.-lbs.

Other Characteristics:

Double Wall Construction.....	Yes
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1.4

Drain Tool Setup and Usage for Select Airframes

Airframe	Wing-Outer	Wing-Middle	Wing-Outer	Fuselage	Conformal Tank	Wing Drop Tank	Fuselage Drop Tank
A-10	NA	NA	NA	NA	NA	NA	NA
B-1B	Os	Os	Os	ES, OS, OC Optional Tank	ES, (Fuselage Center)	NA	NA
B-2	NA	NA	NA	NA	NA	NA	NA
B-52	Os	Os	Os	Os	NA	NA	NA
C-5	Os	Os	Os	Os	NA	NA	NA
C-17	Os	Os	Os	Os (Extended Range)	NA	NA	NA
CV-22	Es, Os	Es, Os	Es, Os	Es, Os	NA	NA	NA
C-130	Os	Os	Os	Os	NA	Oc	NA
F-15	Oc	Oc	Oc	NA	Es	Oc	Oc
F-16	NA	NA	NA	Rs, Os	NA	Oc	Oc
F-22	NA	NA	NA	NA	NA	Oc	NA
KC-135	Os	Os	Os	Os, R	NA	NA	NA
T-38	NA	NA	NA	Es	NA	NA	NA

E - Elongated Drain Tool
O - Oval Drain Tool
R - Round Drain Tool

s- flat seal (E and O Drain Tools)
c- contoured seal (E and O Drain Tools)
NA - Not Applicable

SealVac Plus+ can interface with the following commercial airframes:		
<u>Boeing:</u>	<u>Airbus:</u>	<u>Bombardier:</u>
737	A319	Q400
747	A320	CRJ700
757	A330	<u>Embraer:</u>
777	A380	Phenom 100
787	A400M	Phenom 300
MD-80		
MD-90		
MD-11		
DC-10		

1.5

Daily Inspection Checklist

Part to be inspected	What to Look For				Check Off Once Inspected
Wheels	Is there any visible tire damage?	Are there loose or missing lug nuts?			
Brakes	Are brakes functioning properly?	Are brakes properly adjusted?			
Towbar	Is there any visible damage?	Are there cracks in welds?	Are there missing attachment pins?	Are there missing retaining clips?	
Tank	Are there any visible leaks?	Does Manway close properly?	Are there loose or missing components in the undercarriage mounting hardware?		
Hoses	Are there any cracks?	Are there any rub spots?	Are fitting ends operational?		
Ground Reels	Are the ground reels functioning properly?	Are cable ends securely fastened to cable?			
Valves	Are valves functioning properly?				
Drain Tools	Is there any damage to the drain tool body?	Is there any damage to the seal?			

1.6

Preventative Maintenance Chart

Item	Interval	Action
Sediment Chamber Screen	Weekly	Clean Sediment Chamber Screen by removing collected debris using the Sediment Chamber Lid Removal Instructions in Section 3.15.
Sediment Chamber Seal	Monthly	Inspect for tears, cracks and compression damage. Replace if needed. Refer to section 3.15 For more information.
Manway Seal	Monthly	Inspect for tears, cracks and compression damage. Refer to Section 4.5 for maintenance instructions.
Static Bonding / Grounding	Monthly	Check bond straps between the tank weldment and sediment chamber for electrical resistance. Maximum allowable resistance should be 10 Ohms.
Brakes	Quarterly	Check for proper adjustment and make any adjustments using section 4.19.
Tank Weldment	Yearly	Inspect both inner and outer tank welds for cracks. Remove plug from outer tank test fitting and inspect for fuel evidence
Wheel Bearings	Yearly	Inspect for damage and replace components when needed. Pack wheel bearings with grease. Use sections 4.8, 4.9, 4.16 and 4.17 for maintenance.

SECTION 2.0

SAFETY GUIDELINES

Within this manual are guidelines and safety recommendations for use of the SealVac Plus+. It is the responsibility of the end user to completely read this manual and comply with all local, state and federal laws and regulations applicable for fueling and defueling aircraft. Spokane Industries Inc. is not responsible for industry specific information on safety management, employment safety, health standards, safety codes, etc. Contact your local safety manager or industrial safety representative. It is the responsibility of the end user to ensure persons operating this equipment:

- **Are trained, authorized and permitted to use the equipment.**
- **Have physical and the mental ability to operate this equipment safely.**
- **Are aware of the potential hazards associated with this equipment, i.e. static electricity, electrical shock, fuel spills and pinch points.**

2.1 General Safety Instructions

⚠ WARNING

This manual describes physical and chemical processes which may cause injury or death to personnel, or damage to equipment if not properly followed. This safety summary includes general safety precautions that must be understood and applied during operation and maintenance to ensure safety and protection of equipment.

2.2 Protective Clothing

⚠ WARNING

When fuels are being handled, approved equipment such as gloves, eye protection, face shields, etc. shall be used.

2.3 Static Bonding and Grounding and Other Fire Hazard Precautions

⚠ WARNING

Improper static bonding and grounding can lead to a fire, and as with any other equipment dealing with fuel, there is always a risk of fire if all safety precautions are not followed or the equipment is not used correctly. Make sure to read and understand all instructions before operating this equipment.

2.4 Lockout / Tagout

⚠ WARNING

Personnel shall be aware of the hazards associated with unguarded machinery parts, capacitors, gaseous and wet pipe systems, spring loaded devices, etc. Lockout / Tagout the energy source prior to performing maintenance, adjustment or other procedures that would bypass safety guards, barriers, or otherwise expose personnel to hazardous energy sources. Any equipment, machine or process that could unexpectedly energize, start-up or release energy will be equipped with a means to lockout / tagout the energy sources.

2.5 Area of Use

⚠ WARNING

This equipment has been designed to operate outdoors only. Flammable and/or combustible vapors in ignitable quantities could be produced under certain circumstances. Additionally, local protocols must be consulted to determine if fuel draining equipment can be used in the location being considered.

SECTION 3.0

OPERATION INSTRUCTIONS

3.1 Use Preparation

Remove the drain tools and fuel probe pigtail assembly from the side storage boxes, and place the air transport bolts and nuts from the vacuum system assembly and store them in the storage box.

Place each of the components in the appropriate storage location before use. The coil duplex hose assemblies hang on the hose hangers, coil depuddling hose and place in hose cradle and place the drain tools and fuel probe pigtail assemblies in the storage boxes.

3.2 Shipment Preparation

⚠ WARNING

Flammable and combustible vapors must be removed from tank before shipping to prevent a fire and/or explosion. If this step is not taken, serious injury or death could occur

Before transporting the SealVac Plus+ by truck or cargo aircraft, make sure to drain the tank of all liquid products by opening the drain valve. Remove all flammable and/or combustible vapors from the tank using an approved ventilation method. Make sure that the duplex hose assemblies and the depuddling hose assembly are coiled and placed in a secure location. Place all other loose items in the storage boxes and check to make sure the manway assembly and vacuum system assembly are securely attached.

Loading the SealVac Plus+ for Truck Shipment

⚠ CAUTION

Fork extensions must be in contact with axle tubes only. Damage to the equipment will occur if the equipment is lifted from any other location.

Forklift with fork extensions will be required to load the SealVac Plus+ on a truck. Set

the parking brake. Approach the unit from the front only. Once the SealVac Plus+ is loaded on the truck secure to the truck bed using attachment points on tank weldment.

Loading the SealVac Plus+ for Air Shipment

⚠ CAUTION

Do not back equipment by any means other than hand pushing/pulling. Damage to the equipment will occur if self propelled tow methods are employed.

After placing the SealVac Plus+ in the aircraft, lock towbar upright, make sure the parking brake is set and that the manway assembly and storage boxes are latched.

The following instructions provide a step by step breakdown on how to use the SealVac Plus+. These instructions apply to the 200 gallon, 400 gallon and 600 gallon models of the SealVac Plus+.

3.3 General Precautions to Consider When Using the SealVac Plus+

It is important to follow all of the instructions regarding Warnings, Precautions and Notes that are located throughout this chapter.

Since fuel is flammable and combustible, understanding and practicing all precau-

tionary measures while using the SealVac Plus+ is crucial for safe fuel handling operations.

3.4 How to Operate the SealVac Plus+

The SealVac Plus+ performs three major modes of operation — Vacuum Draining, Depuddling and gravity draining. Section 3.11 Describes the vacuum draining mode and Section 3.12 describes the Depuddling Mode.

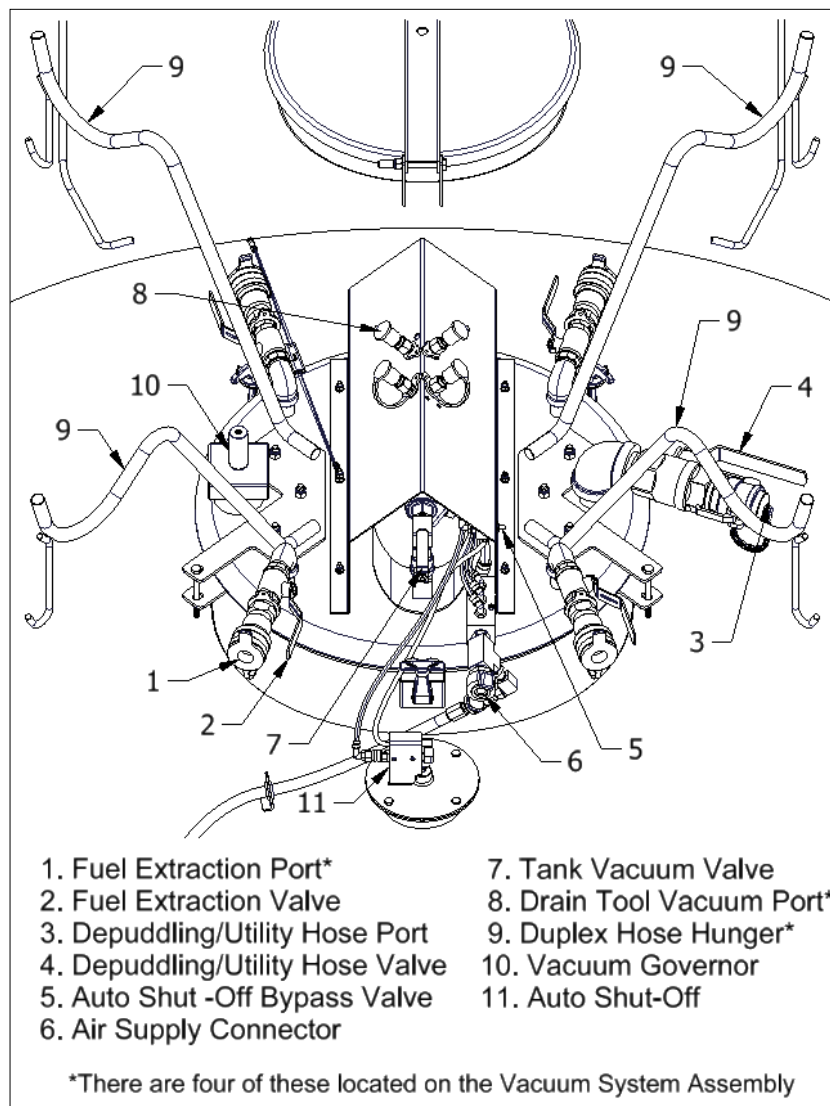


Figure 3-1 Vacuum System Assembly Component Identification

3.5

Controls and Indicators

Description	Function
Parking Brake Handle	Located on front of the SealVac Plus+. Sets parking brake during operation and storage.
Liquid Level Gauge	Located on top centerline of tank, this indicates the level of fluid inside of the tank.
Fuel Extraction Valve; Four Each	Located on top of the vacuum system assembly, these are the control valves for the vacuum draining mode using the drain tools.
Depuddling/Utility Hose / Valve	Located on top of the sediment chamber lid, this is the control valve for the depuddling mode.
Auto Shut-Off Bypass Valve	Located on the top front of the tank weldment, this allows the user to bypass the signal from the auto shutoff assembly that controls whether or not vacuum suction is applied to the tank.
Tank Drain Valve	Located at the bottom rear of the tank, this is used to empty tank when at capacity.
Tank Vacuum Valve	This is the control Valve for operating the vacuum.

Make sure to check the liquid level gauge before engaging in any mode of operation.

3.6 Parking Brake

Chock equipment when necessary. Set the parking brake by moving the handle upward while the SealVac Plus+ is not moving. To release parking brake move handle so that it points to the side.

3.7 Static Bonding and Grounding

▲WARNING

Static bonding/grounding reels are spring loaded. Ensure that the cable stops before letting loose. Injury can occur if cable is allowed to retract uncontrolled.

- a. Set Parking brake
- b. Locate reel with clamp end and pull cable outward until desired length has been taken out.
- c. Allow cable to retract until it stops.

- d. Attach to ramp at an approved bonding/ground location.
- e. Locate reel with plug end and pull cable outward until desired length has been taken out.
- f. Allow cable to retract unit it stops.
- g. Attach to airframe at an approved bonding/grounding location.

3.8 Supply Air Connection

The supply air connector is located at the front of the tank, near the vacuum system assembly. See Figure 3-2 & Section 1.3.

- a. Set parking brake
- b. Make sure tank vacuum valve (arrow B) is "off".
- c. Attach air supply hose to connector (arrow A) by pushing connectors together and turning counter-clockwise a quarter turn.
- d. Secure connection by inserting locking pin into connector safety holes.

3.9 Tank Vacuum Operation

The tank vacuum valve is used to turn the tank vacuum group on and off. See Figure 3-2.

- a. Set parking brake
- b. Follow steps in Section 3.10.
- c. Turn valve handle to "on" position.

3.10 Auto Shut-off Bypass Valve Operation

(See Figure 3-1 for identification.)

⚠ WARNING

The Auto Shut-off Bypass Valve allows vacuum operation to resume after the Auto Shut-off feature stops vacuum operation when tank is full. Overfilling and spills are possible if care is not exercised. Injury and/or exposure to fuel can occur.

The Auto Shut-off Bypass Valve is to be used when tank vacuum is needed to clear fuel from hoses after the tank has reached capacity. The valve bypasses the Auto Shut-off feature should be used with extreme caution. These operational step requires two people.

- a. Close all fuel extraction valves (2).
- b. Perform steps (c), (d), and (e) together.
- c. Operator number 1: detach fuel probe pigtail assembly from Drain Tool. Hold Fuel Probe Pigtail assembly in the air to ensure fuel does not drain out.
- d. Operator number 2: open Fuel

Extraction Valve corresponding to Fuel Probe Pigtail assembly that operator number 1 is holding.

- e. Operator number 2: hold Auto Shut-off Bypass Valve (5) open by depressing button) until fuel has been extracted from fuel probe pigtail assembly that operator number 1 is holding.
- f. Repeat (b) through (e) for remaining fuel probe pigtail assemblies that are still being used.

Note

This procedure can also be used with depuddling mode when tank is full. Simply substitute valve and hose names in the instructions.

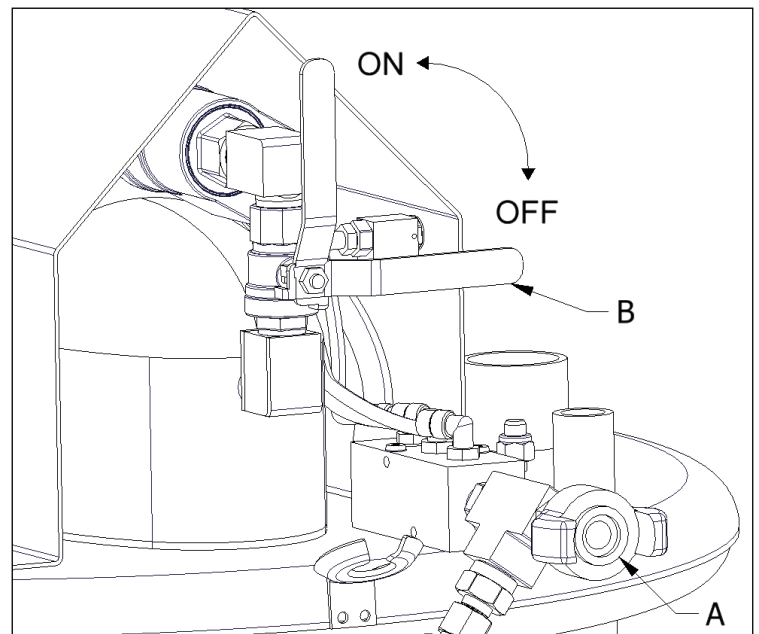


Figure 3-2 Supply Air Connector and Air Tank Valve

3.11 Vacuum Draining Mode

Vacuum Draining refers to draining from under wing airframe sumps using the Drain Tool, Fuel Probe Pigtail assembly, and the Duplex Hose assembly.

Drain Tool Assemblies

The Drain Tools are used to interface with the aircraft. The Drain Tools have two parts—The Vacuum Area that is used to adhere the tool to the aircraft and the Fuel Hub.

The Fuel Hub centers and locks the Fuel Probe that opens the sump poppet drain valve. See Figure 3-3.

The Fuel Probe Pigtail Assembly

The Fuel Probe Pigtail assembly is used to open the aircraft's sump poppet drain valve. The probe has an adjustable pin that depresses the poppet valve while locking into the Fuel Hub, and creates a seal between the Fuel Probe and the Drain Tool. See Figure 3-3.

The Fuel Flow Viewing Window

The Fuel Flow Viewing Window allows the operator to observe whether or not fuel is flowing out of the sump drain. See Figure 3-3.

The Duplex Hose Assembly

The Duplex Hose assembly consists of two individual hoses bundled together. The 3/4-inch drain hose provides vacuum to the Fuel Probe Pigtail assembly and drains fuel. The 1/4-inch vacuum hose provides vacuum to the Drain Tool vacuum area. See Figure 3-3.

Vacuum Draining Setup Steps

Before the vacuum draining operation can begin, the drain tools and the fuel probes need to be configured for the airframe to be drained. Once a setup is established for an airframe, the setup procedure does not have to be repeated.

