TECHNICAL MANUAL

Helifueler 600 Gallon Defueler / Fueler Cart

Spokane Industries

SPOKANE INDUSTRIES, INC.

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MNUL-005 REVISION A

APRIL 2013

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509-928-0720

Limited Warranty Agreement
Aviation Fuel Products

To include SealVac™ Vacuum Fuel Drain System, HandiFueler™ Ground Support Service Cart, HeliFueler™, Spokane Industries UAV Fuel Service Cart and Non-Vacuum Units

Spokane Industries of Spokane Valley, Washington (SI) hereby warrants to the purchaser (the Warrantee) that all products explicitly covered by this Warranty Agreement have been thoroughly inspected upon completion and that they and their component parts are free of defects in materials and workmanship. SI further warrants that in the event the product fails due to defects in materials and/or workmanship within a period of twenty-four (24) months from the effective date of this warranty that SI will provide replacement parts free of charge except for those components which are covered by an Original Equipment Manufacturer's (OEM) Warranty, in which case coverage will be provided by that OEM.

Coverage

The SI Aviation Fuel Products Limited Warranty Agreement covers all products manufactured for use as Aircraft Ground Support Equipment Servicing, UAV Fuel Servicing, Aircraft Fuel Draining Equipment, and Non-Vacuum Units. Certain components of these products are manufactured by third party Original Equipment Manufacturers (OEMs) and are covered by these manufacturers' Warranties. SI Warranty coverage is contingent upon proper installation, operation, maintenance and repair of the product. Refer to the appropriate manuals and documentation for assistance. In cases of uncertainty, SI must be consulted prior to any service work being performed. Failure to do so may result in the termination of Warranty coverage.

Terms and Conditions

REQUESTS FOR WARRANTY COVERAGE

Requests for Warranty Coverage should be addressed to: ***Spokane Industries, Metal Products Division, Quality Assurance Department, 3808 N Sullivan Rd Building 4, Spokane Valley, WA 99216****.Calls concerning Warranty Coverage should be placed to 800-541-3601, Fax: 509-927-0826. Please provide the Model Number, Ship Date, Original Purchaser, and Point of Installation, and, if possible, our original Sales Order number. The Quality Assurance Department will make a Warranty determination based upon this information and our internal records. If Warranty coverage is in effect, replacement parts will be sent provided that credit terms have been established. If Warranty coverage is not in effect, the cost of replacement parts will be quoted.*

TRANSFERABILITY

This warranty is extended only to the original purchaser, and is not transferable without the express written consent of SI. Transferability is contingent on the product being in warrantable condition. SI reserves the right to verify product warrantability by whatever means is deemed appropriate, and the right to refuse to transfer the warranty with or without cause. Warranty transfer requests must be made in advance of the sale or transfer of the product. SI accepts no responsibility for any costs associated with the transfer of existing warranties including any costs associated with verification of product warrantability. Requests for Warranty transfers should be sent to the address above.

RETURN OF WARRANTY PARTS ("EXCHANGE")

- *For the purposes of quality assurance, SI requires that certain parts and assemblies covered under the SI Limited Warranty Agreement be returned by the Warrantee upon receipt of replacements (known as "Exchange"). In these cases, SI will authorize the shipment of replacement parts immediately and provide a Returned Merchandise Authorization (RMA) number along with a full retail invoice for the replacement parts pending receipt of the Warranty ("defective") parts. The Warranty parts must be returned to SI within 30 days with the RMA number CLEARLY marked on the outside of the shipping materials. At this time SI will inspect the Warranty parts to verify Warranty coverage. If the Warranty parts are deemed defective due to materials and workmanship, SI will issue a full credit for the replacement parts. If the Warranty parts are not returned within thirty days the Warrantee's account will not be credited. Payment in full is then due and subject to the standard terms and conditions of SI credit.*
- *In cases where returned parts are deemed not to be defective, SI reserves the right to refuse to cancel the applicable invoice.*
- *Exchange parts must be properly packed and sealed and shipped to SI by prepaid freight. Under no circumstances does SI accept C.O.D. shipments.*
- *SI Warranty replacement parts are provided subject to the terms and conditions of the SI Sales and Service Agreement which states that where no other Warranty coverage is in place, Service and Warranty parts are covered by a ninety-day limited Warranty.*

LIMITATIONS

The following limitations apply to the SI Limited Warranty Agreement:

- *SI shall not be liable under any circumstances for any incidental or consequential damages including, but not limited to, loss of time, inconvenience, expenses incurred by purchaser in order to remedy defects, or liability purchaser may have with respect to any other person for loss or damage arising from the operation of the product or the product's failure to operate in any way, or any other type of consequential damage or economic loss.*
- *This warranty is limited to defects in materials and workmanship. SI assumes no liability whatsoever for damages arising from the inability of the product to perform a certain task. Damage arising during shipping and handling, improper installation, use, maintenance, repair, or any unauthorized modifications, whether performed by qualified service personnel or not, neglect, Acts of God, etc., are expressly excluded. In any case, SI's liability shall be limited only to the provision of suitable replacement parts for those which failed due to defects in materials and workmanship. Incidental damage resulting from the failure, and labor costs associated with the repair and/or replacement of the product, its assemblies, and component parts, are excluded.*
- *SI reserves the right to limit or terminate warranty coverage in instances where repeated product failures are a result of failure to correct operating conditions which are in any way abnormal or exceed operating condition specifications. It is the purchaser's responsibility to remedy such conditions as may be likely to cause initial and/or repeated failures of the equipment. SI assumes no responsibility whatsoever for any costs incurred for this purpose.*
- *The SI Limited Warranty Agreement covers only replacement parts supplied by SI. SI makes every reasonable effort to ensure an adequate supply of replacement parts. However, in cases where the exact replacement part is no longer available, SI reserves the right to provide a suitable substitute.*
- *Components such as batteries, which are subject to normal wear and tear, are pro-rated under the provisions of this Warranty. Warranty coverage shall be pro-rated according to the amount of Warranty coverage remaining.*

EXCLUSIONS

The following exclusions apply to the SI Limited Warranty Agreement:

- *The SI Limited Warranty Agreement applies only to authentic new and, where applicable, refurbished products. Products sold "As Is", demonstration units, and any other products subjected to previous uses are explicitly excluded.*
- *The SI Limited Warranty Agreement excludes any and all parts and assemblies which are covered by another manufacturer's Warranty (see above).*
- *This Limited Warranty Agreement constitutes the complete and entire SI Warranty statement. Any items and/or circumstances not expressly covered by this Warranty Agreement are hereby excluded. This includes, but is not limited to, such additional offerings as SI may make available from time to time. These offerings are independent of this Agreement and, as such, do not in any way extend, modify, or otherwise alter the coverage, terms, conditions, limitations, and exclusions as they are set forth here unless explicitly stated.*
- *The failure to observe any and all of the terms and conditions of this warranty will render it null and void.*
- *Although all reasonable precautions are taken to ensure that shipping damage is avoided. Any damage incurred during the shipment, unloading, and installation of the product is explicitly excluded. Any and all damage during shipment is the sole responsibility of the transportation carrier(s). Product should be thoroughly inspected prior to acceptance from the freight carrier. All SI products are shipped F.O.B. Spokane Washington.*
- *This Warranty is in lieu of all other warranties whatsoever, express, implied and statutory, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose, and all such warranties express or implied, shall be excluded from this transaction and shall not apply to the goods sold.*

Warranty inquiries are welcomed and should be addressed to:

Spokane Industries
Metal Products Division
Quality Assurance Department
3808 N. Sullivan Road Bldg 4
Spokane Valley, WA 99216
(800) 541-3601

Section

Section

Drawing No.