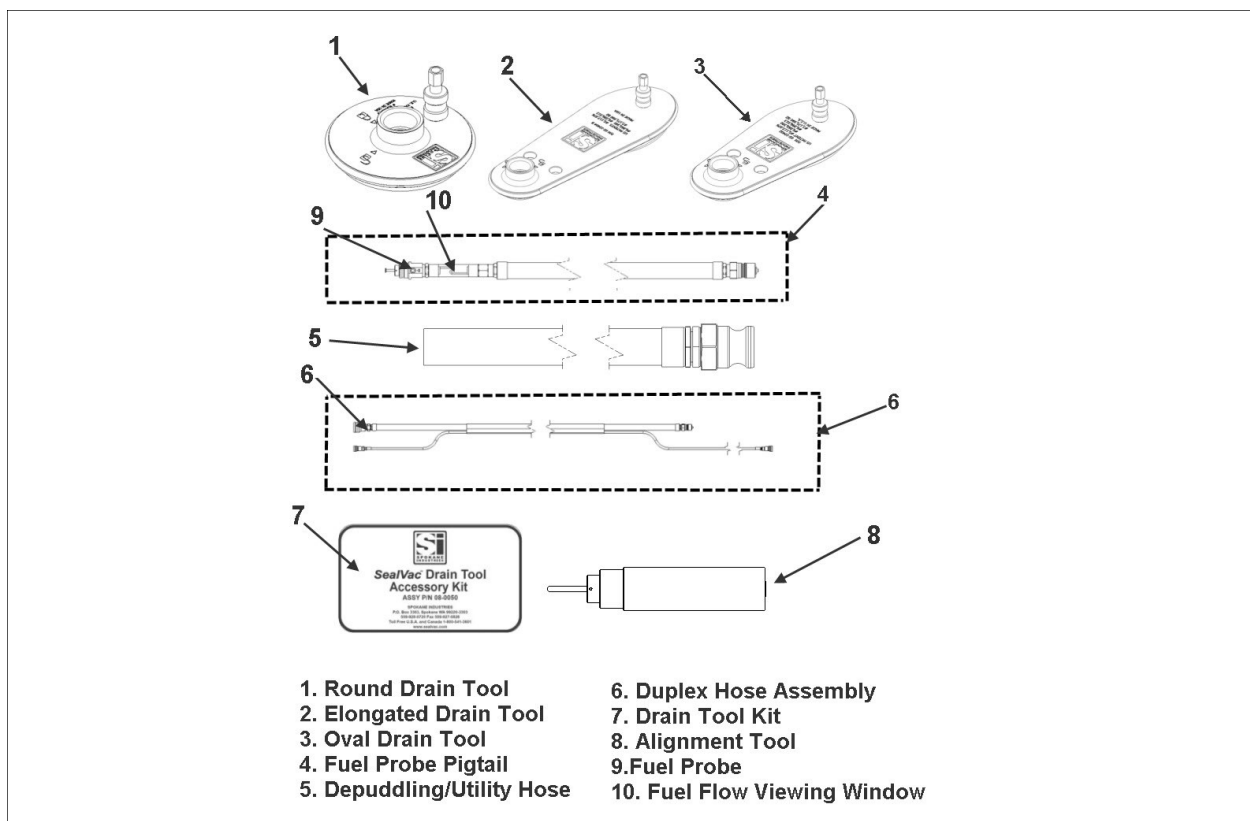


Figure 3-3 Drain Tool Accessories

Drain Tool Setup

The Drain Tools use two functional seals. The Hub Seal, (see Figure 3-4) creates a seal around the Fuel Probe. The Vacuum Area Seal (3), creates the vacuum area that allows the Drain Tool to adhere to the airframe. The Oval and Elongated Drain Tools use either the Flat Vacuum Area Seal or the Contoured Vacuum Area Seal, depending on the surface profile. Section 1.4 suggests which seal should be used for a specific airframe.

Selection of the Vacuum Seal

When working with a relatively flat surface, the Flat Vacuum Area Seal is used. When working with a curved surface, the Contoured Vacuum Area Seal is used. Round Drain Tools use the Short Hub Seals, while the Oval and Elongated Drain Tools use the Tall Hub Seals.

Changing the Vacuum and Hub Seals

To change either the Vacuum Seal or the Hub Seal, follow the steps described below. See Figure 3-4.

- a. Wipe drain tool (1) and seal surfaces free of any fuel and oil.
- b. Grasp seal (2) or (3) and pull directly outward. If seal will not come loose, use a small screwdriver to carefully pry out the seal.
- c. Remove any foreign material from seal groove.
- d. Orient seal so that the knife edge (reference arrow A) is pointing away from the drain tool and the tallest side is along the outer edge.
- e. Lubricate seal with petroleum jelly.
- f. For Vacuum Area Seals, align seal seam (reference arrow B) along center of long side of oval groove.
The Hub Seals do not have a seam alignment requirement.
- g. Press firmly while working the seal into the groove. Start at the seam and work in around the perimeter

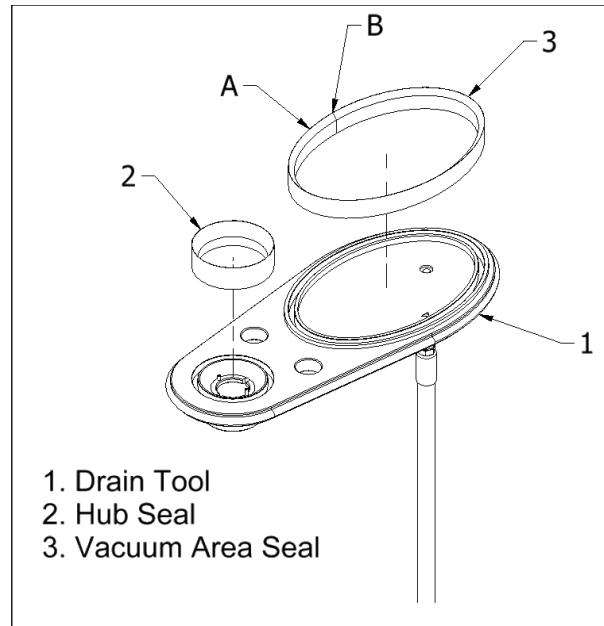


Figure 3-4 Changing Drain Tool Seals

- of the seal.
- h. After seals are installed, connect the vacuum supply line of the Duplex Hose Assembly and verify that the seal installation is correct by adhering drain tool to side of tank.

Fuel Probe Pigtail Assembly

The Fuel Probe Pigtail assembly uses a number of different types and lengths of Fuel Probe Pins. Due to the variety of fuel drain sump designs, it will be necessary to adjust the length and type of the Probe Pin. Probe pin length is critical for efficient vacuum draining operations. Too short of a pin will not fully open the poppet drain. Too long of a Pin will fully open the drain, but will not allow the Fuel Probe to lock into the Drain Tool.

⚠ CAUTION

Do not over tighten the Probe Pins. Damage to the Fuel Probe will occur if Fuel Probe Pins are over tightened.

Types of Probe Pins

There are two types of Fuel Probe Pins. The first type is a button head machine screw. The button head pins are typically used on larger poppet drain valves. The second type is an Allen head set screw. The set screw type pins are typically used on smaller poppet drain valves.

⚠ WARNING

Poppet drain valves can get stuck open for a number of reasons. An open poppet drain valve will allow uncontrolled fuel flow. Exposure to fuel can occur.

Determining Fuel Probe Pin Length

Use the following steps in conjunction with Figure 3-5 to determine proper Fuel Probe Pin length.

- Determine which pin type (1) or (2) is most appropriate for the poppet drain valve being opened.
- Select a medium length Fuel Probe Pin from the pin kit.
- Thread pins (1) and (2) into Fuel Probe end (3) and tighten.
- Perform steps for Vacuum Draining stopping at step (m).

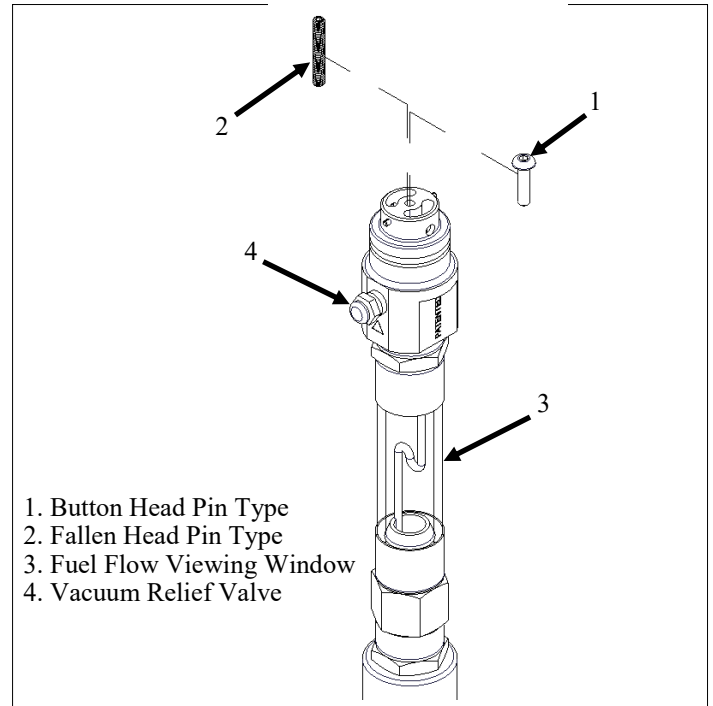


Figure 3-5 Fuel Probe and Pins

- Turn on Tank Vacuum Valve.
- Verify that Fuel Probe locks into Drain Tool. If it does not, go back to step (b) of these instructions and select a shorter pin. If it does lock into the drain tool, continue to step (f) of the instructions.
- Observe Fuel Flow Viewing Window (4). If no, or small flow is present, turn off tank vacuum and go back to step (b) of these instructions, selecting the next longer sized pin. If good fuel flow is present, the correct pin length has been selected. You may wish to make a note of the pin length that operates best.

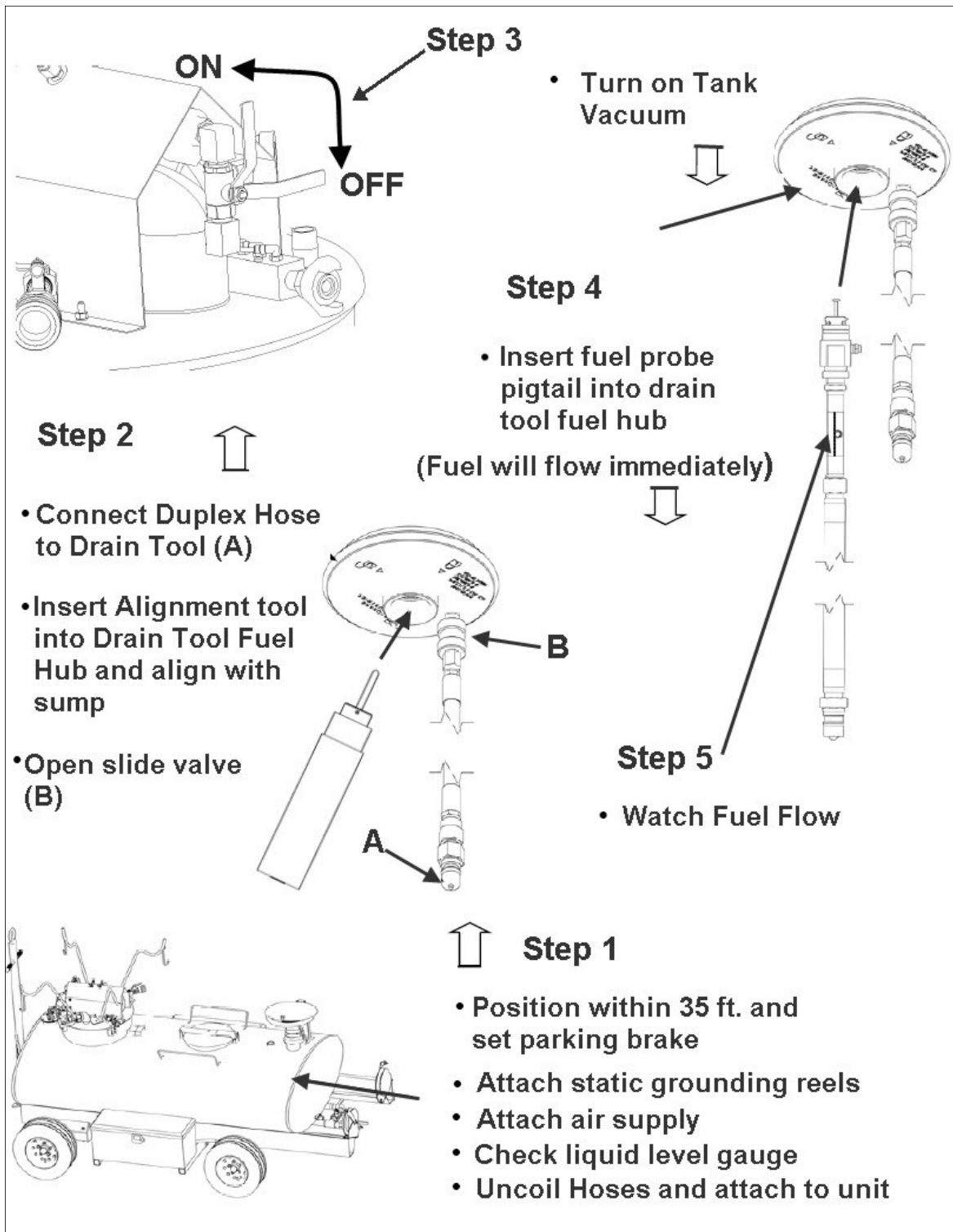
CAUTION

The aircraft fuel cell must be properly vented before applying vacuum suction. Obstructed fuel cell vents can cause severe damage to aircraft fuel cell.

**Vacuum Draining Procedure
(See Figure 3-6)**

The Vacuum Draining procedure can only be performed after the draining set up steps have been finished.

Figure 3-6 Vacuum Draining Procedure



- a. Position SealVac Plus+ within 35-feet of the Duplex Hose assembly and set parking brake.
- b. Attach static bonding/grounding cables as described in Section 3.7.
- c. Check Liquid Level Gauge for tank capacity.
- d. Attach air supply hose to the Vacuum System Assembly.
- e. Uncoil the Duplex Hose assembly and select the correct drain tool.
- f. Make Duplex Hose connections to Fuel Extraction Port and the Drain Tool Vacuum Port at the Vacuum System Assembly.
- g. Connect Duplex Hose to Fuel Probe Pigtail assembly and Drain Tool Assembly. Make sure that the vacuum slide valve is closed.
- h. Stretch Duplex Hose to point of use. If elevated, secure Duplex Hose to stand with safety lanyard.
- i. Insert Alignment tool into Drain Tool.
- j. Align Drain Tool and Alignment tool to aircraft sump poppet drain valve.
- k. Push up on slide valve (open valve) and adhere Drain Tool to surface.
- l. Return to the SealVac Plus+ and turn on the Tank Vacuum Valve.
- m. Return to Drain Tool and insert Fuel Probe Pigtail Assembly into the Fuel Hub. Lock probe by turning a quarter turn until probe stops.
- n. Stop draining if hub seal leaks fuel.
- o. Observe fuel flow in Fuel Flow Viewing Window; (see Figure 3-5)
- p. To stop draining, push and hold Vacuum Breaker Valve (see Figure 3-5), unlock probe and pull out of drain tool.
- q. Allow vacuum to clear fuel in

- Duplex Hose.
- r. Turn off Tank Vacuum Valve.
 - s. Remove Drain Tool by pulling down on slide valve (close valve) and remove tool.
 - t. Coil Duplex Hose and store tools.

NOTES:

Use petroleum jelly on drain tool seals to ease tool adherence on some surfaces such as around rivets, screws, and over panel gaps. Apply to seal before adhering. Do not seal drain tools over aircraft wing or fuselage weep holes, because this may cause vacuum leaks and poor sealing.

3.12 Depuddling Mode

Depuddling operations are performed by using the 3/4-inch by 35 or 60-foot Depuddling Hose Assembly. Aircraft specific depuddling procedures take precedence over the steps described here.

- a. Position the SealVac Plus+ within the reach distance of the 35 or 60-foot Depuddling Hose assembly.
- b. Set parking brake.
- c. Attach static bonding/grounding cables. (See Section 3.7.)
- d. Check Liquid Level Gauge for tank capacity.
- e. Attach Air Supply Hose to the Vacuum System Assembly.
- f. Remove Depuddling Hose from Hose Cradle and uncoil.
- g. Turn on Tank Vacuum by opening the Tank Vacuum Valve.
- h. Open Depuddling Port Valve (See Figure 3-1).

3.13 Using the Diaphragm Pump

More comprehensive information regarding the Diaphragm Pump including all warnings and cautionary statements in the Ingersoll-Rand Operators Manual which can be found online by searching the model number.

The diaphragm pump (Ingersoll Rand, Model Number 650717-C) is subject to change. If this happens, these instructions may not work.

⚠ WARNING

When not handled properly, excessive air pressure can cause personal injury as well as pump and property damage. Do not try to service or clean the pump or hoses or any other parts associated with the pump while it is hooked up and running.

Static sparks can cause an explosion which could result in injury or death.

Pipe exhaust away from working area because the contaminants that are emitted could cause injury.

This diaphragm pump is designed to be used specifically for aircraft fuel.

- Make sure parking brake is set.
- Attach static grounding bonding cables.
- Make sure all levers on the Sealvac Plus+ are in the position described by the Diagram shown in 3-9.
- Turn on Pump Operation by Using the Lever Designated for the Pump
- Turn on air source turning air source valve.
- Disconnect the air source when not using the pump.

⚠ CAUTION

The pump should NEVER be operated at pressures exceeding 50 PSI (345 kPa) inlet air pressure. This pump is equipped with a pressure relief valve on the material outlet manifold which will open at 40+/-4psi (2.76 bar) to relieve pressure increases in the outlet hoses/ caused of thermal expansion or other external forces.

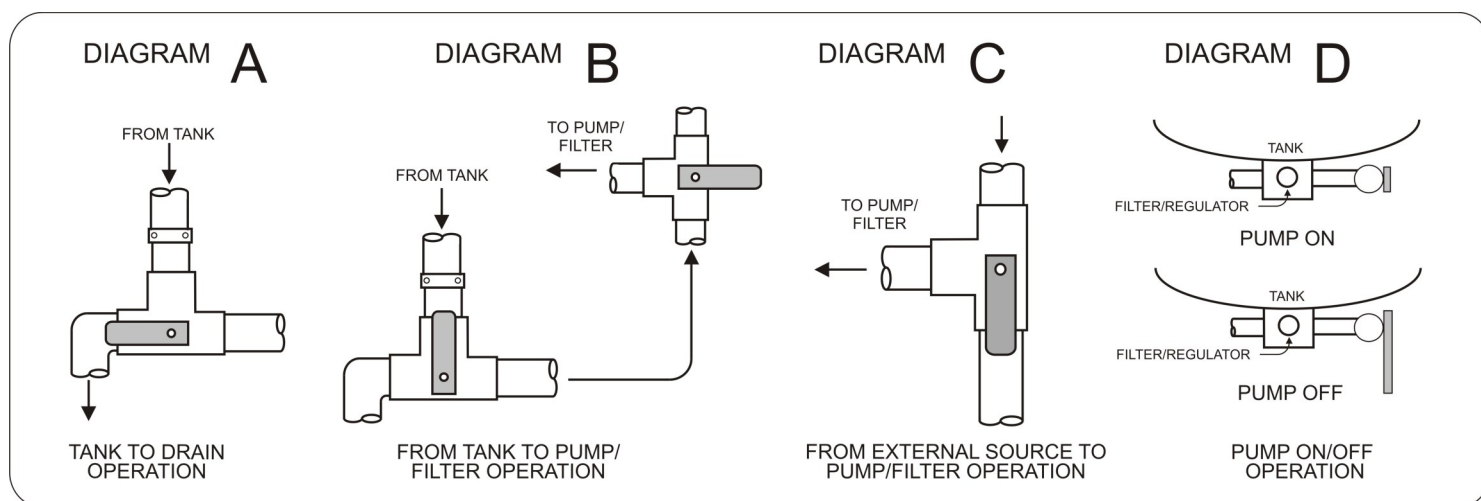


Figure 3-9 Lever Positions While Running Pump

3.14 Towing the SealVac Plus+

CAUTION

Do not back equipment by anything other than hand pushing/pulling. Backing the equipment using any other method may result in damage to the equipment.

The SealVac Plus can be towed by self propelled equipment specifically designed for towing or by pushing/pulling by hand.

- Make sure that all hoses and static bonding grounding cables are stored securely and that all valves are closed.
- Release tow bar from upright position by applying foot pressure to tow latch (A) and swing tow bar down (B).
- Attach to towing equipment if applicable.
- Release parking brake (C).
- Watch towing speed, making sure to stay at 15 MPH or under and observe a turning radius (curb to curb) of no more than 372 inches.

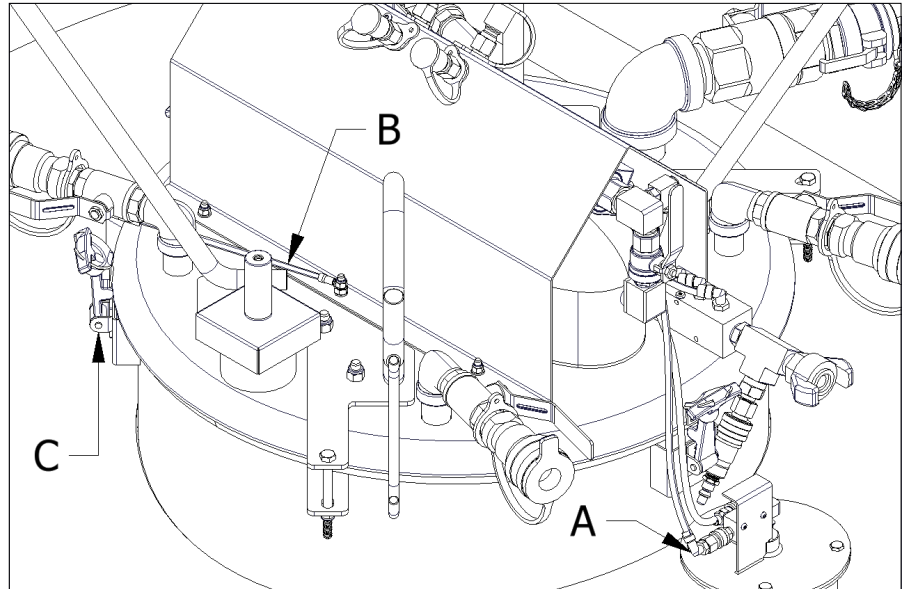


Figure 3-11 Accessing the Sediment Chamber

3.15 Checking the Sediment Chamber

WARNING

The Vacuum System Assembly weighs over 90-pounds. The use of two people is recommended to remove the assembly. Injury could result from a one person lift.

The Sediment Chamber collects foreign objects/debris from the fuel being extracted by Vacuum Draining and Depuddling modes. Figure 3-11 In conjunction with the following information will assist when checking for debris in fuel.

- Set parking brake.
- Disconnect air supply. See Section 3.8 For instructions)
- Disconnect Auto Shut-off pneumatic lines (A) and the bond strap (B).
- Unlatch rubber straps, four places (C).
- Lift vacuum system assembly/ sediment chamber lid assembly vertically and place to the side.
- Remove debris from chamber.

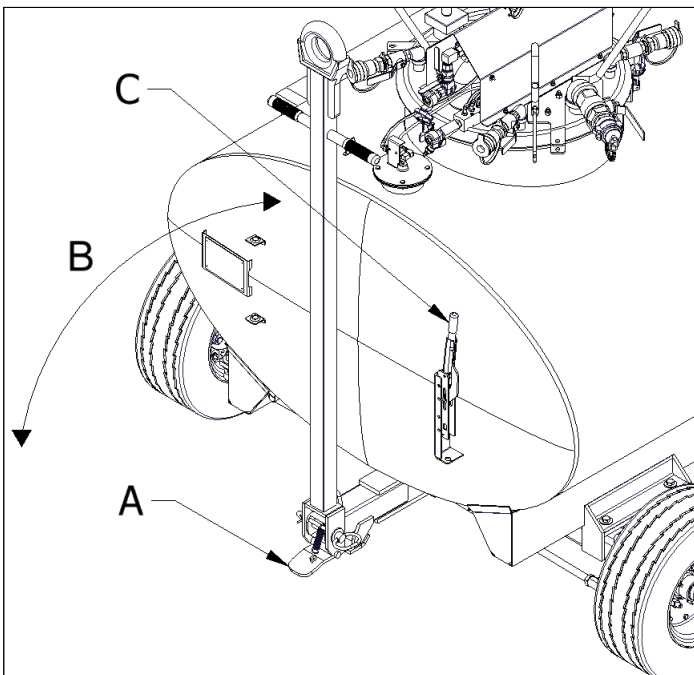


Figure 3-10 Releasing the Tow Bar

3.16 Fuel Moisture Removal Low Point Drain

The low point drain is located at the rear of the tank assembly.

- a. Set parking brake.
- b. Attach bonding/grounding reel.
- c. Use the fuel pump to empty tank contents into a safe container.
- d. Open low point sump valve and allow remainder of fuel to drain.
- e. Open petcock drain on filter to drain fuel from filter housing.
- f. Remove pipe plugs to drain fuel from plumbing system.

SECTION 4.0

MAINTENANCE, ASSEMBLY AND REPAIR

The SealVac Plus+ should always be inspected prior to use to make sure it is in working order.

4.1 Repair and Replace Instructions

Remember to set the parking brake while performing maintenance procedures. Approved jack stands and wheel chocks must also be used. Serious injury or death may occur from rolling or falling equipment.

The following procedures are used for the disassembly, reassembly, and repair to equipment components.

4.2 General Tank Equipment

▲WARNING

Make sure that the tank is free of fuel and flammable and/or combustible vapors before performing any maintenance operation involving the tank. Serious injury or death could occur.

This procedure covers all components attached to the tank by means of threaded pipe connections and describes how to properly apply pipe joint sealing compounds. Pipe joint sealing compounds should be approved for fuel service.

- a. Remove parts that need to be repaired or replaced.
- b. Remove old pipe sealing compound from component (s) by wire brush or approved solvent. If solvent is used, allow parts to dry before continuing to step (C).
- c. Inspect threads, replacing damaged parts.
- d. Apply an even coat of pipe joint sealing compound across and all around the first four threads. The coat thickness should fill the thread “valleys”, and no more.
- e. Tighten the threaded components until they are hand-tight. Do not cross thread components.
- f. Tighten parts until there is a connection that is leak free.

4.3 Vacuum System Assembly

The Vacuum System Assembly weighs approximately 90-pounds. The use of two people is recommended to remove the assembly. Injury could result from a one person lift.

The Vacuum System Assembly consists of three main groups that are accessed by removing the Vacuum System Assembly cover. The following maintenance steps allow access to the Drain Tool Vacuum Group, The Control Valving Group and the Tank Vacuum Group.

- a. Remove hose assemblies from connection points and hangers.
- b. Disconnect Auto Shut-off Assembly control lines. (See Figure 4-1, (A).)
- c. Disconnect static bond wire (See Figure 4-1, (B)).
- d. Unlatch rubber hold downs (See Figure 4-1, (C)).
- e. Lift Vacuum System Assembly vertically and place on work bench.
- f. Detach pneumatic tube from Drain Tool Vacuum Group at connection points on manifold (See Figure 4-2, (A)).

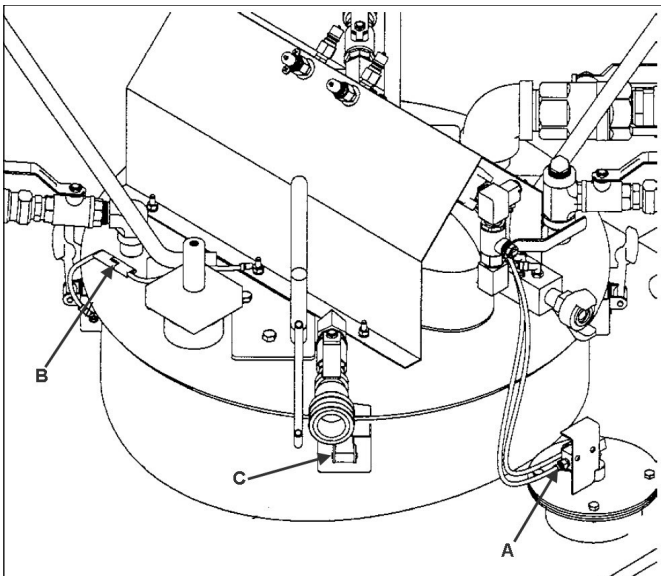


Figure 4-1 Vacuum System Removal

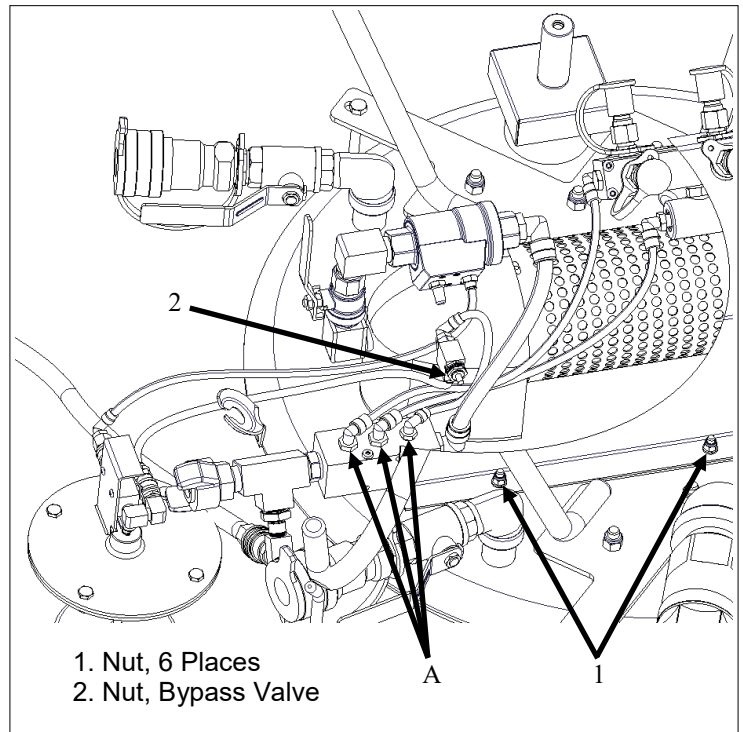


Figure 4-2 Vacuum System Assembly Cover Removal

- g. Remove nuts (1), six places; and bypass valve nut (2) remove cover and Drain Tool Vacuum Group. Make sure that the Auto Shut-off Bypass Valve is free from cover before removing. (See Figure 4-2).

Drain Tool Vacuum Group

The Drain Tool Vacuum Group is contained inside of the Vacuum System Assembly cover. Follow the maintenance steps for the Vacuum Maintenance Assembly before beginning the next maintenance steps. See Figure 4-3 for maintenance and assembly of the Vacuum Tool Group.

- a. Remove quick disconnect fittings (5) and close nipples (6).
- b. Remove bolts (2) and nuts (3). Separate manifold from cover.
- c. Remove vacuum generators (4).
- d. Remove close nipples (8) and hex plugs (7).
- e. Remove tube fittings (1) from vacuum generators (4).
- f. Repair / replace components.

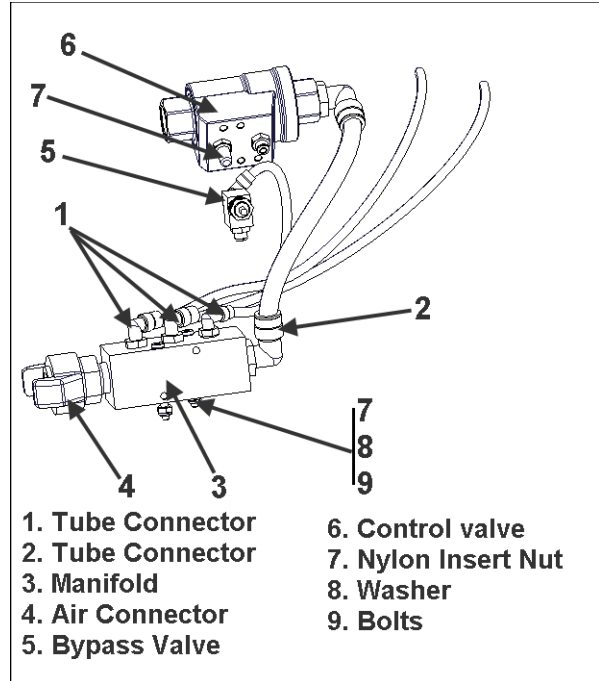


Figure 4-4 Control Valving Group

Control Valving Group

The Control Valving Group is located under the Vacuum System Assembly Cover. Before beginning the next maintenance steps, see Figure 4-4 in combination with the following instructions.

- a. Remove pneumatic lines coming from the Auto Shutoff Assembly (not shown) from the Control Valve (6) and Auto Shut-off Bypass Valve (5) by releasing tube connectors. This will free the Auto Shut-off Bypass Valve from the group.
- b. Remove remaining pneumatic tubes from tube connectors (1) and (2), at the manifold (3), and Control Valve (6).
- c. Remove manifold (3) from Sediment Chamber Lid by removing nuts (7), washers (8), and bolts (9).

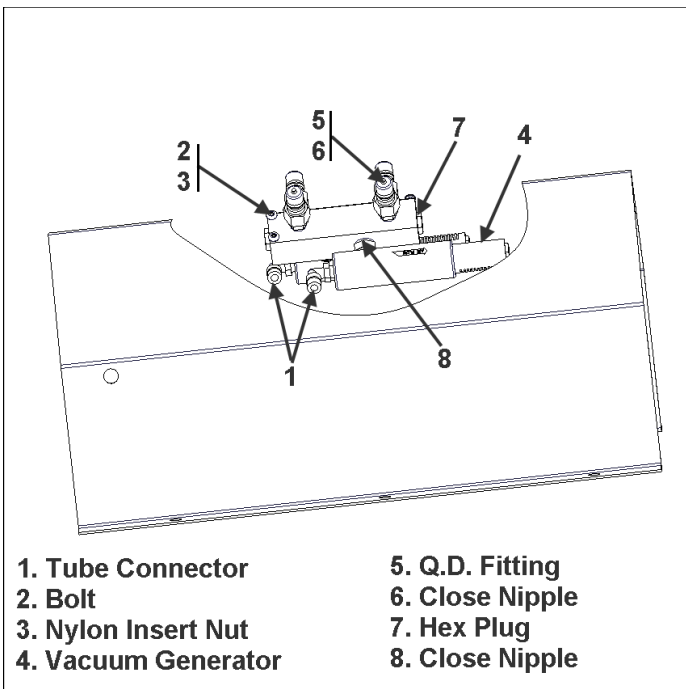


Figure 4-3 Drain Tool Vacuum Group

Tank Vacuum Group

The Tank Vacuum Group is mounted to the Sediment Chamber Lid. Make sure to complete the maintenance steps for the Vacuum Assembly before working on the Tank Vacuum Group. See Figure 4-5 for the following steps.

- Detach pneumatic lines to Control Valve as described in Section 4.3.
- Remove bolts (7) and lock washers (6).
- Lift vacuum generator vertically to remove. Note presence of gasket (2).
- Disassembly Tank Vacuum Valve (4), street elbows (3), and nipples (5), as needed.
- After reassembling use Section 4.2 for the pipe joint sealing compound instructions.

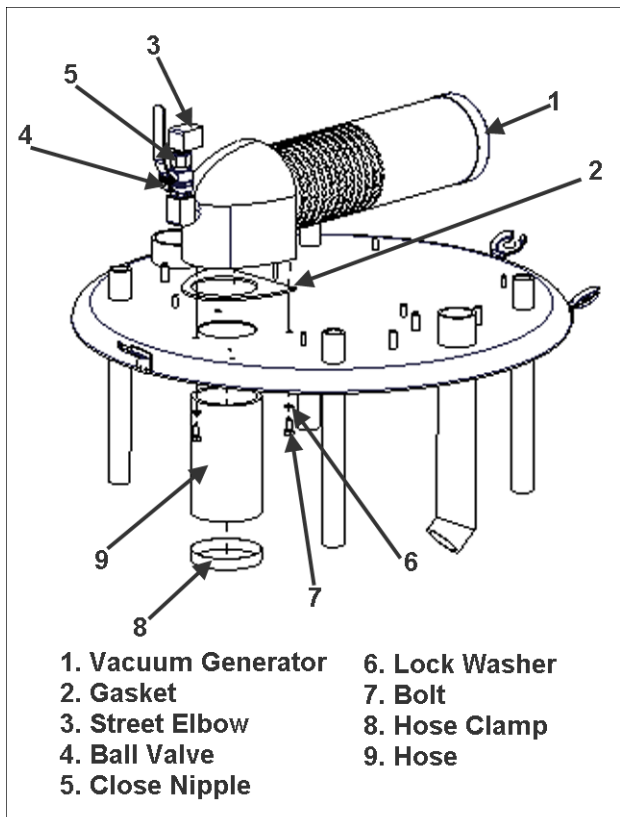


Figure 4-5 Tank Vacuum Group

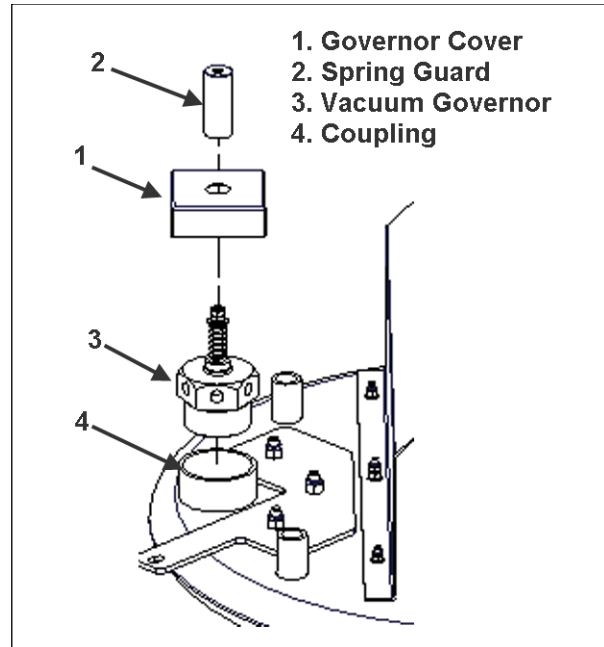


Figure 4-6 Vacuum Governor

Vacuum Governor

The Vacuum Governor is located on the right side of the Vacuum System Assembly. Use Figure 4-6 when following the listed maintenance steps.