SECTION 1.0 INTRODUCTION

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 Helifueler Defueler/ Fueler cart manufactured by Spokane Industries, Inc. of Spokane Valley, Washington.

DESCRIPTION

.**Throughout this manual the unit will be referred to as the DFC.** The Helifueler DFC is a 600-gallon defueler / fueler cart designed to provide a portable, self-contained defueling/fueling system for refueling helicopters. The DFC is easy to use and maintain.

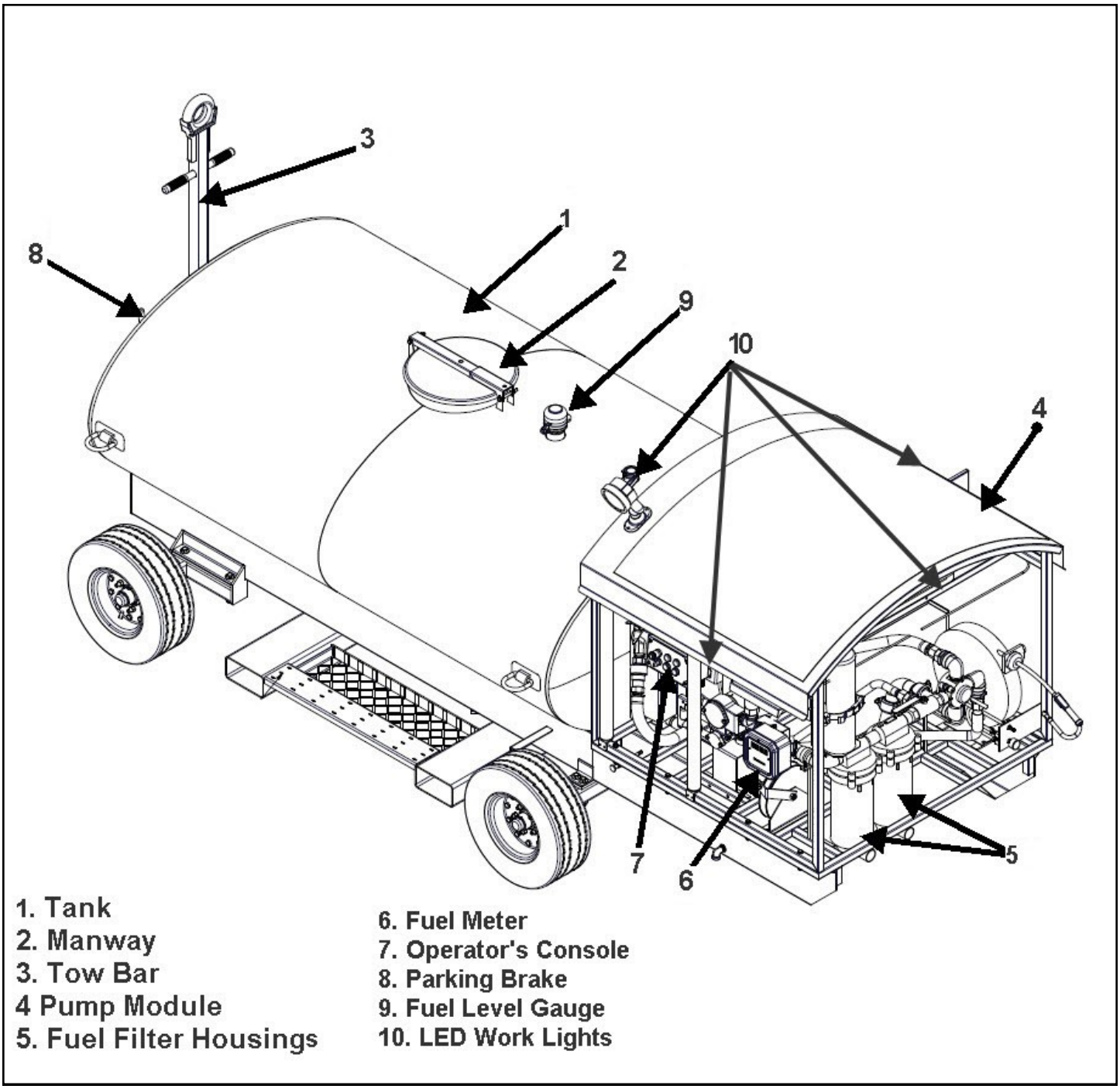
The DFC Helifueler consists of an inner tank assembly and an outer tank, otherwise known as tight wrap construction. This easy to use fueler /defueler consists of a pump, fuel meter, fuel filter and a plumbing system that allows for fuel to recirculate through the system, as well as go in and out of the tank for either defueling or fueling purposes of helicopters.

When fuel is extracted, it is filtered through the plumbing system and placed back into the tank with a 35-foot fuel hose. There is a rigid and a soft extraction wand so that the user can fuel and defuel different size tanks.

Fueling and defueling is made simple with fittings that are designed for specific fueling and defueling purposes for .Chinook, Apache and Blackhawk helicopters. Please see section 1.3 for the hose fitting hookups for select airframes.

Additional features of the Helifueler include an air compressor with a hose and an air chuck with a gauge for checking air in the tires of the aircraft, storage capable of storing up to three five liter bottles of fluid, a spill containment kit, and cabinet lighting, which makes it easier and safer to fuel up at night.

Refer to the specifications chart (Section 1.2) for more information regarding dimensions, fuel capacity and other information on the 600-gallon DFC. Refer to Section 1.4 for the Daily Inspection Checklist and Section 1.5 for The Preventive Maintenance Chart



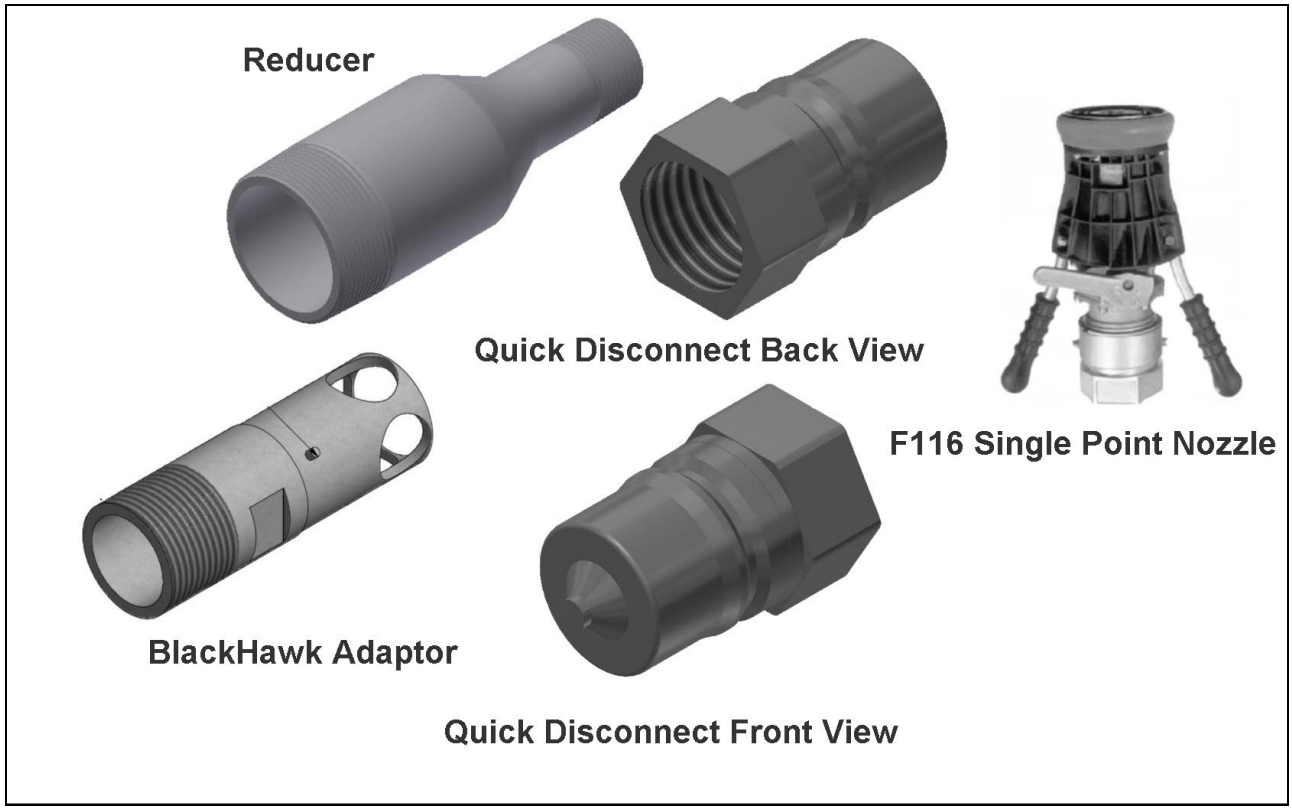
Section 1.1 **Figure 1-1 Component Identification**

1.2 Specifications for the Helifueler

Dimensions	600 Gallon (Maximum Capacity 660 Gallons)
Length — (Tow Bar Up)	156 Inches
Length— (Tow Bar Down)	221 Inches
Width (Tire to Tire)	77 Inches
Height (Tow Bar Up)	72 Inches
Height (Tow Bar Down)	62 Inches
Weight—Empty	2,780 Pounds
Weight– Full	6,980 Pounds
Ground Clearance (at Tow Bar)	6 Inches
Ground Clearance (at Axle)	8 inches
Operating Temperature Range	-25 to 110 F
Storage Temperature Range	-40 to 150 F
Tire Size (B-Range with Tube Split Wheel)	20.5 x 8.0-10

1.3 Hose Fitting Hookups and Usage for Select Airframes

Helicopter Type	Defuel Fittings	Fuel Fittings
UH-60 Blackhawk	RD-045 Custom Plug Fitting	Single Point (Whittaker F116) Whittaker Valve
AH-64 Apache	Single Point (Whittaker F116)	Single Point (Whittaker F116) Whittaker Valve
CH-47 Chinook	Defuel Elbow (Blue) Threaded Swivel Connection	Single Point (Whittaker F116) Whittaker Valve



Part Number Reference

Black Hawk Fitting RD-045
Whittaker Nozzle –AV.COM Part Number F116VX7D
Whittaker Valve– 999-14-18

1.4 Daily Inspection Checklist

Part to be inspected	What to Look For	What to Look For	What to Look For	What to Look for	Check Off Once Inspected
Wheels	Are tires damaged?	Are there loose or missing lug nuts?			
Brakes	Inspect for proper function	Are brakes properly adjusted?			
Towbar	Are there cracks in welds?	Are there missing attachment pins?	Are there missing retaining clips?		
Tank	Are there leaks or any obvious damage?	Does Manway close properly?	Are there loose or missing components in the undercarriage mounting hardware?		
Fueling Nozzle	Are there any leaks?				
Ground Reel	Is cable end securely fastened to cable?				
Valves	Are valves functioning properly?				
Fuel Filter Housings	Are there any cracks?	Are there any leaks?			
Fuel Hose	Are there any cracks?	Are there any leaks?	Are there any rub spots?	Are fitting ends operational?	
Low-Point Drain	Is water drained from tank low-point sump?				

1.5 Preventative Maintenance Chart

Item	Interval	Action
Manway Seal	**Monthly**	Inspect for tears, cracks and compression damage. Refer to Section 4.3 for maintenance instructions.
Brakes	**Quarterly**	Check for proper adjustment and make any adjustments using sections 4.15, 4.16 and 4.17.
12 Volt batteries	**6 Months**	Check battery cell fluid level. If the batteries need to be serviced, remove the battery box before servicing the batteries.
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 and 4.17 For maintenance.

SECTION 2.0 SAFETY GUIDELINES

Within this manual are guidelines and safety recommendations for use of the DFC. 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 defueling and fueling 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 permit ted 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

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

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

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

Personnel shall be aware of the hazards associated with unguarded machinery parts, capacitators, 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

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 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 DFC 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 Place any loose items in the storage box and and check to make sure the manway assembly is securely attached.

Loading the DFC 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 DFC on a truck. Set the parking brake. Approach the unit from the front only. Once the DFC is loaded on the truck, secure to the truck bed using attachment points on tank weldment.

Loading the DFC for Air Shipment

Caution: Do not back equipment by any means other than hand pushing/pulling. Or it will cause damage to the equipment.

After placing the DFC in the aircraft, lock tow bar upright, make sure the parking brake is set and that the parking brake, funnel cover, manway assembly and storage boxes are latched.