- Remove vacuum governor cover (1), by unscrewing component (2) from the assembly.
- Remove vacuum governor (3) from Sediment Chamber Lid fitting (4).
- After replacing components and reassembling, refer to section 4.2 for pipe joint sealing compound instructions.

All Other Vacuum System Assembly Components

The remaining components of the Vacuum System Assembly (e.g. Fuel Extraction Ports and Duplex Hose Hangars) do not require maintenance steps for disassembly and reassembly. When performing maintenance steps on pipe thread connections, refer to Section 4.2 on General Tank Equipment.

4.4 Auto Shut-off Assembly

The auto shut-off assembly is located in the front of the tank weldment. Use Figure 4-7 in conjunction with the following steps.

- a. Remove pneumatic tubes from the Vacuum System Assembly by releasing the quick disconnect fittings. (See Figure 4-1, A).
- b. Remove bolts (11) and nuts (9); four places. Lift Auto Shut-off Assembly vertically to remove from tank, note presence of gasket (10).
- c. Remove bolts (7) and nuts (8) to detach control valve (2) from body (1).
- d. Remove fittings (5), (6), and (4) and pneumatic muffler (3) as needed.
- e. Remove retainer clip (14) to remove float rod (12) from body (1).
- f. Un-thread float rod (12) from float (13). Use caution not to damage float by puncturing it during maintenance activities.

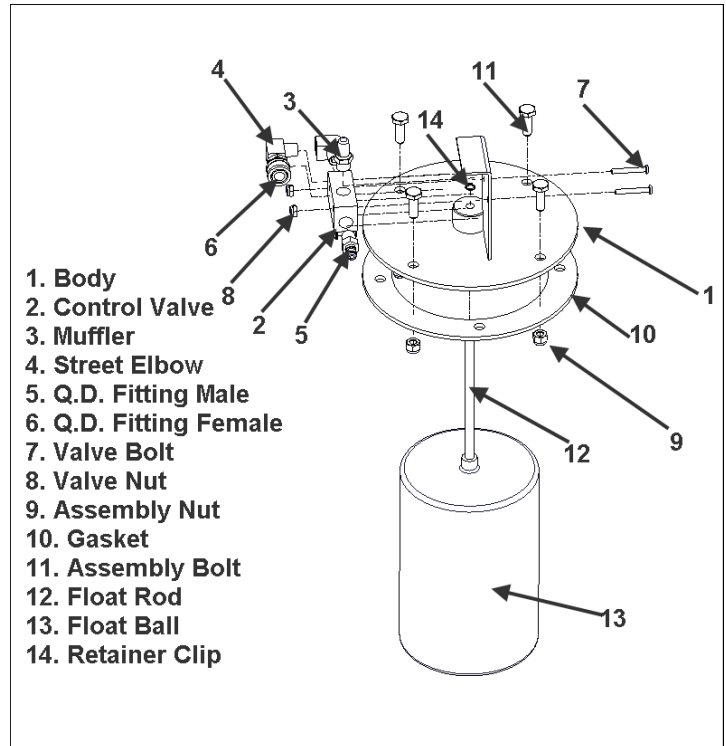


Figure 4-7 Auto Shut-Off Assembly

4.5 Manway Assembly and Maintenance

The manway assembly is located on the top of the tank. The manway assembly has one adjustment point. Use Figure 4-8 for the following maintenance steps.

Manway Disassembly/Reassembly

- a. Open handle (2).
- b. Open Manway Assembly.
- c. Remove nut (7).
- d. Remove gasket retainer (5), gasket (4), and lid (3).
- e. Remove bolt (6) and nut (10) to remove cross-arm (1).
- f. Repair / replace components
- g. Reassemble in reverse order, leaving nut (7) only partially threaded onto cross arm (1).

Manway Adjustment

- a. Open handle (2).
- b. Open Manway Assembly.
- c. Rotate nut (11) to adjust lid position. Turn clockwise to move lid closer to the tank. Turn counter clockwise to move the lid away from the tank.
- d. Tighten nut (7) until snug.

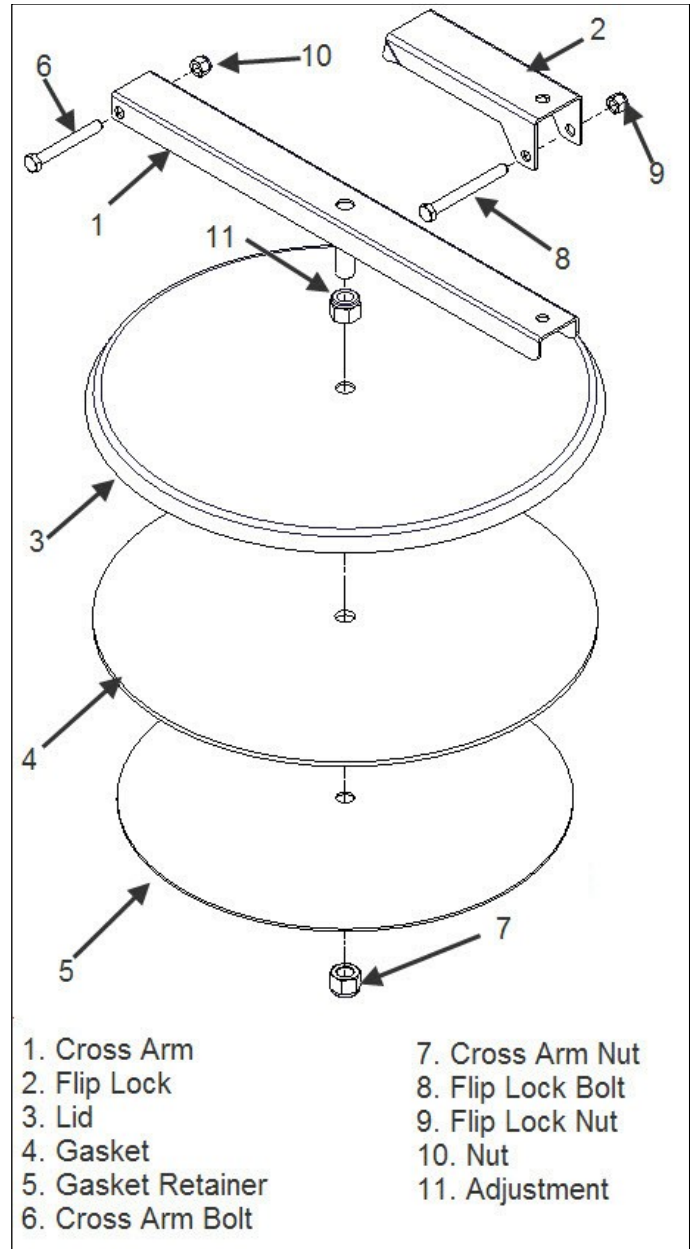


Figure 4-8 Manway Assembly

4.6 Diaphragm Pump Assembly

This section covers basic maintenance and assembly for reference purposes. For more detailed information on the Diaphragm pump by Ingersoll Rand, Model Number 650717-C, you can access the manufacturer's manual from Ingersoll Rand at <http://www.ingersollrandproducts.com>.

Fluid Section Assembly

- a. Remove Top Manifolds
- b. Remove Balls (1), "O" Rings and Seats (3).
- c. Remove Fluid Caps (4).
- d. Remove the Screw (5), Washer (6), "O" Ring (7), Plate (8), diaphragm (9), and plate.
- e. Remove "O" Rings.
- f. Clean and inspect all parts for damage or wear, and replace any damaged parts.
- g. Use Key-Lube grease on diaphragm rod (12) and "O" Ring (2).
- h. Make sure the fluid caps (4) are in line with the diaphragm (9) before making final torque adjustments on bolts and nuts so that the diaphragm (9) is not twisted.

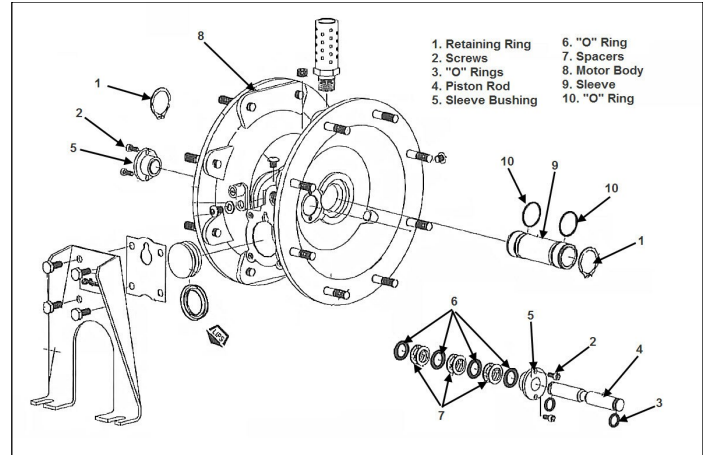


Figure 4-12 Pilot Valve Assembly

Pilot Valve Assembly

- a. Remove Retaining Ring (1).
- b. Remove screws (2) and "O" Rings (3).
- c. Remove Piston Rod (4), Sleeve Bushing (5), "O" Rings (6), and Spacers (7) from the Motor Body.
- d. Remove Sleeve (9), and "O" Rings.
- e. Replace the two "O" Rings (10) if they are worn or damaged.
- f. Install one of the sleeve bushings (5), "O" Rings (6), and Spacers (7), and remaining Bushing(5).
- g. Push Piston Rod (4) into Bushings and secure with "O" Rings (3) and Screws (2).
- h. Replace Retaining Rings (1).

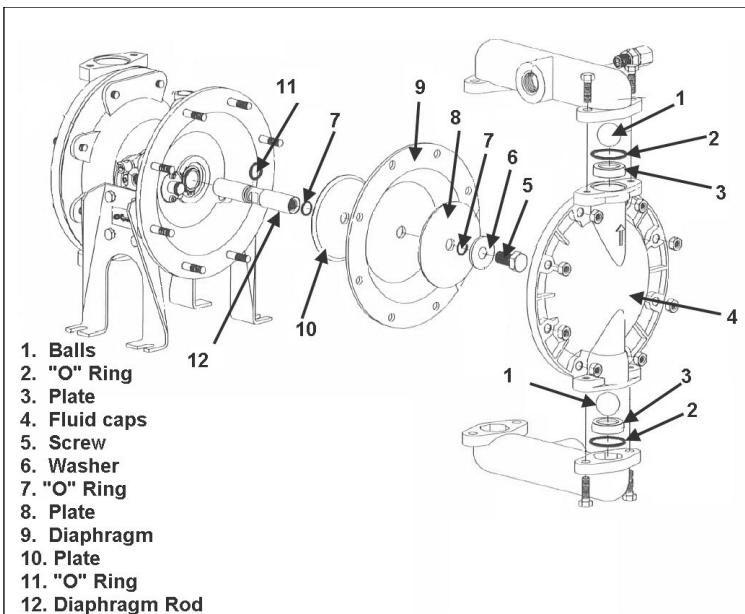


Figure 4-11 Fluid Section Assembly

Major Valve Reassembly

- a. Remove Legs(1) and Gaskets (2).
- b. Push on the Inner Diameter Spool (3) on the opposite of the Air Inlet, forcing the Piston (4) out. Continue pushing and remove Spool (3).
- c. Reach into the exhaust side of the air inlet and remove the Spacer (5), Spacers (6), "O" Rings (7), (8) and Washers (9), making sure the "O" Rings aren't damaged.
- d. After lubricating "O" Ring with key lube and replacing worn parts replace Washer (9), "O" Rings (7), and (8) into Spacer (5). Make sure to keep the Spacer Legs away from internal ports. (1).
- e. Lubricate and insert Spool (3)
- f. Install Gaskets.
- g. Lubricate and install Packing Cup (10) and insert Piston (4) into air inlet side of the Cavity. Pointing the Packing Cup Lips outward.
- h. Install Gasket (2) and Replace Leg.

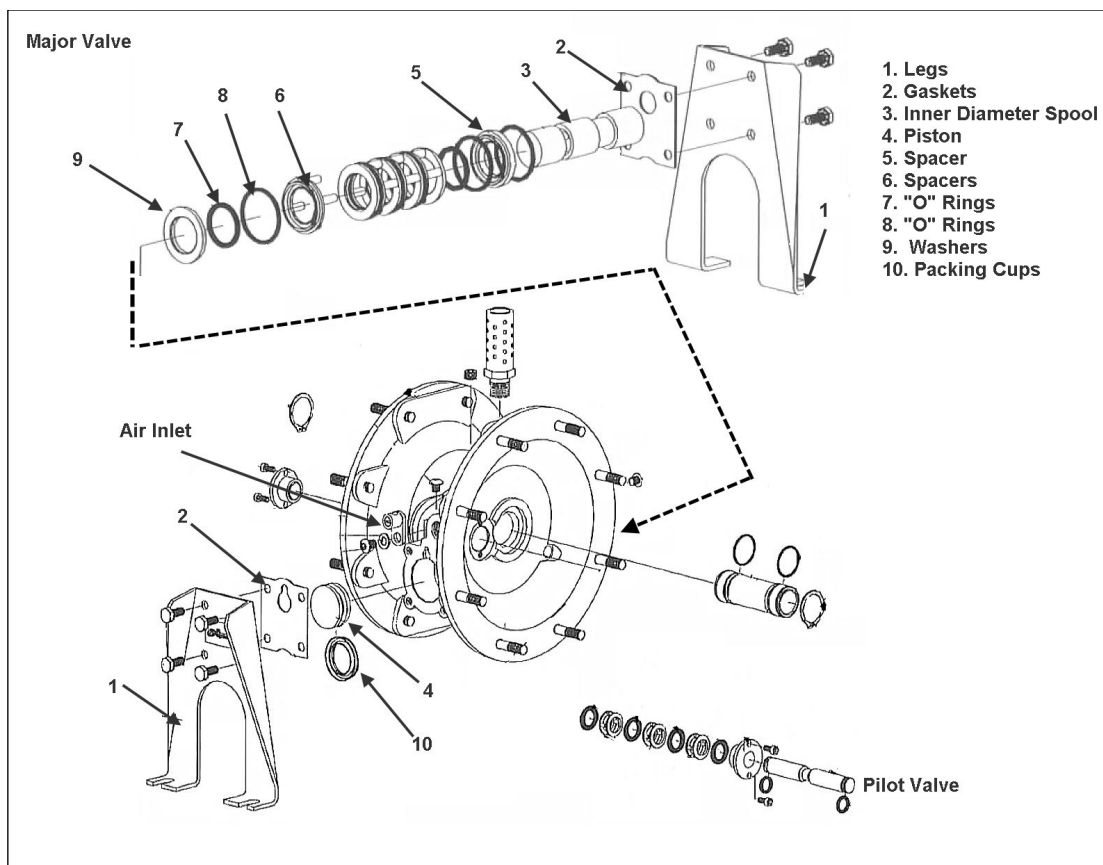


Figure 4-13 Major Valve Reassembly

4.7 Front Undercarriage Assembly

The Front Undercarriage assembly consists of a wheel assembly, a hub assembly, a spindle assembly, a tow latch assembly, a steering arm assembly and an adjustable tie rod assembly.

4.8 Front Wheel Assembly Removal

To remove the wheel assembly, the equipment must have the front end raised and placed on approved jack stands.

- Loosen lug nuts on wheel assembly requiring maintenance one turn while equipment is still on the ground.
- Raise equipment with suitable maintenance jack (see Figure 4-14, arrow A for jack placement) high enough to remove wheel assembly.
- Place approved jack stands under front axle (see Figure 4-14, arrow B for stand placement).
- Remove lug nuts of wheel assembly needing maintenance, and remove.

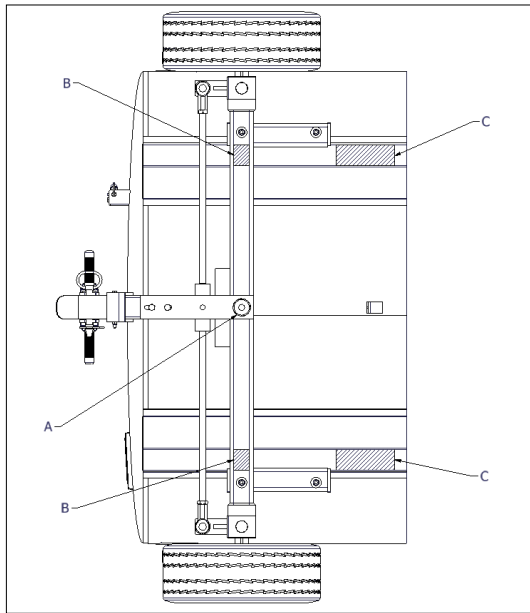


Figure 4-14 Lift Points

4.9 Front Hub Assembly

To remove the front hub assembly, follow these maintenance steps

- Remove dust cap (1) by lightly tapping with a rubber hammer.
- Remove cotter pin (2), castle nut (3), and washer (4).
- Grasp front hub (7) and pull outward firmly. Ensure that bearing (5) doesn't separate from the hub and strike the ground.
- Remove bearing (5), seal (10), and bearing (9) from the front hub (7). Using a suitable H-frame press, remove bearing races (6) and (8).
- Replace components and grease bearings before reassembly.
- When reassembling, castle nut (3) should be tightened until the hub assembly rotates past free.

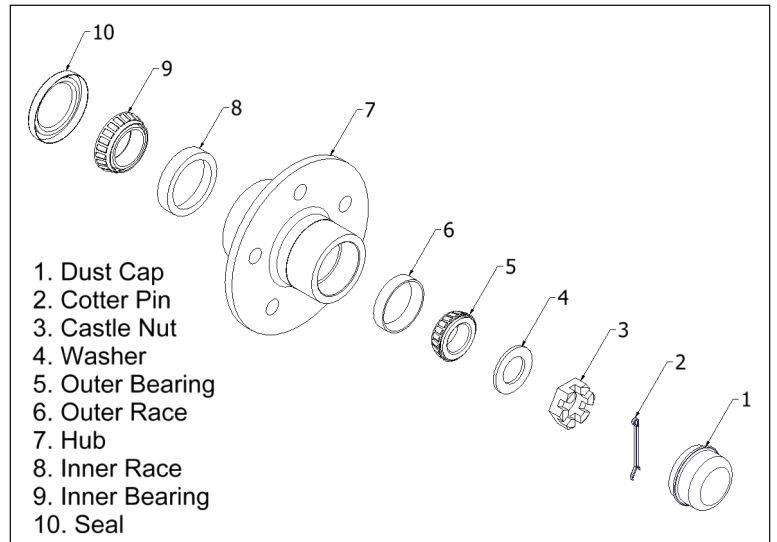


Figure 4-15 Front Hub Assembly

4.10 Tow Latch Assembly

The tow latch assembly is used to secure the tow bar in the upright position. (See Figure 4-16).

- a. Remove tow bar (1) by placing the tow bar in upright, latched position. Remove pin (2). While holding onto towbar, place foot on toe latch assembly (See reference arrow A) and depress.
- b. Pull hitch pin (3) from steering arm assembly and place tow bar to the side.

(The remaining steps are illustrated in Figure 4-17) .

- c. Remove bolt (7) and nut (10).
- d. Rotate toe latch plate (9) downward to free from assembly.
- e. Detach spring (8) from toe latch plate (9) and spring anchor (24).

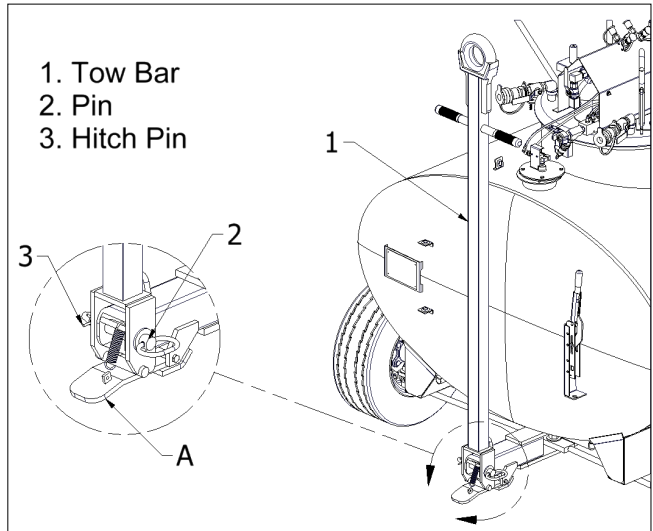


Figure 4-16 Tow Bar Removal

CAUTION

Removing hitch pin from steering arm assembly will free tow bar. Prevent tow bar from falling by holding it firmly until free. Set aside.

4.11 Spindle Assembly

To remove the spindle assembly, follow the maintenance steps for the front hub assembly before beginning the next steps. See Figure 4-17.

- a. Remove nut (17) and washer (16).
- b. Remove nut (21) and washer (20).
- c. Remove king pin (14) from yoke by using a rubber hammer.
- d. Grasp spindle assembly (18) and rotate toward front of tank until the yoke is free.
- e. Remove spindle assembly from tie rod (15).
- f. Remove bushings (19) with bronze punch and hammer.
- g. Repair / replace components.

4.12 Steering Arm Assembly

- a. Remove the thin lock nut (1).
- b. Remove nuts (17) and flat washers (16).
- c. Remove bolts (22) and nuts (5). Allow lower steering arm subassembly (11), bushing (3), and tie rod assembly (12) to drop down; place to the side.

- d. Lift upper steering arm subassembly vertically to clear pivot pin (arrow A), then pull to clear tank and front axle tube.
- e. Remove tie rod assembly (12) by removing nut (6) and flat washer (4). Note the presence of the bushings (23).
- f. Repair / replace components.

4.13 Tie Rod Assembly

Refer to Figure 4-17 for the removal of the tie rod. Before beginning this process make sure that you have followed the steps for the steering arm assembly.

Note presence and location of bushings (23) when removing tie rod assembly from steering arm assembly.

- a. Disassemble the tie rod assembly by the unthreaded components. Before disassembly, mark rod length with masking tape. Note that tie rod ends angle downward when reassembling.
- b. Adjust tire toe in / toe out as needed.

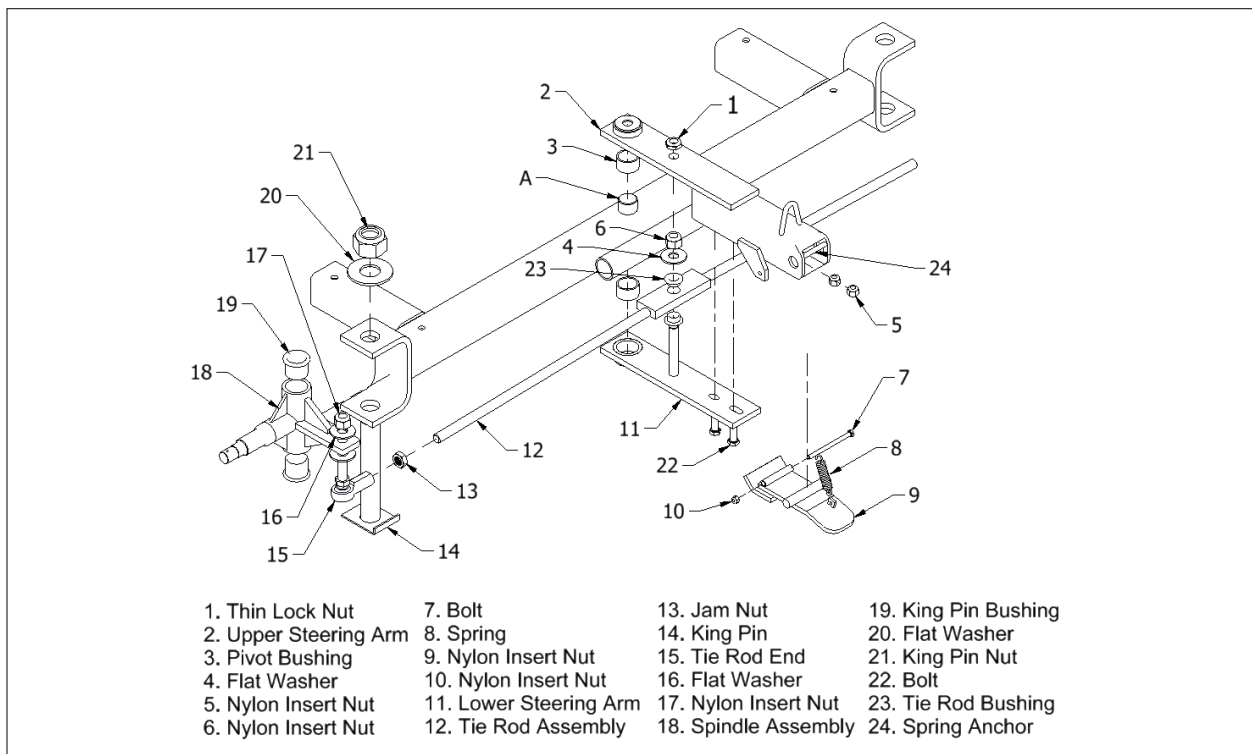


Figure 4-17 Exploded View of Undercarriage

4.14 Front Undercarriage Removal

To remove the entire Front Undercarriage assembly, the equipment must have the front end raised. See Figure 4-14 for lift points. See figure 4-18 for front undercarriage removal.

- a. Raise equipment with suitable maintenance jack (see Figure 4-14, arrow A for jack placement) To allow four inches of space between the wheels and ground.
- b. Place cribbing under tank skids (see Figure 4-14, arrows labeled C) to safely support the equipment.
- c. Lower onto cribbing. Leave jack in place.
- d. Raise jack to apply slight pressure on assembly. **(Tow bar must be in upright position.)**
- e. Remove bolts (2) and nuts (3).
- f. Carefully lower jack and assembly until wheels are on the ground and front axle tube clears tank mounts.
- g. Pull Front Undercarriage forward. Note location of rubber mounting pads (5).

⚠ WARNING

Use suitable lifting and support equipment when performing these steps. Serious injury or death could occur from rolling or falling equipment.

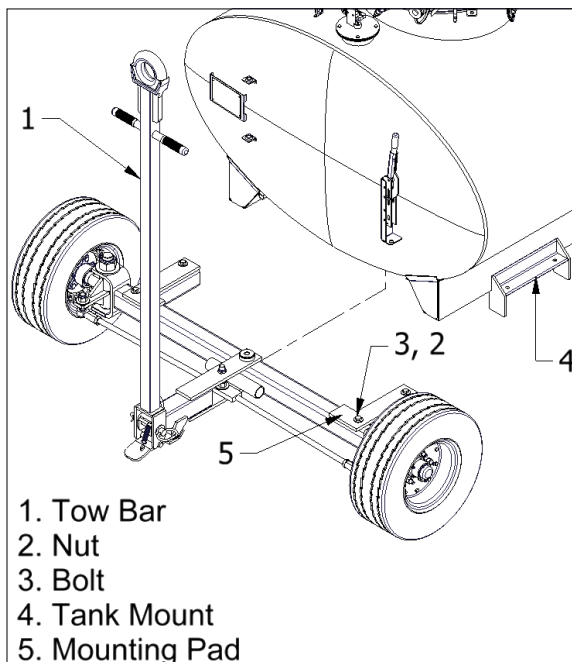


Figure 4-18 Front Undercarriage Removal

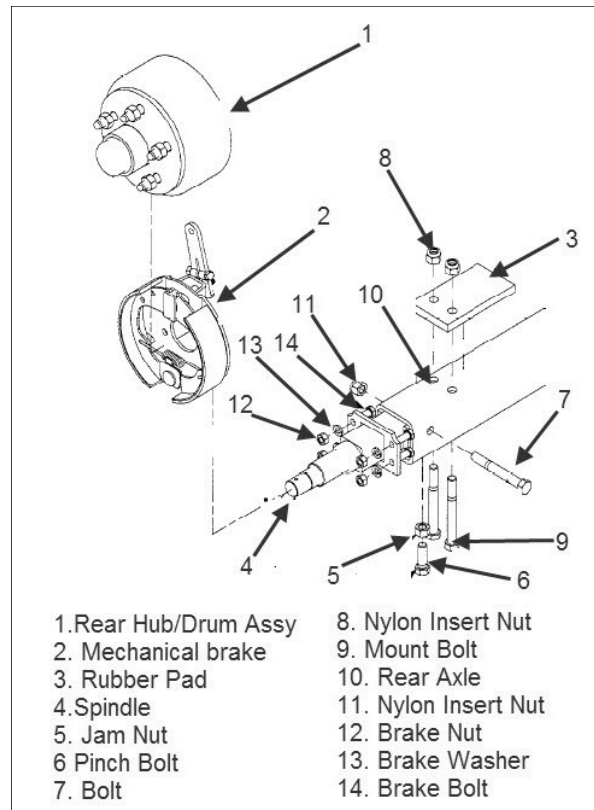


Figure 4-19 Rear Undercarriage Removal

4.15 Rear Undercarriage Assembly

See Figure 4-19 for the following maintenance steps. The rear undercarriage assembly consists of: a wheel assembly, a hub and brake drum assembly (1), a mechanical parking brake assembly (2), a rear spindle (4), and the axle (10).

4.16 Rear Wheel Assembly Removal

To remove wheel assembly, the equipment must have the back end raised and placed on approved jack stands. Points A and B are similar on both the rear and front axles.

- a. Raise equipment with suitable maintenance jack high enough to remove wheel assembly. (see Figure 4-14, arrow A for jack placement).
- b. Place approved jack stands under rear axle (see Figure 4-14, arrow B for stand placement).
- c. Remove lug nuts of wheel assembly needing maintenance.

4.17 Rear Hub / Brake Drum Assembly

To remove the rear hub and brake drum assembly, follow the maintenance steps for the rear wheel assembly removal in Section 4.16 before beginning the next steps. Figure 4-20 illustrates the process for the rear hub/ brake drum assembly.

- Remove dust cap (1) by lightly tapping with a rubber hammer.
- Remove cotter pin (2), castle nut (3) and washer (4).
- Grasp front hub (7) and drum (8) and pull outward firmly. Ensure that bearing (5) doesn't fall from hub and strike the ground.
- Remove bearing (5), seal (11), and bearing(10) from the rear hub (7).
- Using a suitable H-frame press, remove bearing races (6) and (9).
- Remove drum (8) by pressing out wheel studs (12) in suitable H-frame press.
- Replace components and grease bearings before reassembly.
- Reassemble in reverse order. Castle nut (3) should be tightened until the hub assembly rotates barely past free.

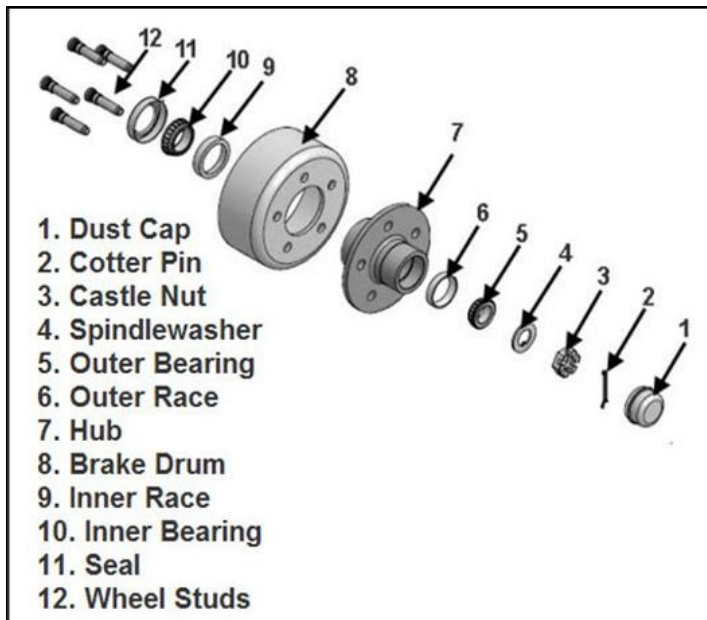


Figure 4-20 Rear Hub and Brake Drum

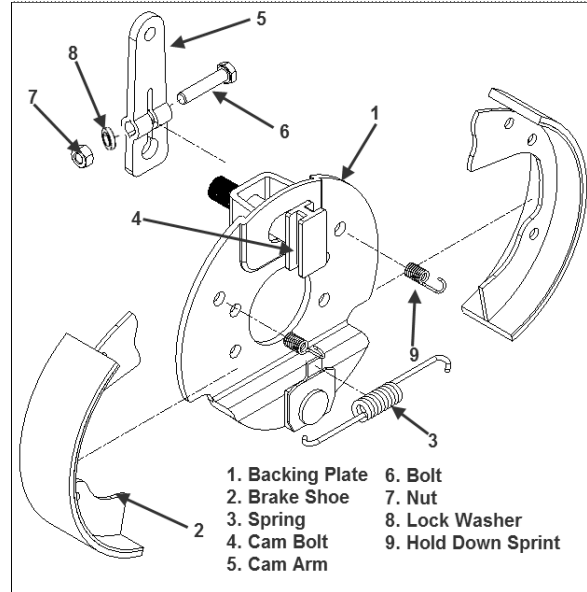


Figure 4-21 Mechanical Brake

4.18 Mechanical Brake Assembly

The assembly can be disassembled while attached to the rear spindle or removed from the unit. See Figure 4-21.

- Remove Rear Wheel Assembly as described in Section 4.16.
- Remove Rear Hub and Brake Drum Assembly as described in Section 4.17
- Remove brake cable end from arm (5) as described in section Section 4.20, step (a).
- Remove nuts (16), washers (17), and bolts (18) shown in Figure 4-22.
- Remove Mechanical Brake Assembly and place on flat surface.
- Remove spring (3).
- Release brake shoes (2) by removing springs (9) from the backing plate (1).
- Remove nut (7), lock washer (8), and bolt (6) to release arm (5).
- Remove brake cam (4) by pulling directly outward.

NOTE: Steps (d) and (e) are needed only if Mechanical Brake Assembly is to be removed from the axle.

4.19 Parking Brake Assembly and Adjustment

The parking brake assembly consists of a brake handle and cable assembly and a mechanical brake assembly. The parking brake can be adjusted at three different locations.

An in-field adjustment can be made at the brake handle by turning the handle cap clockwise to tighten brakes and counterclockwise to loosen the brakes (see reference arrow D in Figure 4-22.) This adjustment must be made with the brake handle in the off position. Maintenance level adjustments can be made at reference arrow E and reference arrow F of Figure 4-22 (each side).

4.20 Brake Handle and Cable Assembly

The brake handle and cable assembly only need to be disassembled to the point that the repair is needed. These instructions start at the wheel assembly and progress toward the brake handle. (11)

- a. Remove cotter pin (13) and clevis pin (14) to release clevis (12).
- b. Unthread clevis (12) from cable
- c. Remove nut (15) and remove cable housing (10) from bracket.
- d. Remove nut at opposite end of cable and disassemble cable linkage parts (6), (7), (8), and (9).
- e. Repeat steps (a) through (d) for opposite side.
- f. Remove nut (4) to release cable equalizer (5).
- g. Repeat step c. for cable housing leading to brake handle.
- h. Remove nut at other end of cable and release cable by disassembling cable linkage from brake handle (1).
- i. Remove bolts (2) and nuts (3) to free brake handle (1).