3.2 Controls and Indicators

Description	Functions
Battery Switch	Main power disconnect
E-Stop Switch	Emergency shut down switch
Fuel Filter petcocks (several)	Maintains the two fuel filters
Fuel Meter	Gauge that shows fuel level during defueling and fueling operations
Operator Console	Turns Defuel / Fuel pumps both ON and OFF
Parking Brake Handle	Sets Parking Brake
Liquid Level Gauge	Located on the top centerline of the tank, this shows how much fuel is in the tank.
Sample Port Valves	There are two of these. One is located on the left side of of the fuel meter and the other valve is located on the right side of the recirc valve. These are used to take fuel samples from the tank.
LED Worklights	Located on top of the helifueler and underneath the top hood, these are used to light the working area.

3.3 Defueling the Aircraft

WARNING

Never operate the DFC in a closed area or in an area with little or no ventilation

All fuels are flammable, do not allow sources of ignition within 50 feet of the DFC.

CAUTION

Make sure there is enough room in the tank to store the fuel being removed from the aircraft.

a. Set brakes by moving the handle so it points upward.
b. Chock tires if chocks are available.
c. Attach static bonding/grounding cables by locating reel with clamp end, and pulling cable outward until desired length has been taken out.
d. Allow cable to retract until it stops. Attach at ramp to an approved bonding/grounding site.
e. Open pump module covers (left and right) and uncoil 35-foot Hose assembly from hose cradle.
f. Attach the DEFUEL adapter.
g. Position the Selection Valve to the DEFUEL position."
h. Ensure that the recirc valve is properly positioned.
i Turn on the Battery Switch. The " POWER ON" indicator lamp will light up.
j. Make sure E-stop switches are in the non-stopped condition by twisting them clockwise and allowing them to spring outward.
k. Place the Pump Selector Switch in the "DEFUEL" position.
l. Start the fuel pump by pushing the "Pump ON" button.
m. Monitor fuel meter to remove desired quantity of fuel.

NOTE: Repeat steps I through M if defueling any other fuel cells on the aircraft

n. Turn off fuel pump by depressing the "PUMP OFF".
o. Retract the fuel hose from aircraft
p. Turn off main battery switch.
q. Recoil hose and store.

3.4 Fueling the Aircraft

WARNINGS: Never operate the DFC in an enclosed area. Proper ventilation must be maintained at all times. All fuels are flammable, do not allow sources of ignition within 50 feet of the DFC.

Do not attempt to charge batteries while using the DFC 12 Volt electric fuel pump, damage to charger will occur.

a. Set brakes by moving Brake lever upright.
b. Chock tires if chocks are available.
c. Locate reel with clamp end, and pull cable outward until desired length has been taken out. Allow cable to retract until it stops. Attach at ramp to an approved bonding /grounding location.
d. Position the selection valve to the FUEL Position.
e. Uncoil and fully extend hose.
f. Remove Nozzle from stowed position and attach to hose end.
g. Start the fuel pump by depressing the “PUMP ON” button.
h. On battery box turn main power switch ON by turning clockwise.
i. Ensure battery charge indicator indicates enough charge for operation.
j. Open aircraft fuel tank and insert nozzle.
k. Fill tank to desired capacity.
l. Remove nozzle, close fuel tank and turn off pump.
m. Turn main power switch OFF at battery box.
n. Remove nozzle and stow in nozzle holder.
o. Retract fuel hose by pulling on retracted hose and allow the hose reel to start retrieving hose, control the rate of retraction by providing a small amount of resistance against the hose reel.

Caution: Improper grounding may result in an ignition source.

NOTE: Periodically monitor differential pressure gauges during fueling operations. This allows real time reading of filter contamination level. Red scale begins at 15 PSI differential pressure.

3.5 Taking Samples Using the Sample Ports

There are two ports used solely for taking for taking fuel samples. The sample port located on the right side of the fuel meter and the sample port located on the left side of the recirc valve.

a. Make sure parking brake is set
b. Attach bonding/grounding cables
c. To take fuel before filtering, unscrew the cap to the sample port located on the right side of the fuel meter (1).
d. After filtering fuel samples can be taken by unscrewing cap to the fuel sample port located on the left side of the recirc valve.

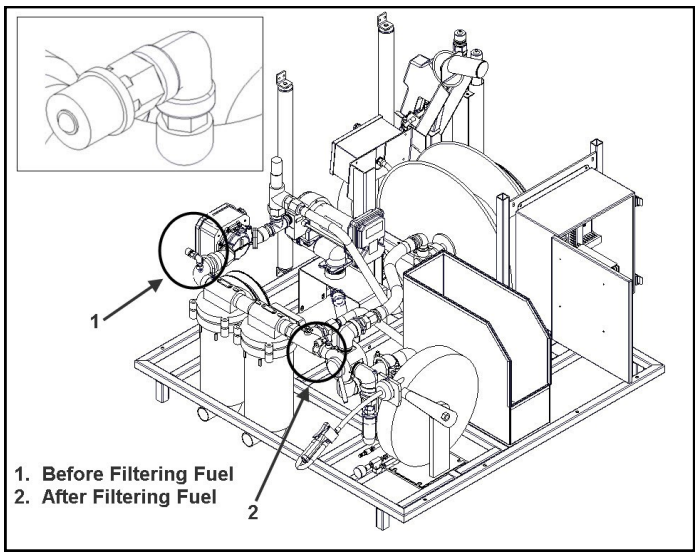


Figure 3-1 Sample Ports

3.6 Fuel Moisture Removal Low Point Drain/ Fuel Filter Housings.

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

a. Make sure that the parking brake is set.
b. Attach bonding/grounding reels.
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 DFC 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 shocks must also be used. Serious injury or death may occur from rolling or falling equipment.

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

4.2 General Tank

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.

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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 moving on to step c.
c. Inspect threads, and replace any 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 until hand-tight. Do not cross thread components.
f. Tighten parts until the connection does not have leaks.

4.3 Manway Assembly and Maintenance

The manway assembly is located on the top of the tank. The manway assembly has one adjustment point. Use Figure 4-1 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.