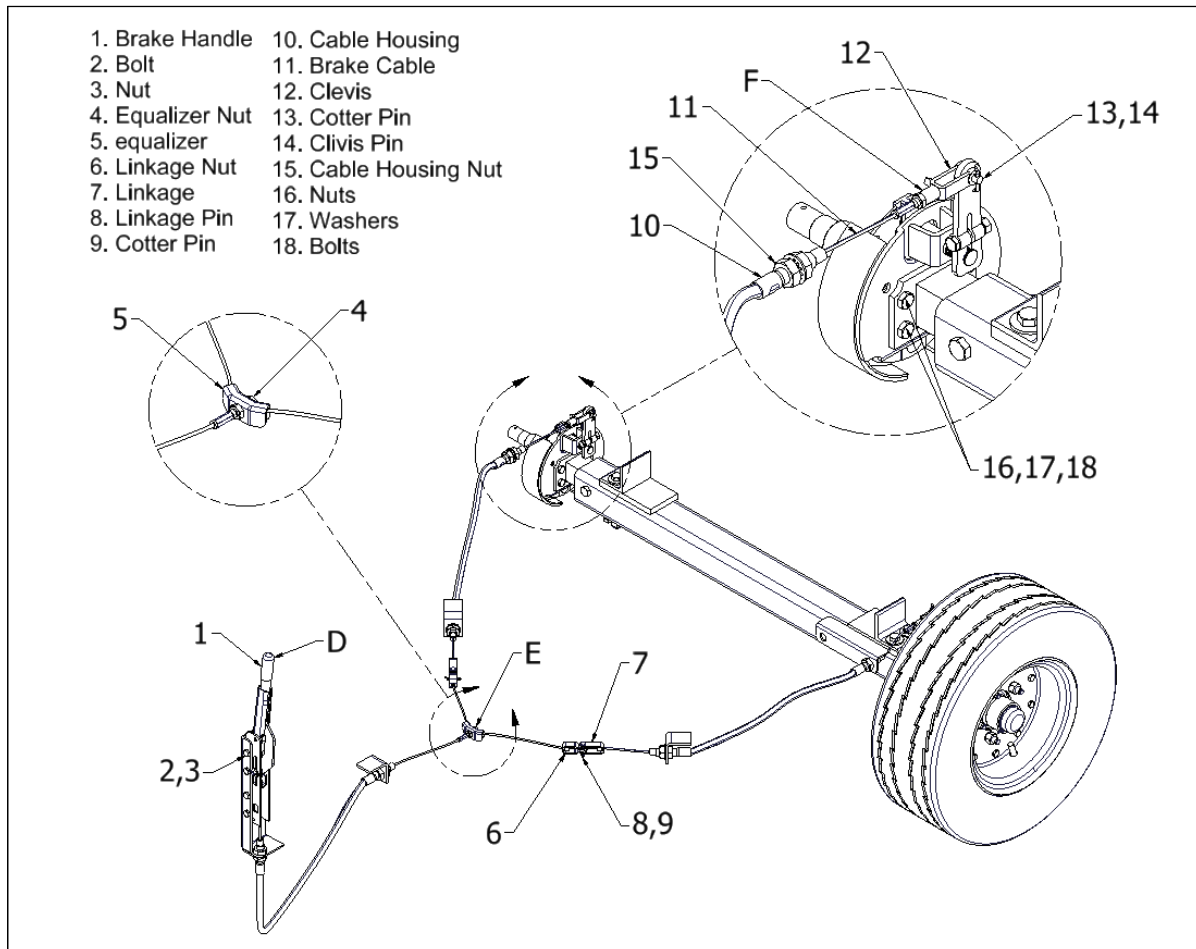


Figure 4-22 Brake and Cable Assembly

4.21 Rear Undercarriage Assembly

To remove the entire Rear Undercarriage assembly, the equipment must have the back end raised.

- a. Raise equipment with suitable maintenance jack (see Figure 4-23, arrow A for jack placement) and allow for 2-inches of space between the wheels and the ground.
- b. Place cribbing under tank skids to safely support the equipment. (see Figure 4-23, reference points labeled with a C)
- c. Lower onto cribbing. Leave jack in place.
- d. Disconnect parking brake cables at mechanical brake assembly as described in Section 4.20, step (a).
- e. Raise jack to apply slight pressure on assembly.
- f. Remove mounting nuts and bolts from both sides of axle assembly.
- g. Carefully lower jack and assembly until wheels are on the ground and the front axle.

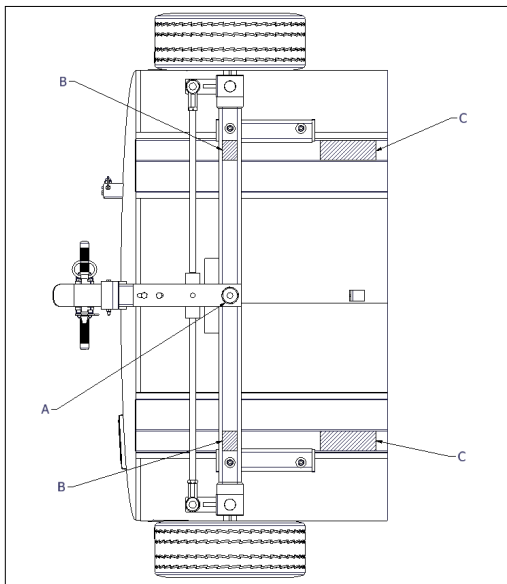


Figure 4-23 Lift Points

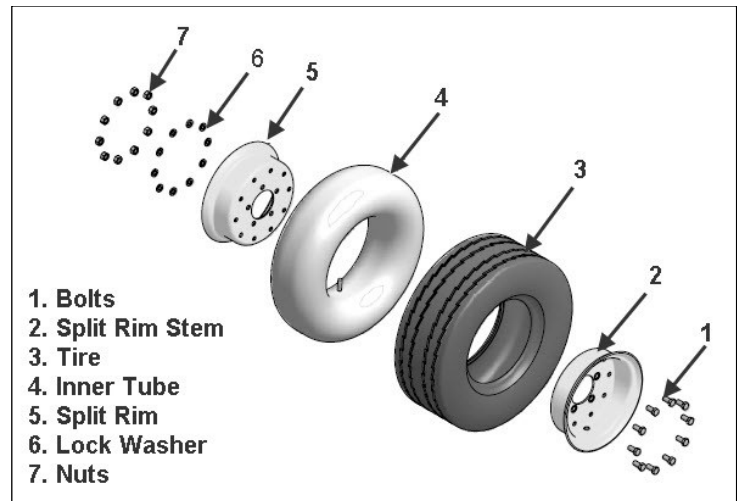


Figure 4-24 Wheel Assembly

4.22 Wheel Assembly

The Wheel assembly is a two-piece, split rim design. Use Figure 4-24 for the following maintenance steps.

- a. Remove wheel assembly as described in Section 4.16 for the side needing repair.
- b. Release air pressure from the inner tube by depressing stem valve or by removing the stem valve.
- c. Remove nuts (7), lock washers (6), and bolts (1).
- d. Separate split-rims (2) and (5) from tire (3).
- e. Remove inner tube (4) from tire (3). When reassembling, make sure that the inner tube stem is positioned through access hole in split-rim.
- f. Torque split rim nuts (7) to 75-foot-pounds before applying air pressure to wheel.
- g. Torque lug nuts to 100-foot-pounds.

4.23 Using Special Tools and Equipment With the SealVac Plus+

The SealVac Plus+ is very easy to use and maintain and does not require a great deal of additional tools or test or equipment except for some pressure, vacuum and flow test equipment.

If the supply air pressure reading cannot be found at the source of the air supply, an air pressure gauge capable of reading 0 to 125 PSI is required to troubleshoot the equipment.

If air flow rate readings cannot be obtained at the air connection point of the equipment an air flow gauge capable of reading 0 to 100 SCFM is required to troubleshoot the equipment.

When troubleshooting issues with vacuum pressure and vacuum flow, a vacuum pressure gauge that can read 0 to 30 inch HG and a vacuum flow gauge capable of reading 0 to 100 SCFM is required to troubleshoot the equipment.

The only other piece of testing equipment needed for troubleshooting is a meter capable of reading milliohms for the static bonding/grounding components.

4.24

Troubleshooting the SealVac Plus+

Problem	Probable Cause	Corrective Action
Threaded Connection leaking or weeping	Loose fitting, bad seal, damaged fitting	Use Section 4.2 To fix condition
Valve Leaking, weeping, or doesn't operate	Internal damage to valve's ball, stem, or seat	Replace valve using section 4.2
No Vacuum Suction Or Low Vacuum Suction	<ol style="list-style-type: none"> 1) Supply air not within required specifications 2) If there is no suction and Tank is full Auto-Shut off has shut down vacuum 3) If there is low suction, the Depuddling/Utility Valve valves may be open 4) Air leakage from tank 	<ol style="list-style-type: none"> 1) Check supply air pressure and flow rate 2) Empty tank 3) Close valves 4) Check sediment chamber gasket, manway assembly, and threaded connections.
Drain tool won't adhere or has weak adherence	<ol style="list-style-type: none"> 1) Supply air not within required specifications 2) Vacuum area Seal damaged or installed incorrectly 3) Drain tool vacuum generator muffler restricted 4) Drain tool is being adhered over aircraft weep hole 	<ol style="list-style-type: none"> 1) Check supply air pressure and flow rate 2) Inspect seal and fix the damaged seal 3) Inspect and fix if necessary 4) Point tool away from weep hole
Little or no fuel flow through probe	Fuel probe pin missing, or too short to fully open sump poppet valve or fuel probe, fuel line. The quick disconnect may also be clogged with debris	Check fuel probe pin and Inspect items for debris
Auto Shut-off doesn't work on a full tank or vacuum doesn't work on an empty tank	<ol style="list-style-type: none"> 1) Control lines not attached properly 2) Float rod assembly sticking 3) Float is sunk 	<ol style="list-style-type: none"> 1) Make sure control lines are connected using section 4.3 Step b, with Figure 4-1 & 4-2 2) Disassemble as needed and clean float rod 3) Replace float
Product discharged from exhaust outlet of Diaphragm pump	<ol style="list-style-type: none"> 1) Diaphragm may have a rupture 2) Diaphragm nut may be loose 	<ol style="list-style-type: none"> 1) Replace diaphragm pump or ruptured part if possible. 2) Tighten nut
Diaphragm pump producing air bubbles in product discharge	<ol style="list-style-type: none"> 1) Loose connections in the suction plumbing 2) O Rings between the intake manifold and fluid caps may be loose 3) Diaphragm nut may be loose 	<ol style="list-style-type: none"> 1) Tighten any loose Connections 2) Tighten loose O Rings 3) Tighten loose diaphragm nut
Diaphragm pump has low flow, erratic flow or no flow	<ol style="list-style-type: none"> 1) Low air supply, plugged outlet hose or kinks in outlet hose as well as kinks or a collapsed inlet material hose 2) Joints on manifolds and suction connections may be loose 3) Objects may be lodged in the diaphragm chamber or seat area 	<ol style="list-style-type: none"> 1) Unkink hoses, and get rid of obstructions in hoses 2) Tighten any loose joints and suction connections 3) Dislodge any objects found in the diaphragm chamber or seat area

Troubleshooting the SealVac Plus +

Problem	Probable Cause	Corrective Action
Manway won't seal	Manway Assembly is out of adjustment or seal is damaged	Adjust manway assembly using section 4.5
Tow bar won't lock in up-right position	Tow latch spring, damaged or missing	Inspect and replace if needed
Wheels won't steer properly	1) Steering arm assembly is damaged or tie rod assembly is damaged or misadjusted.	Inspect and repair when needed using Section 4.11, 4.12 and 4.13.
Wheels wobble or drag while rolling	Wheel bearings are damaged or loose	Inspect and Repair if needed
Brakes don't secure unit while engaged	Brakes are out of adjustment or parking brake assembly is damaged or missing	Adjust brakes or adjust and repair using sections 4.18, 4.19 and 4.20.

SECTION 5.0

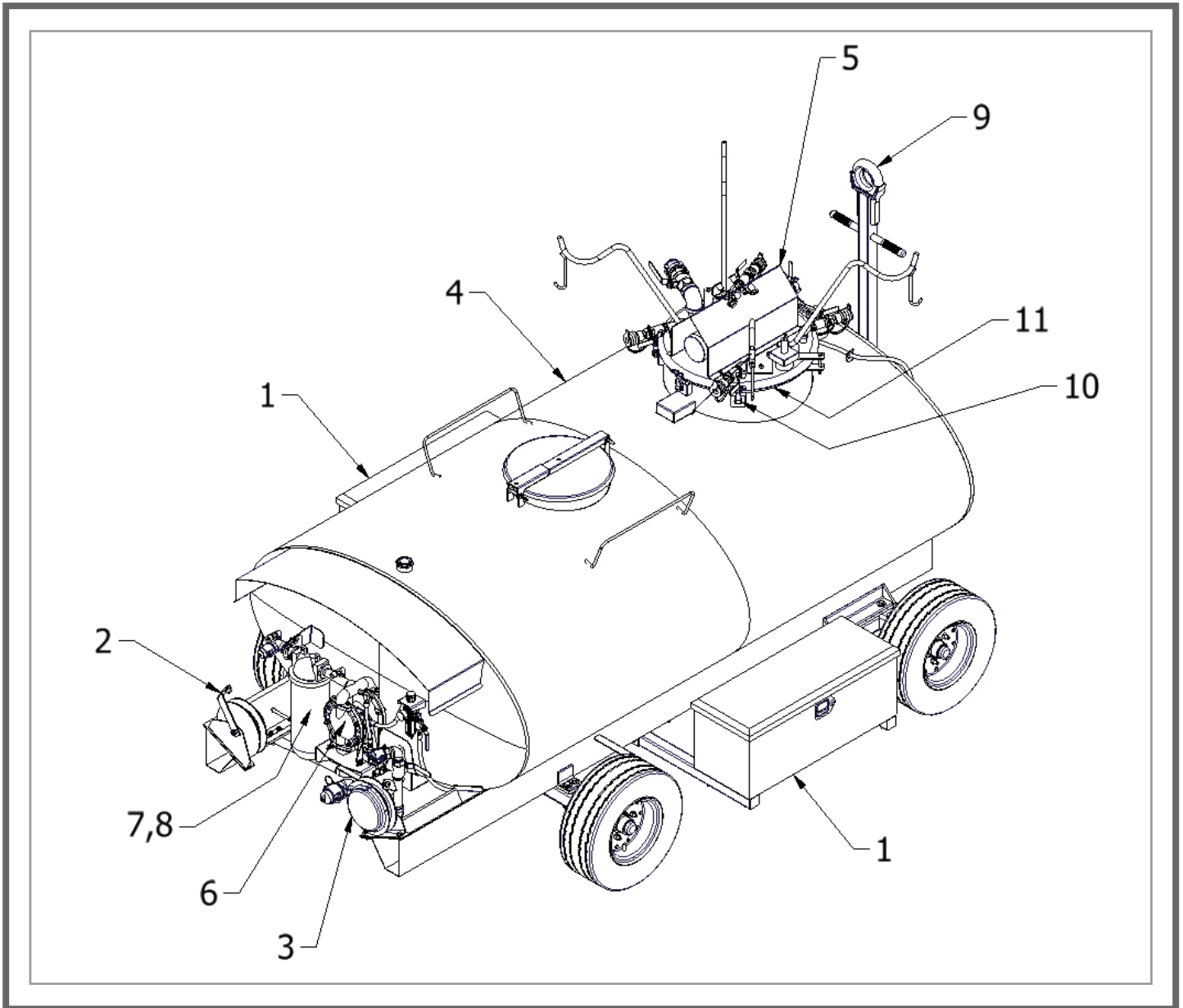
PART BREAKDOWN DRAWINGS AND PART NUMBERS

The following figures are supplied to assist in component identification and parts reordering. When reordering, ensure the complete model number and serial number are provided to the sales representative.

You may access customer service by contacting the Metal products Division at 800-541-3601, or 509-928-0720. (The toll free number does not work internationally). If you would like more information about the Spokane metal products division of Spokane Industries you may visit the website at www.spokaneindustries.com.

DRAWING NUMBER

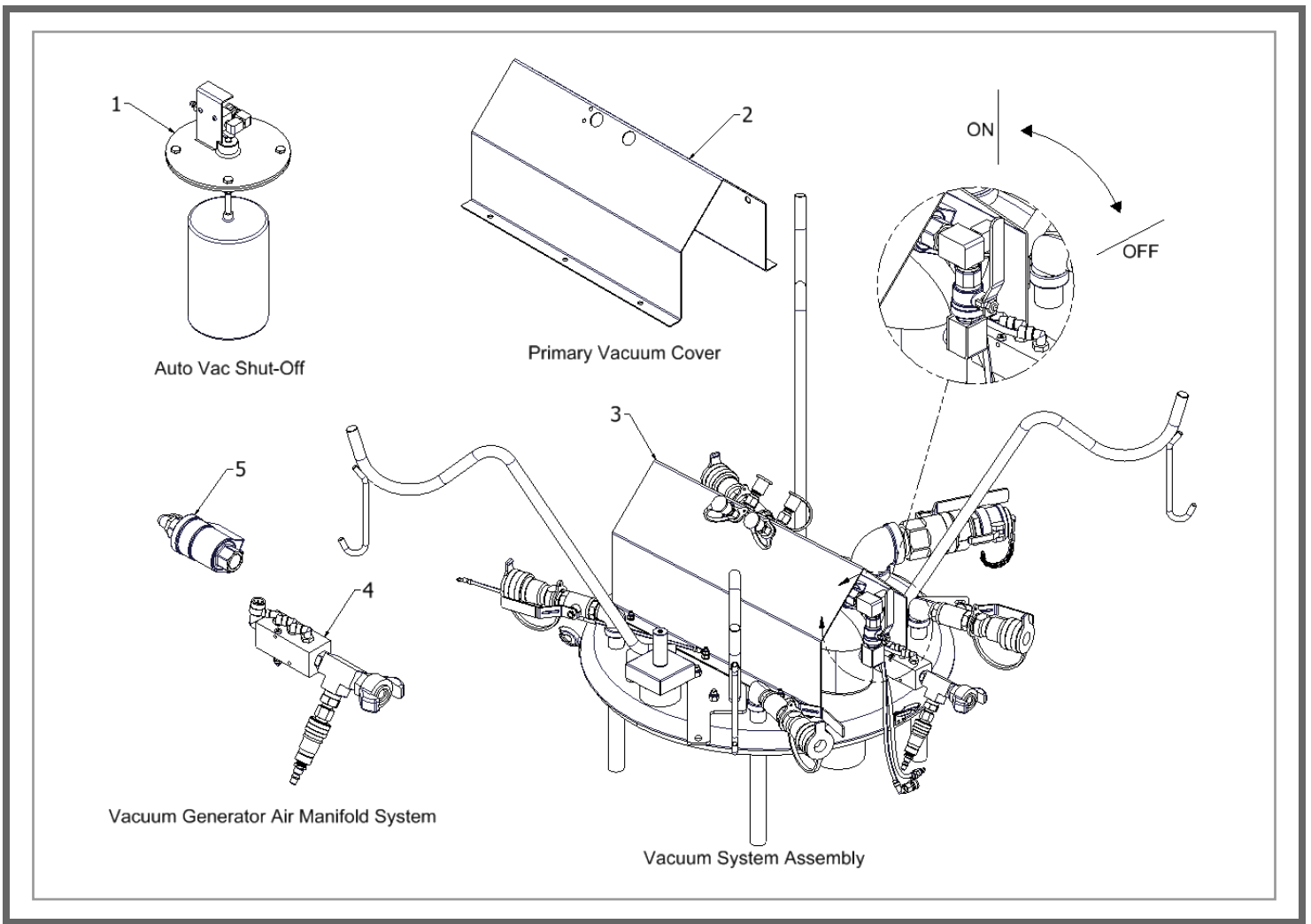
- 1.0 Overview, Component Identification**
- 2.0 Vacuum System Assembly**
- 3.0 Drain Tool Assembly**
- 4.0 Hoses**
- 5.0 Manway Assembly**
- 6.0 Front Undercarriage**
- 7.0 Rear Undercarriage and Axle**
- 8.0 Front Hub Assembly**
- 9.0 Rear Hub and Drum Assembly**
- 10.0 Wheel and Tire Assembly**