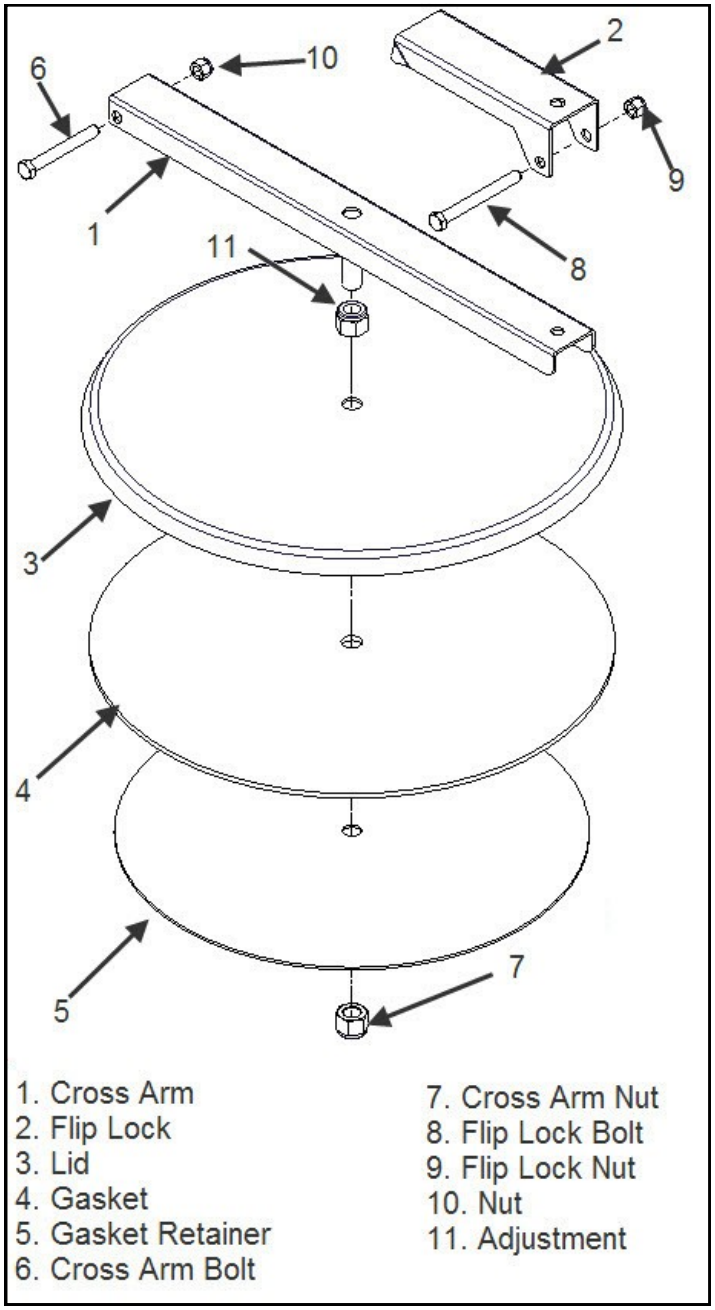

Figure 4-1 Manway Assembly

4.4 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.

4.5 Front Wheel Assembly Removal

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

a. Loosen lug nuts on wheel assembly requiring maintenance one turn while equipment is still on the ground.
b. Raise equipment with suitable maintenance jack (see Figure 4-2, arrow A for jack placement) high enough to remove wheel assembly.
c. Place approved jack stands under front axle (see Figure 4-2, arrow B for stand placement).
d. Remove lug nuts of wheel assembly needing maintenance, and remove.

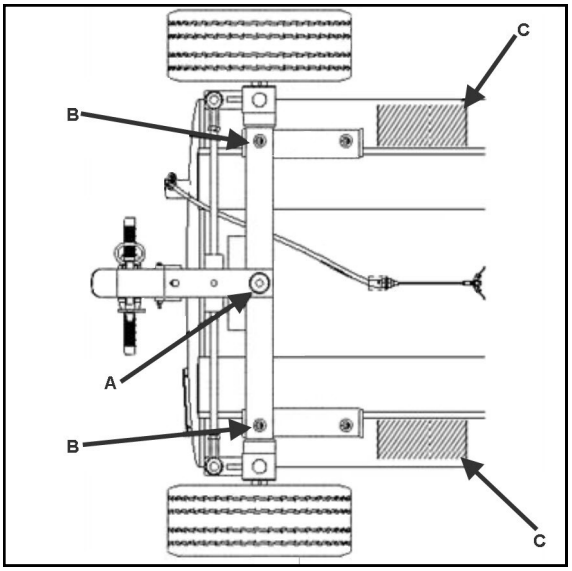

Figure 4-2 Lift Points

4.6 Front Hub Assembly

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

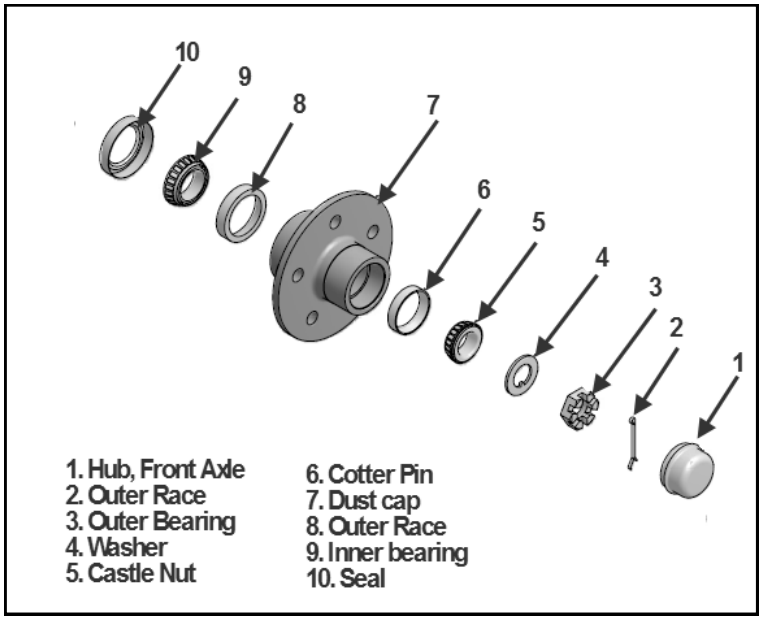

Figure 4-3 Front Hub Assembly

4.7 Tow Latch Assembly

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

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 4-5) .

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).

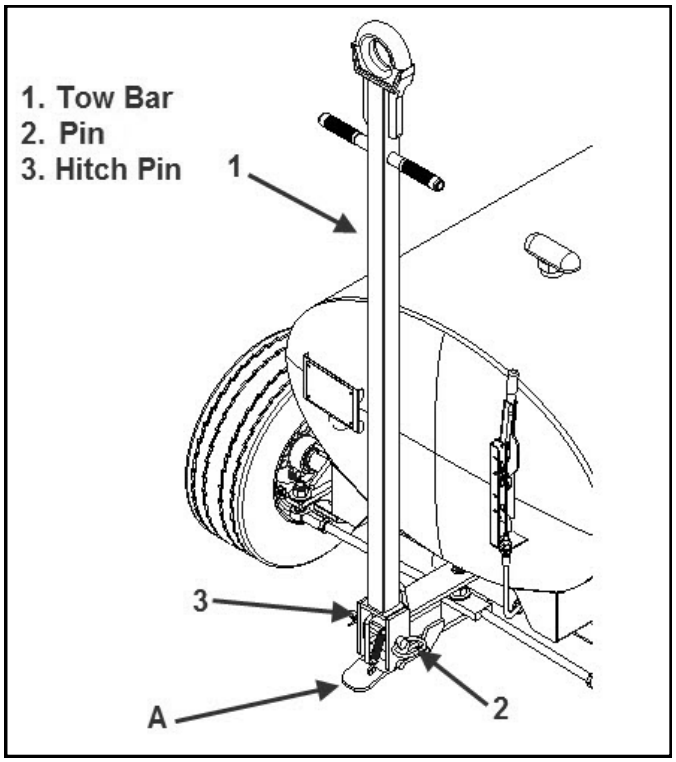

Figure 4-4 Tow Bar Removal

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

4.8 Spindle Assembly

To remove the spindle assembly, follow the maintenance steps for the front hub assembly before beginning the next steps. See Figure 4-5.

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.

4.9 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 (reference 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.

4.10 Tie Rod Assembly

Refer to Figure 4-5 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.

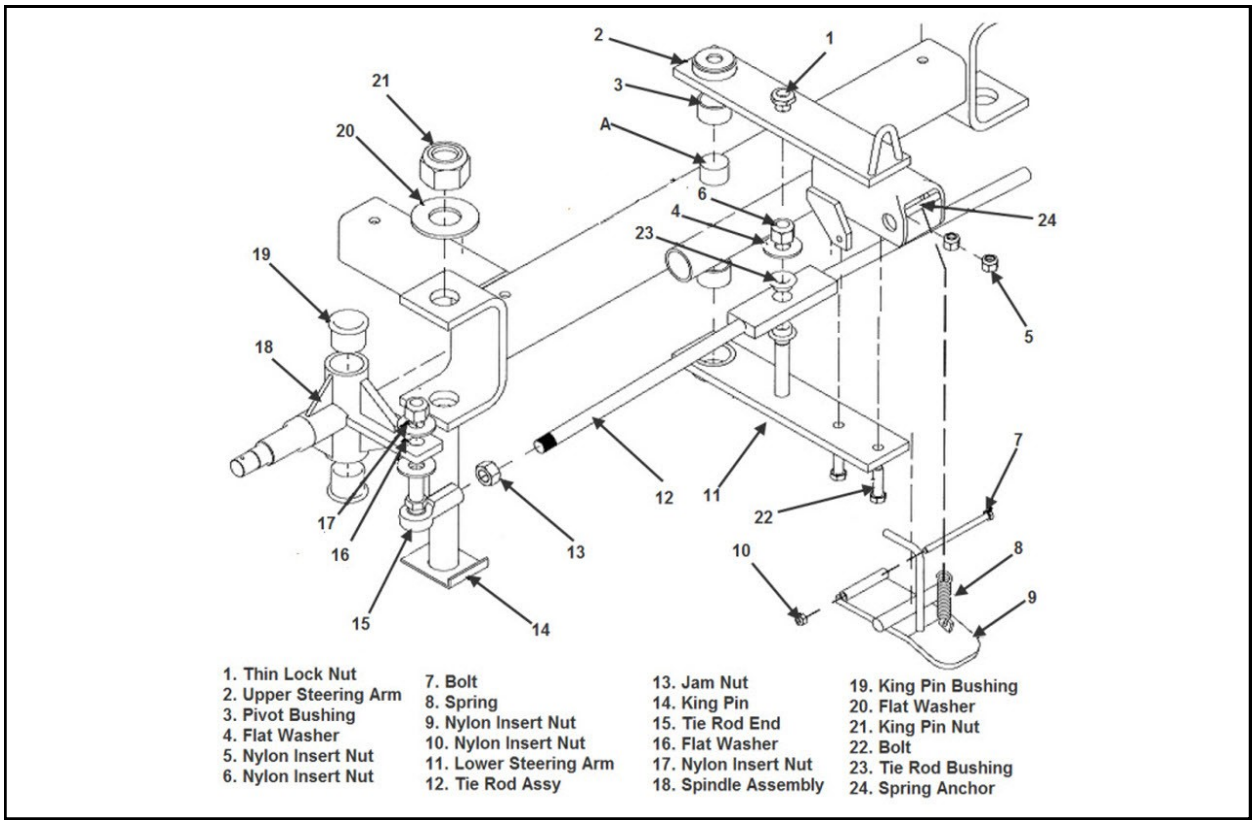


Figure 4-5 Exploded View of Undercarriage

4.11 Front Undercarriage Removal

To remove the entire Front Undercarriage assembly, the equipment must have the front end raised. See Figure 4-2 for lift points.

a. Raise equipment with suitable maintenance jack (see Figure 4-4 arrow A for jack placement) to allow four inches of space between the wheels and ground.
b. Place cribbing under tank skids (see Figure 4-2, reference arrows C) to safely support th 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.

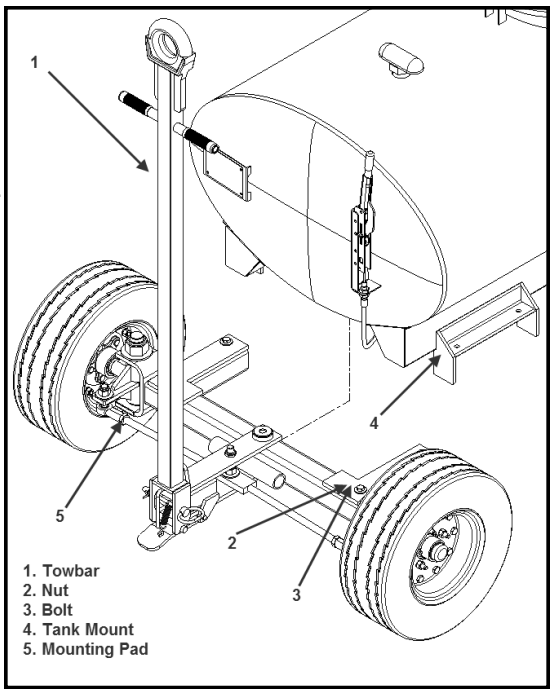


Figure 4-6 Front Undercarriage Removal

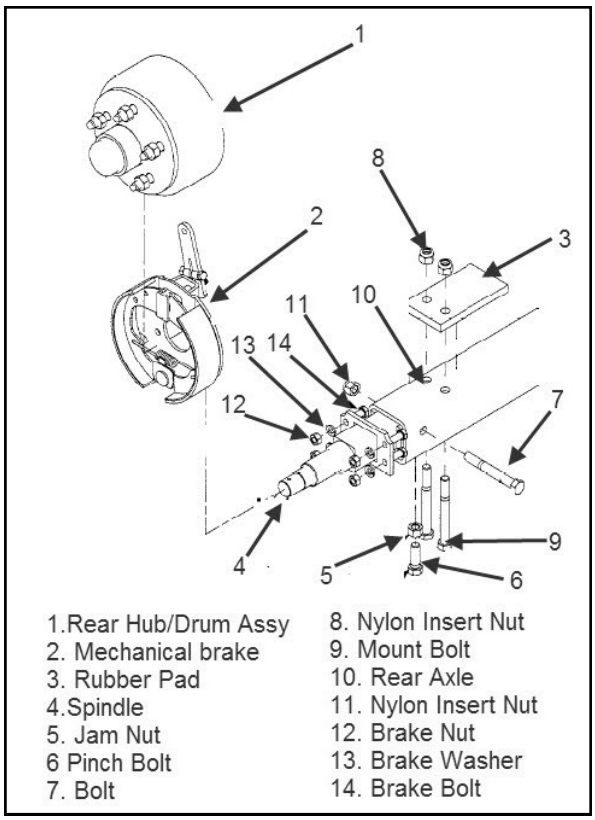


Figure 4-7 Rear Undercarriage Removal

4.12 Rear Undercarriage Assembly

See Figure 4-7 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).