DRAWING 1.0

Overview Component Identification

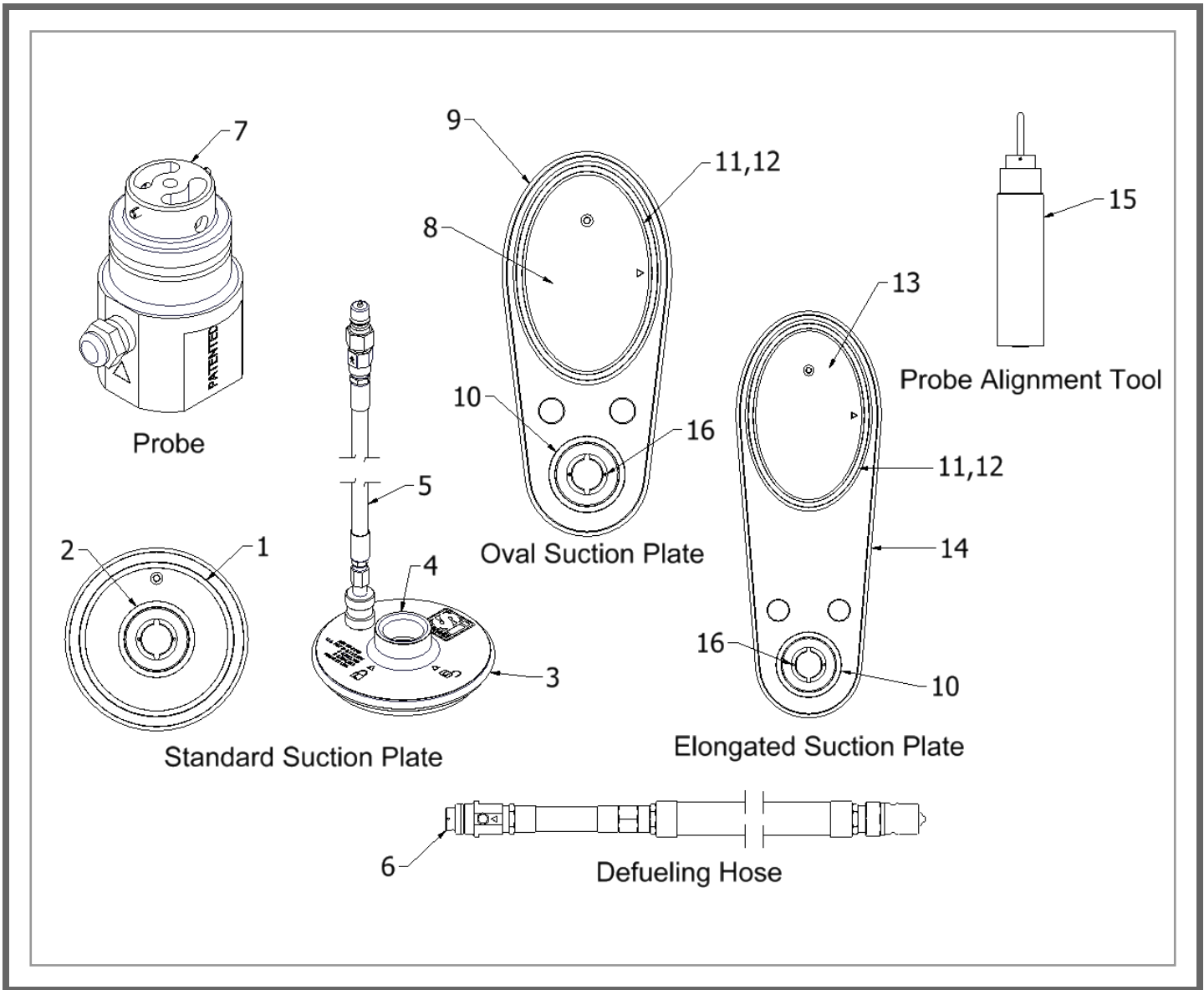
ITEM	QTY	P.N.	DESCRIPTION	MATERIAL	WEIGHT
1	2	04-00301	12 x 12 x 32 Black Utility Box	Aluminum	13.1lb
2	1	04-10361	Red Grounding Reel With Clamp	Various	9.4 lb
3	1	04-10361R	Red Grounding Reel With Plug	Various	9.4 lb
4	1	07-9012	SealVac Plus+ Tank Weldment	Various	1713.7 lb
5	1	08-1000U	SealVac Plus+ Vacuum System Assembly	Various	103.6 lb
6	1	04-8076	Diaphragm Pump	Various	15.6 lb
7	1	04-80192	Filter Housing	Various	
8	1	04-8020	Filter Element	Various	
9	1	07-1103-1	Tow Bar	Various	33.7 lb
10	4	04-1062	Latch, Rubber Tie Down	Rubber	
11	1	06-1022V	Sediment Chamber Gasket	Foam/Rubber	



Drawing 2.0

Vacuum System Assembly

ITEM	QTY	P.N.	DESCRIPTION
1	1	08-1805	Auto Vac Shut Off
2	1	07-1034SV2	Primary Vacuum Cover
3	1	08-1005U	SVU Vacuum System Assembly
4	1	04-8002	Supply Air Manifold
5	1	04-8008	Air Control Valve

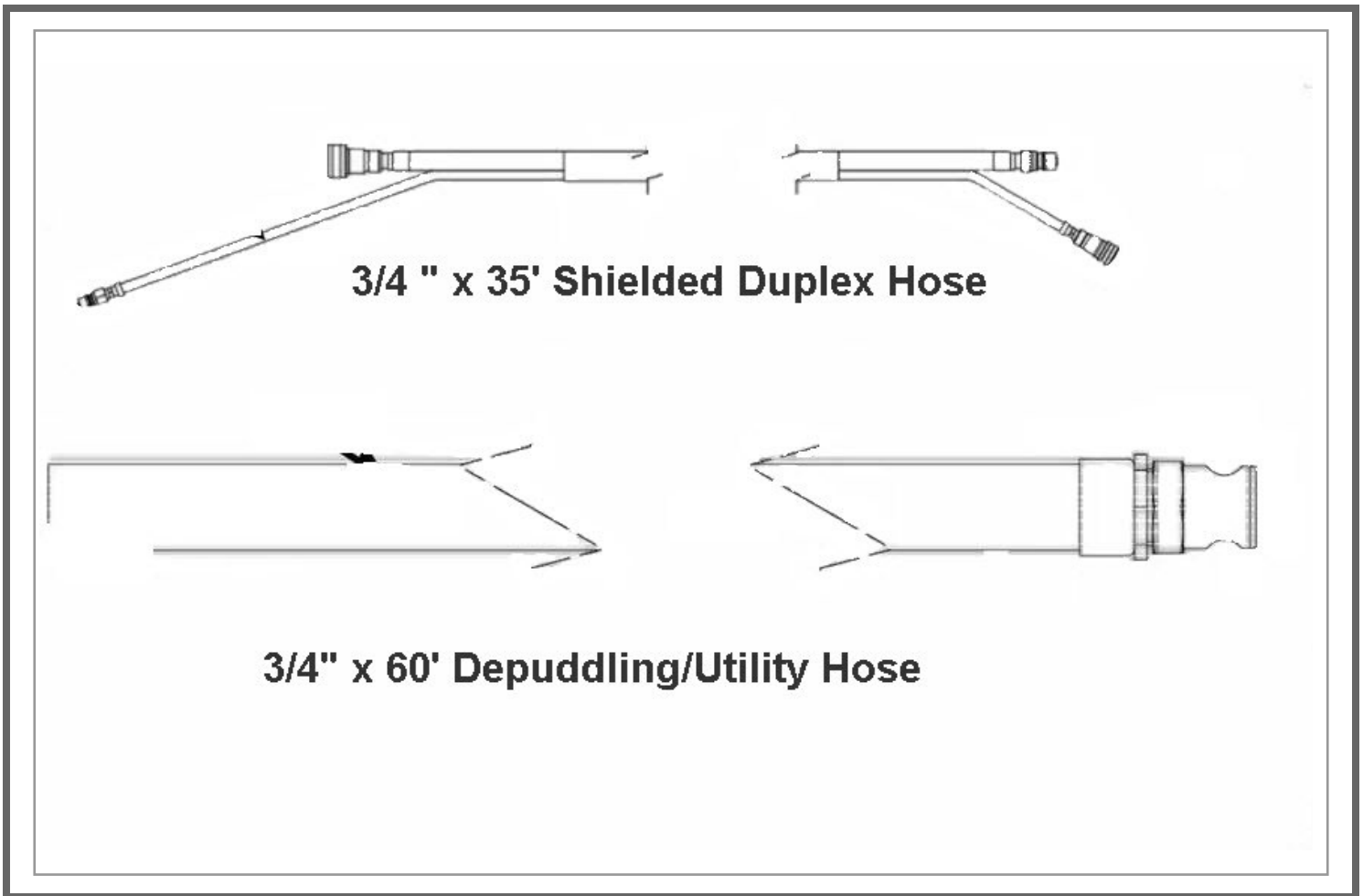


Drawing 3.0

Drain Tool Assembly

ITEM	QTY	P.N.	DESCRIPTION
1	1	06-0075	Seal, 4.75" O.D
2	1	06-0074	Seal, 2" Lid
3	1	06-00688	Bumper, Round
4	1	08-0200	Round Suction Plate Asm.
5	1	08-15059	Drain Tool Pigtail
6	1	08-0151	Drain Tool Pigtail W/ Window
7	1	08-0100	Defueling Probe Straight
8	1	08-0300	Oval Suction Plate Asm.
9	1	06-00685	Bumper, Oval
10	1	06-0073	Hub Seal Tall

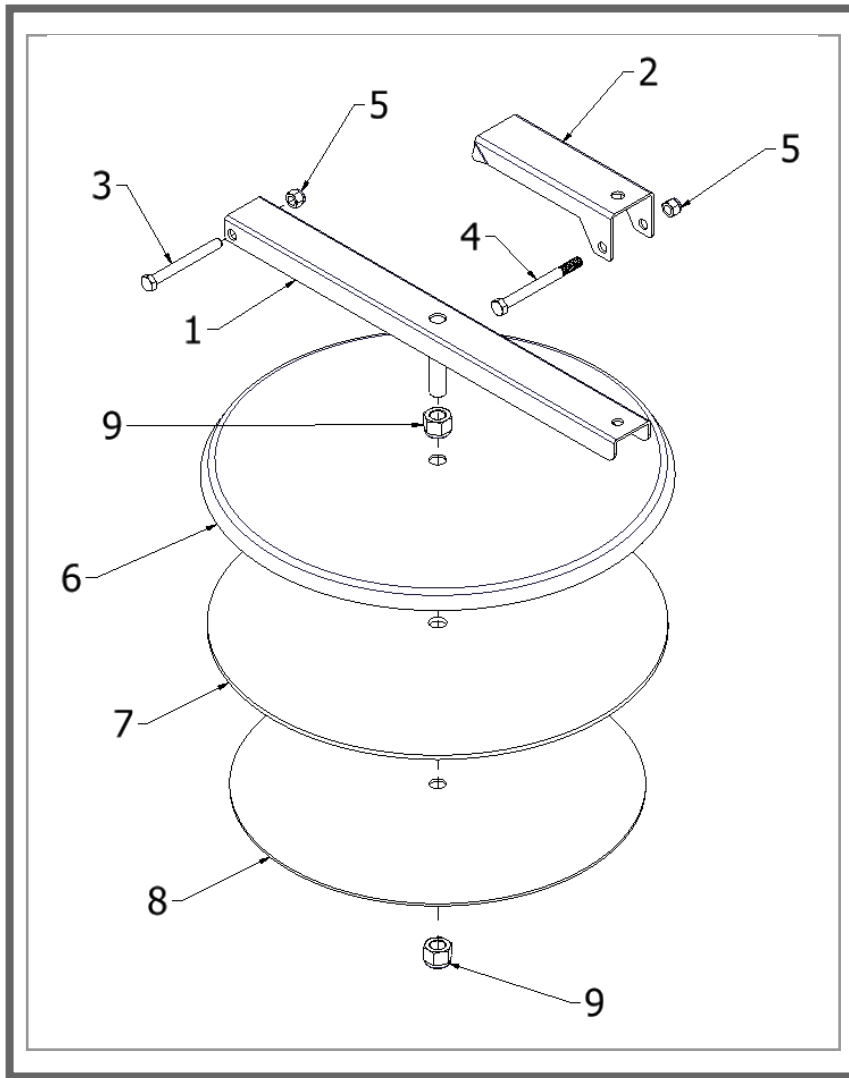
11	1	06-00774	Seal, Vacuum Area, Contoured
12	1	06-0077	Seal Flat
13	1	08-0310	Elongated Suction Plate Asm.
14	1	06-00686	Bumper, Elongated
15	1	08-12020	Probe Alignment Tool
16	6	02-3102	Roll Pin, 3/32" x 1/4" LG



Drawing 4.0

Hoses

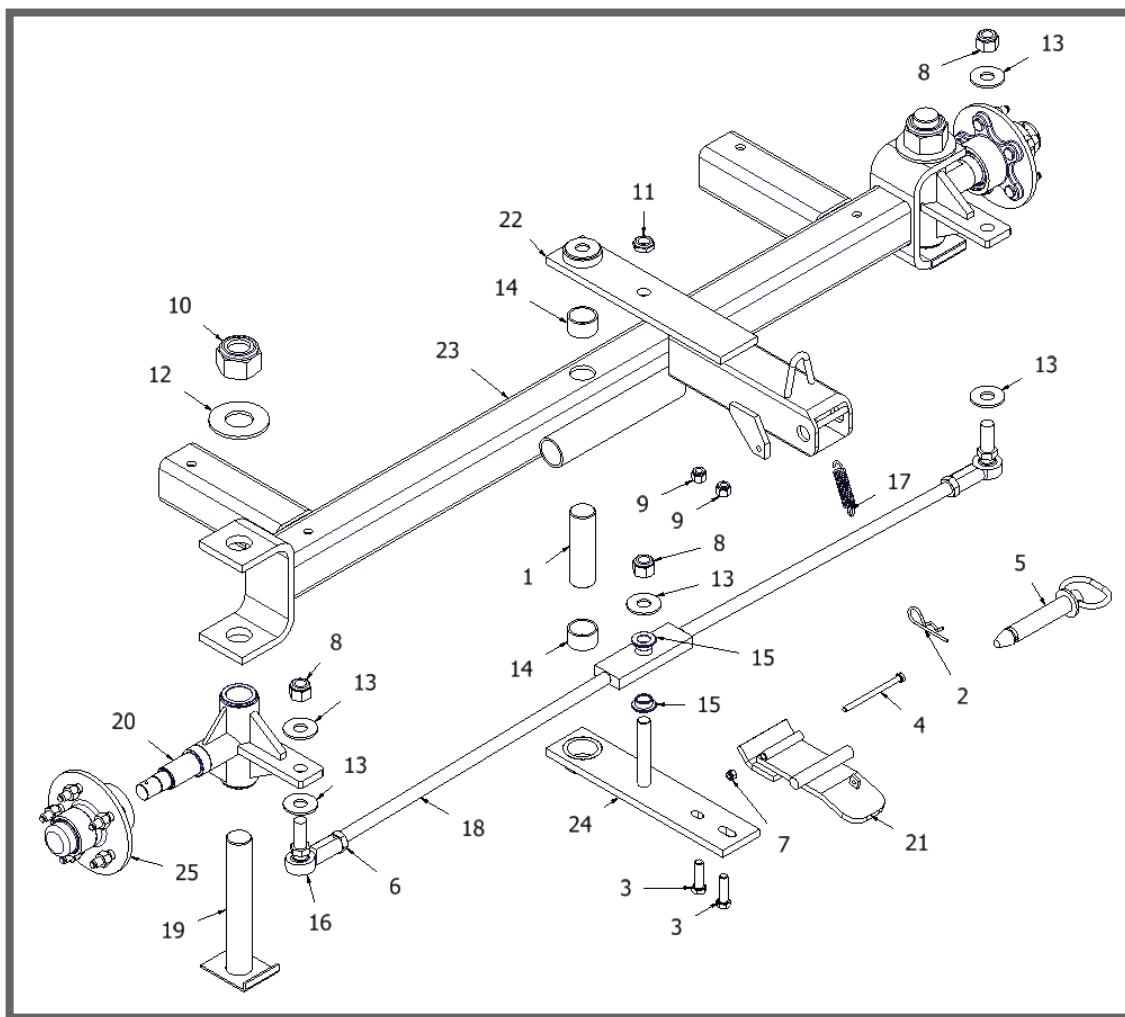
ITEM	QTY	P.N.	DESCRIPTION
1	2	08-0030	Shielded Duplex Hose
2	1	08-1301	Utility / Depuddling Hose



Drawing 5.0

Manway Assembly

ITEM	QTY	P.N.	DESCRIPTION
1	1	07-1039S	Cross Arm
2	1	01-8222S	Flip Lock
3	1	02-3044	Hex Hd. Capscrew, NC, 3/8" by 3-1/2" LG
4	1	02-3045	Hex Hd. Capscrew, NC, 3/8" by 4" LG
5	2	02-3089	Nut, Nylock, NC, 3/8"-16
6	1	01-86001	Manway Lid, 16" Diameter w/ Thru Hole
7	1	06-25025	Manway Gasket, 16" Standard, 3/16" Thk, Buna
8	1	01-8710	Retainer Gasket, SV
9	2	02-3091	Nut, Nylock, NF, 5/8"-18