4.13 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 4-2, arrow A for jack placement) .
b. Place approved jack stands under rear axle (see Figure 4-2, arrow B for stand placement).
c. Remove lug nuts of wheel assembly needing maintenance.

4.14 Rear Hub / Brake Drum Assembly

To remove the rear hub and brake drum assembly, follow the maintenance steps for the rear wheel assembly removal before beginning the next steps. Figure 4-8 illustrates the process for the rear hub/ brake drum assembly.

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

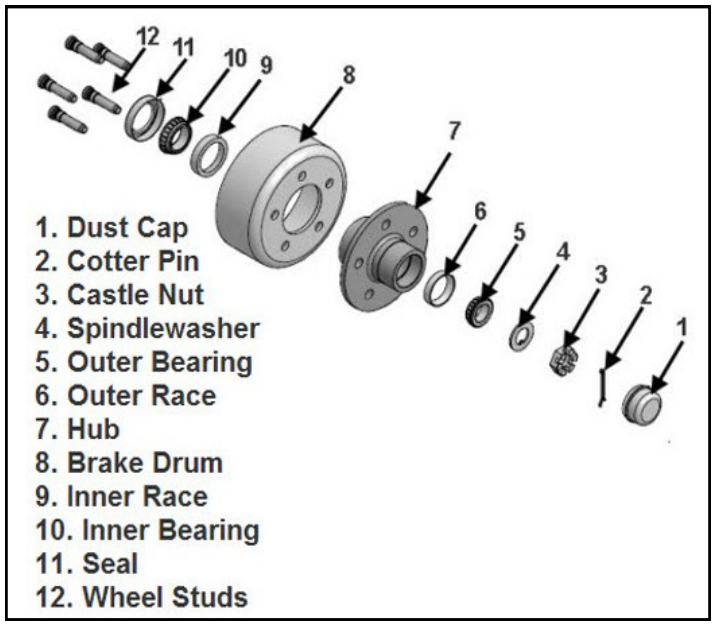


Figure 4-8 Rear Hub and Brake Drum

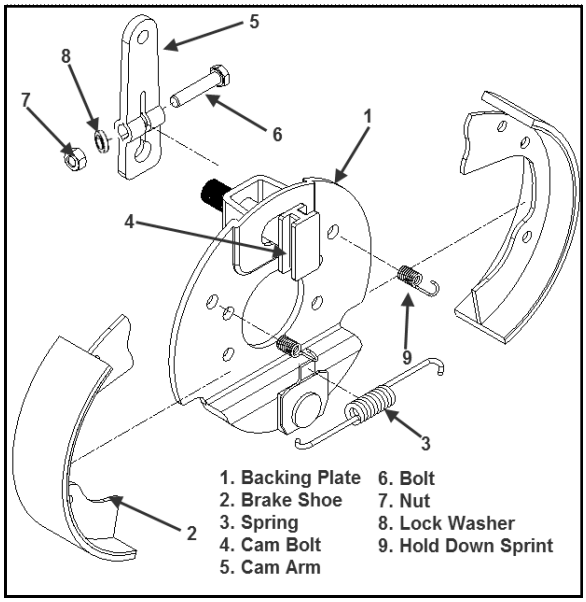


Figure 4-9 Mechanical Brake

4.15 Mechanical Brake Assembly

The assembly can be disassembled while attached to the rear spindle or removed from the unit. See Figure 4-9.

a. Remove Rear Wheel Assembly as described in section 4.13.
b. Remove Rear Hub and Brake Drum Assembly as described in section 4.14.
c. Remove brake cable end from arm (5) as described in section Section 4.17, step (a).
d. Remove nuts (12), washers (13), and bolts (14) shown in Figure 4-9
e. Remove Mechanical Brake Assembly and place on flat surface.
f. Remove spring (3).
g. Release brake shoes (2) by removing springs (9) from the backing plate (1).
h. Remove nut (7), lock washer (8), and bolt (6) to release arm (5).
i. 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.

4.16 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 4-10.) 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 4-10 (each side).

4.17 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).