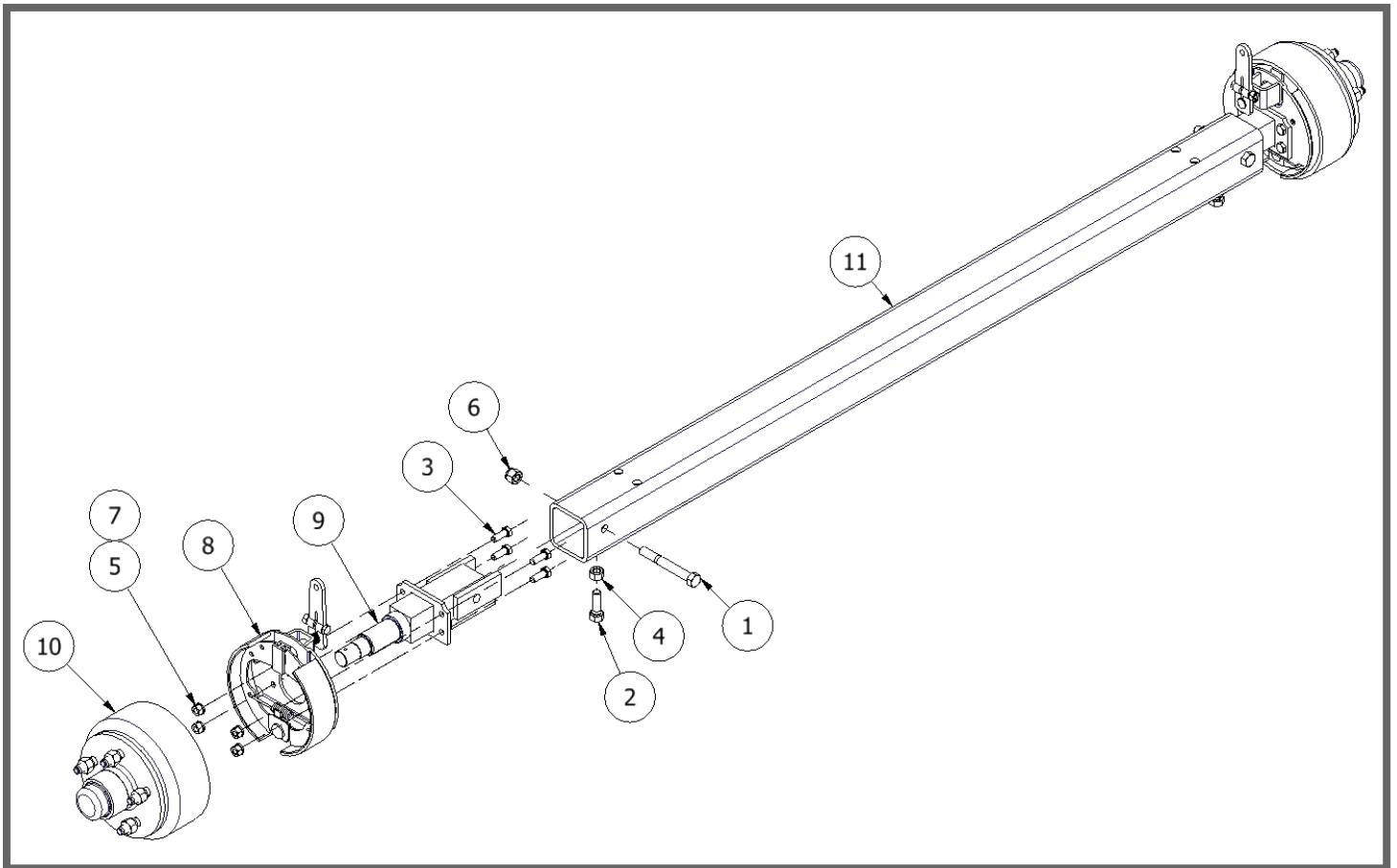


Drawing 6.0

Front Undercarriage

ITEM	QTY	P.N.	DESCRIPTION
1	1	01-8414	PIVOT PIN, FRONT AXLE
2	1	02-3016	HITCH PIN CLIP
3	2	02-3022	HEX HD CAPSCREW, NC, 1/2-IN BY 1 3/4-IN, GRD 5, PLATED
4	1	02-3055	HEX HD CAPSCREW, NC, 5/16-IN BY 4 1/2-IN LG, PLATED
5	1	02-3063	HITCH PIN, 1-IN BY 4 1/2-IN LG, PLATED
6	2	02-3081	NUT, JAM, UNF, 3/4-IN-16, PLATED
7	1	02-3082	NUT, NYLOCK, NC, 5/16-IN-18
8	3	02-3083	NUT, NYLOCK, NF, 3/4-IN-16
9	2	02-3087	NUT, NYLOCK, NC, 1/2-IN-13, FIN, PLATED
10	2	02-3093	NUT, NYLOCK, UNF, 1 1/2-IN-12, FIN
11	1	02-3094	NUT, NYLOCK, NF, 3/4-IN-16, FIN, THIN
12	2	02-3127	WASHER, FLAT, 1 1/2-IN, PLATED

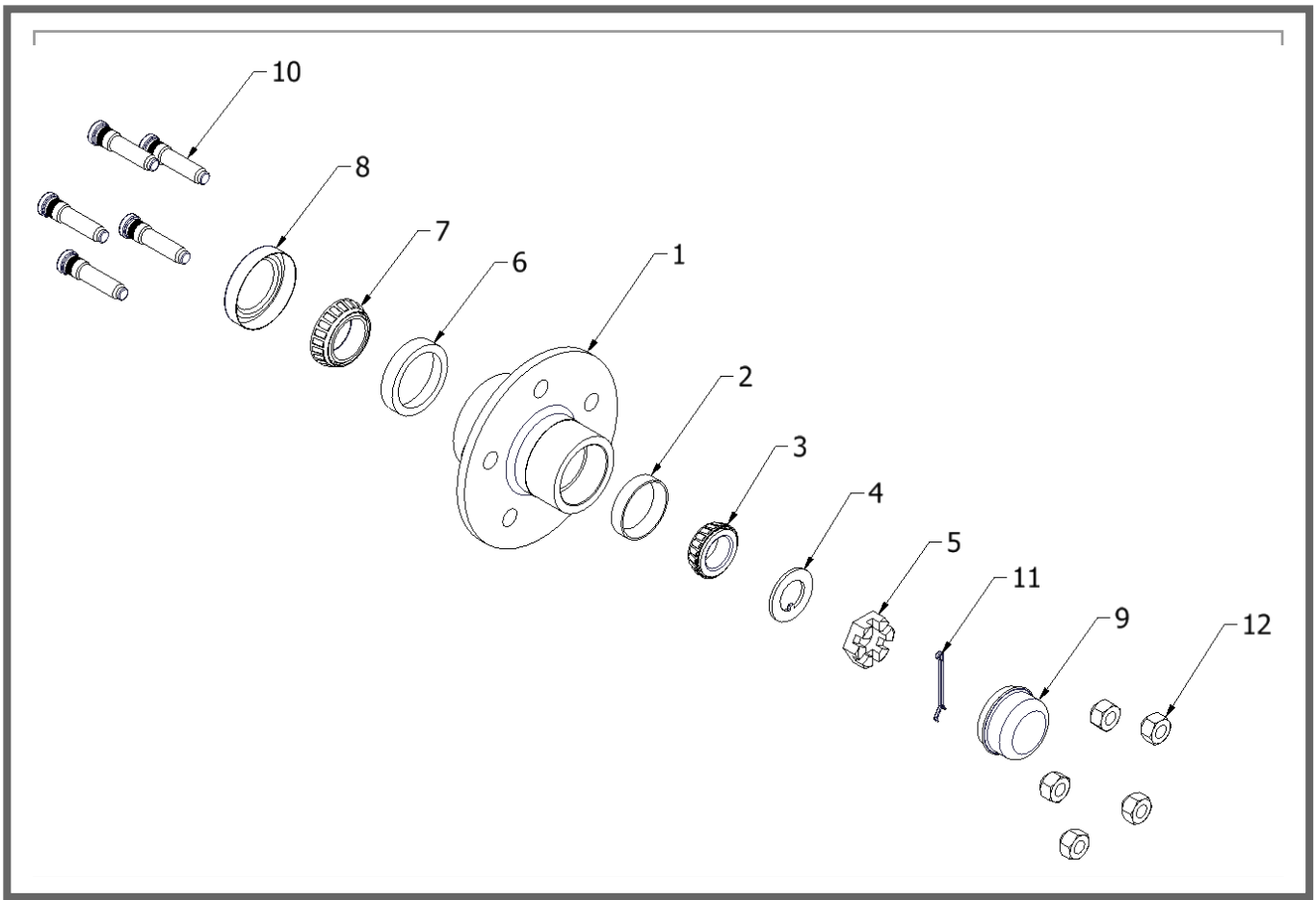
ITEM	QTY	P.N.	DESCRIPTION
13	5	02-3131	WASHER, FLAT, 3/4-IN, PLATED
14	2	03-1014	BUSHING, STEERING ARM
15	2	03-1015	BUSHING, TIE ROD, PIVOT POINT
16	2	03-1016	ROD END, BALL JOINT LINKAGE
17	1	04-1054	SPRING, TOW LATCH
18	1	07-1005	TIE ROD ASSEMBLY, 400/600 GALLON
19	2	07-10105	KING PIN
20	2	07-1015	ASM, KING PIN HOUSING
21	1	07-1020	TOW LATCH WMT, ALL SIZES
22	1	07-1104	STEERING ARM, UPPER, 400 & 600 GALLON
23	1	07-11071	FRONT AXLE WELDMENT, 400 & 600 GALLON
24	1	07-5002	STEERING ARM, LOWER PLATE, ALL SIZES
25	2	08-1011	FRONT HUB ASSEMBLY



Drawing 7.0

Rear Undercarriage and Axle

ITEM	QTY	P.N.	DESCRIPTION
1	2	02-3024	HEX HD CAPSCREW, NC, 1/2-INCH BY 4-INCH, GRD 5, PLATED
2	2	02-3026	HEX HD CAPSCREW, NC, 1/2-INCH BY 1 1/2-INCH, GRD 5, PLATED
3	8	02-3050	HEX HD CAPSCREW, NC, 3/8-INCH BY 1-INCH, GRD 5, PLATED
4	2	02-3068	NUT, HEX, 1/2"-13 UNC PLATED
5	8	02-3072	NUT, HEX, NC, 3/8-IN-16, FIN., PLATED
6	2	02-3087	NUT, NYLOCK, NC, 1/2-INCH-13, FIN., PLATED
7	8	02-3143	WASHER, MEDIUM LOCK, 3/8-INCH PLATED
8	2	04-1063RBO	BRAKE ASSEMBLY
9	2	07-1010	REAR SPINDLE WELDMENT, REAR AXLE
10	2	08-10111	REAR HUB & DRUM ASSEMBLY
11	1	08-103011	REAR AXLE WELDMENT, 400 & 600 GALLON

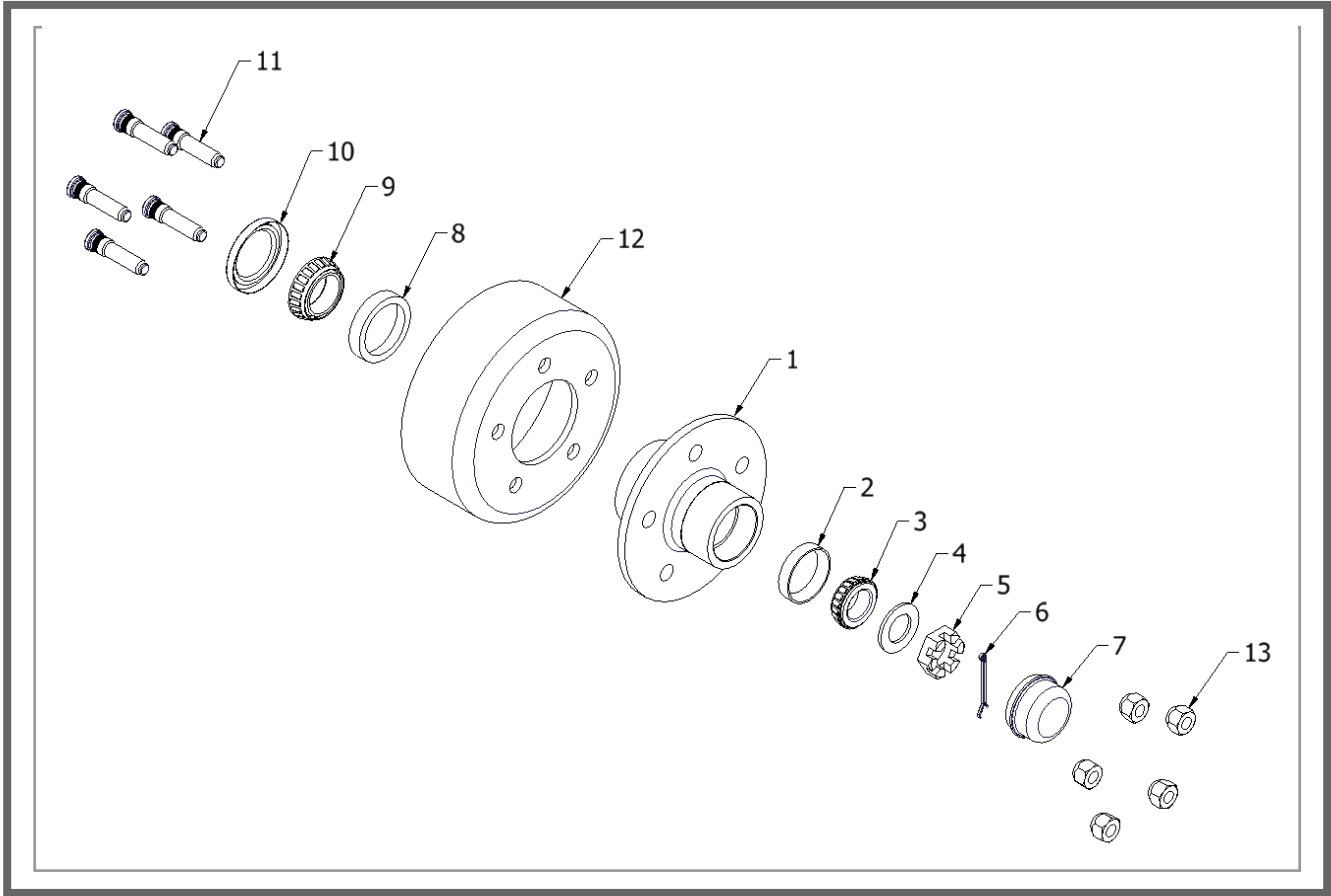


Drawing 8.0

Front Hub Assembly

ITEM	QTY	P.N.	DESCRIPTION
	1	08-1011	Front Hub Assembly
1	1	04-1017	Hub, Front Axle
2	1	04-1016	Cup, Outer Bearing
3	1	04-1014	Cone, Outer Bearing
4	1	02-12055	Washer
5	1	02-1205	Nut, Castle
6	1	04-1015	Cup, Inner Bearing
7	1	04-1013	Cone, Inner bearing
8	1	04-1012	Seal bearing
9	1	04-1019	Cap, Hub
10	5	02-1017	Stud
11	1	02-1303	Pin, Cotter
12	5	02-3065	Nut, lug

*Replacement parts only available as whole assembly.

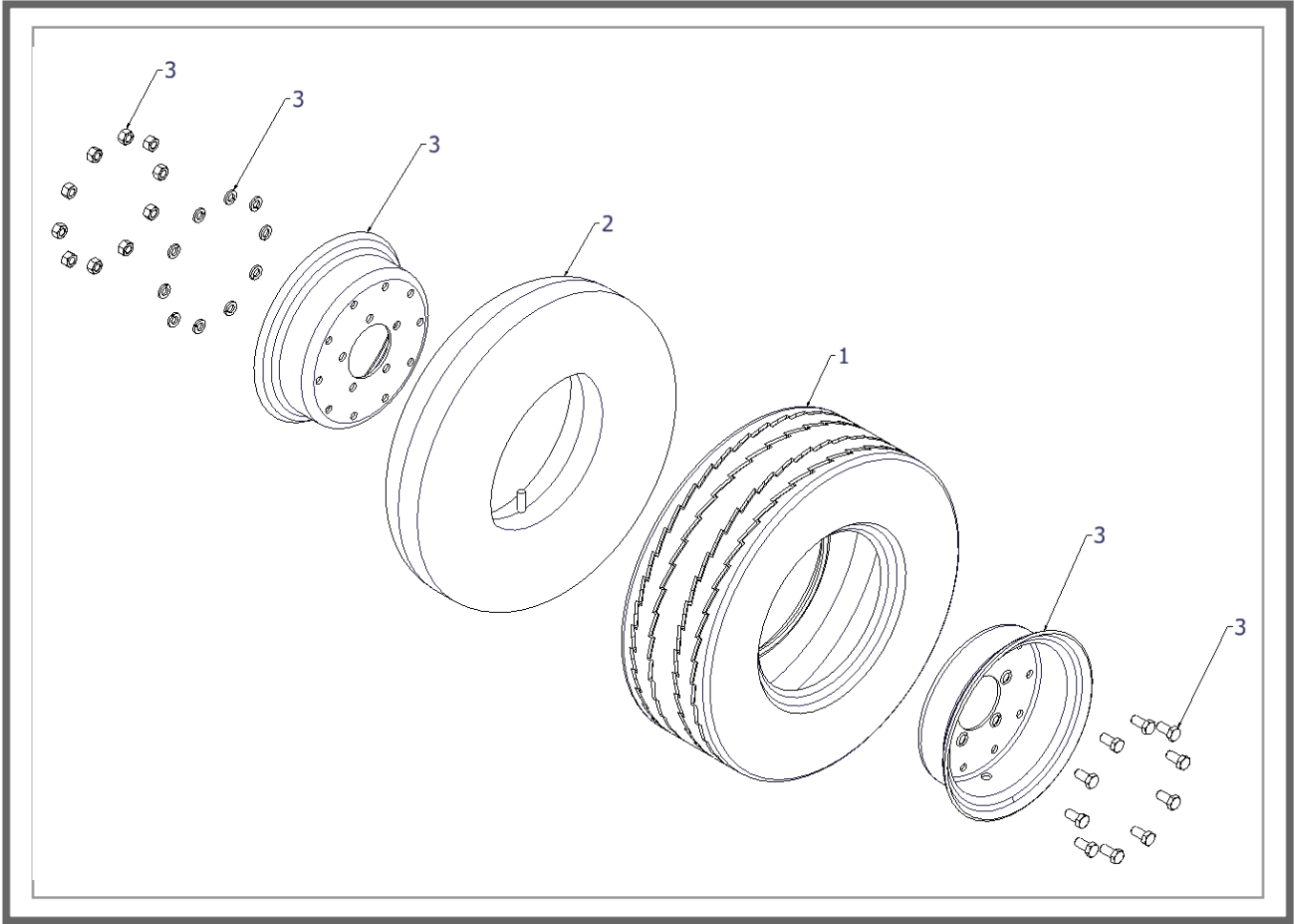


Drawing 9.0

Rear Hub and Drum Assembly

ITEM	QTY	P.N.	DESCRIPTION
	1	08-10111	Rear Hub Assembly
1	1	04-1017	Hub, Rear Axle
2	1	04-1016	Cup, Outer Bearing
3	1	04-1014	Cone, Outer Bearing
4	2	02-12055	Washer
5	1	02-1205	Nut, Castle
6	1	02-1303	Pin, Cotter
7	2	04-1019	Cap, Hub
8	2	04-1015	Cup, Inner Bearing
9	1	04-1013	Cone, Inner bearing
10	1	04-1012	Seal, Bearing
11	5	02-1303	Stud
12	1	08-10111	Drum, Brake
13	5	02-3065	Nut Lug

*Replacement parts only available as whole assembly.



Drawing 10.0 Wheel and Tire Assembly

ITEM	QTY	P.N.	DESCRIPTION
	4	07-10201-1	Complete Wheel Assembly (All Numbers)
1	1	04-10221	Tire, 20.5x 8.0-10, E-Range
2	1	04-1059	Inner Tube
3	1	04-1020	Split Rim Wheel Assembly