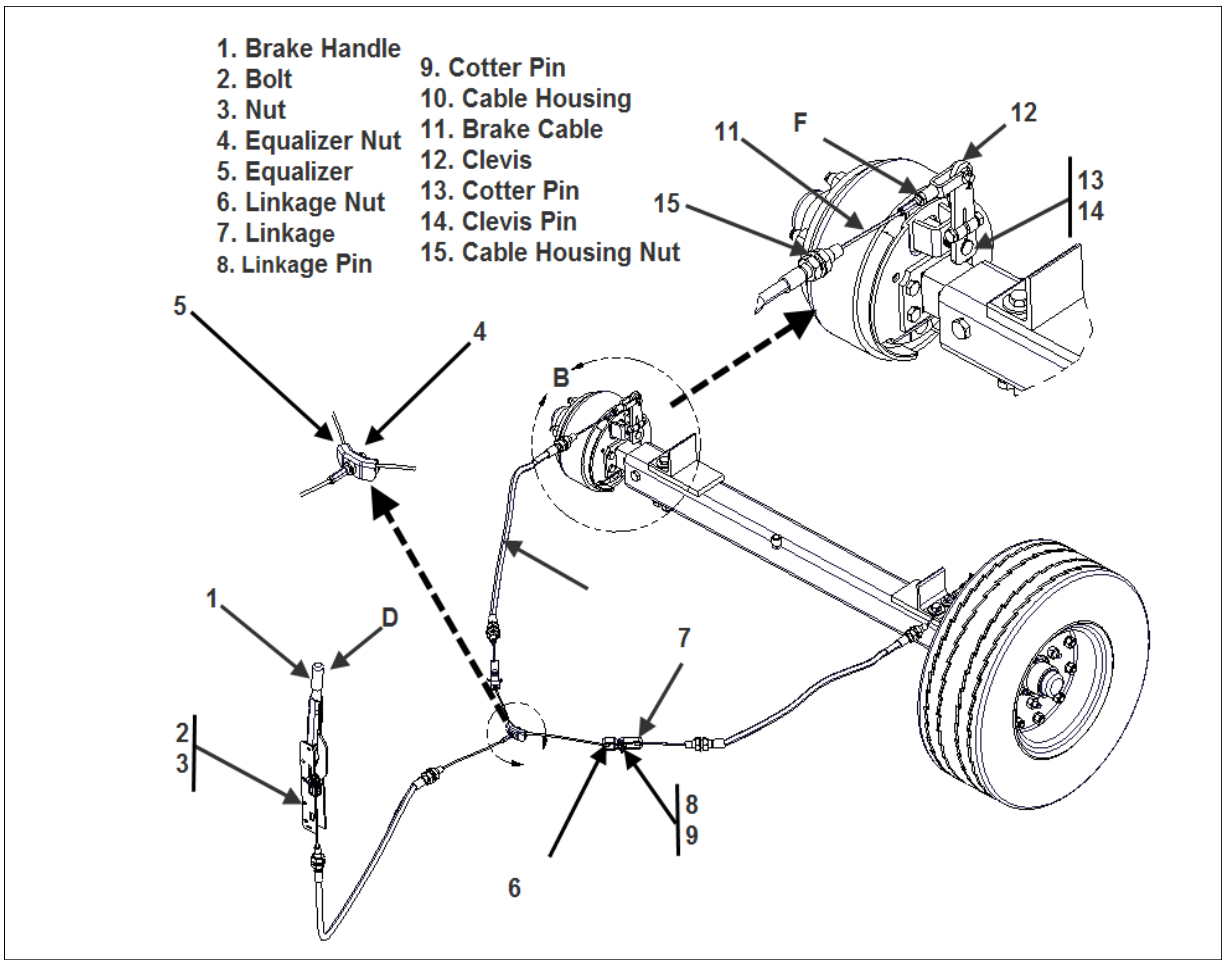


Figure 4-10 Brake and Cable Assembly

4.18 Rear Undercarriage Assembly

To remove the entire Rear Undercarriage assembly, the equipment must have the back end raised. See Sections 4.12, and 4.13 with Figure 4-11.

a. Raise equipment with suitable main tenance jack (see Figure 4-11 refeence 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 4-11, reference points labeled with a C).
c. Lower onto cribbing. Leave jack in place.
d. Disconnect parking brake cables at mechanical brake assembly in Section 4.15, 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 tube clears tank mounts.

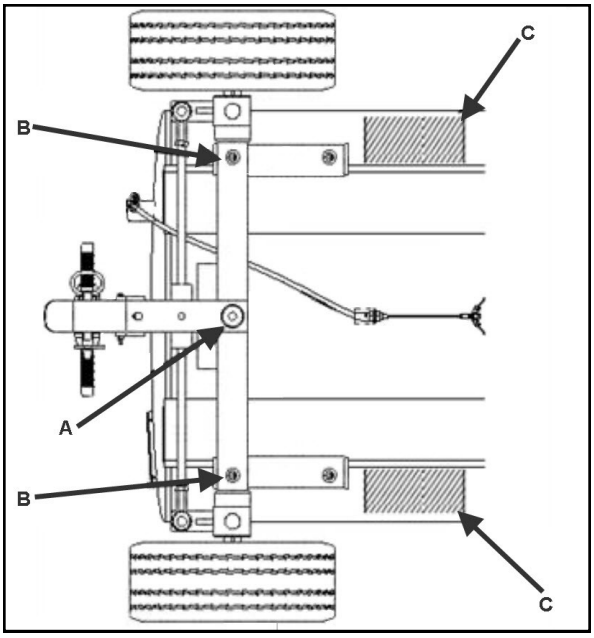


Figure 4-11 Lift Points

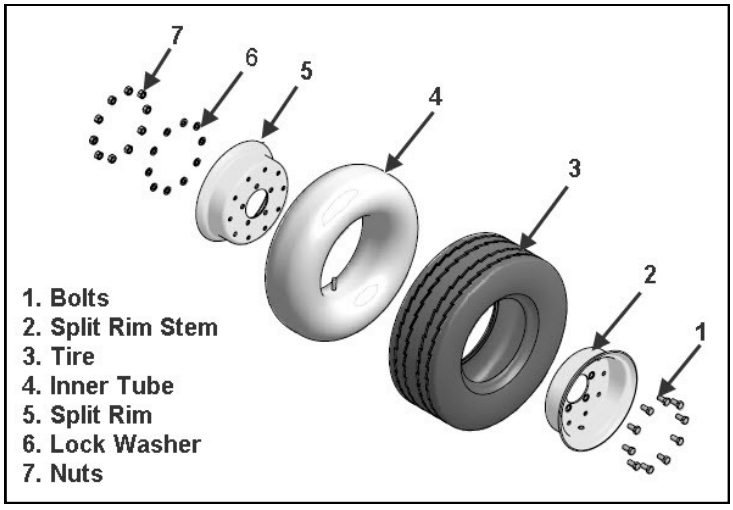


Figure 4-12 Wheel Assembly

4.19 Wheel Assembly

The Wheel assembly is a two-piece, split rim design. Use Figure 4-12 and sections 4.12 and 4.13 for the following maintenance steps.

a. Remove wheel assembly as described in Section 4.17 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 nuts (6) to 150-foot-pounds before applying air pressure to wheel.

WARNINGS:
Disconnect all electrical connections to the unit (batteries, battery charger, tow vehicle) before performing any of the steps described here. Flammable liquids and vapors and be ignited by accidental electrical arcs. Serious injury or death could result.

Drain all flammable liquids from the tank and plumbing system before performing any of the steps described here. Flammable liquids and vapors pose a fire danger that could result in serious injury or death.

4.20 Removing the Fuel Pump

a. Remove electrical leads from pump motor. The cover plate is located in back of the pump motor and the conduit is located in front of the pump motor.
b. Remove the two bolts connecting the fuel meter (6) to the pump-to-meter line (9).
c . Remove the pump to meter line (9).
d. Remove the four bolts at the bottom of the pump mounting plate.
e. Remove the threaded hose from the pump's inlet.

4.21 Removing the Fuel Meter

a. Remove the two bolts connecting the fuel meter (6) to the pump-to-meter line (9).
b. Remove the four bolts connecting the fuel meter (7) to the back of the pump.

4.22 Removing the Filter Housings

a. Remove the Victaulic fitting on the left side of the housing filter.
b. Unthread the recirc valve (8).

4.23 Removing the 4-Way Selection Valve

a. Remove fuel meter (6) as described in Section 4.20.
b. Remove the valve-to pump line (2).
c. Remove the valve-to-pump line threaded Victaulic fitting at the elbow next to the 4-way selection valve. (10)
d. Remove the tank-to-valve line (5) Victaulic fitting at the elbow next to the selection valve.
e. Remove the U-bolt (not shown) that secures the remaining assembly to the frame.
f. Using a pipe wrench and a bench vise, Remove remaining components.

4.24 Removing the Hose Reel

a. Remove all items connected to mounting bracket (12) and remove bracket.
b. Remove valve-to-reel line. (7)
c. Remove the quick disconnect from the fueling nozzle (14).

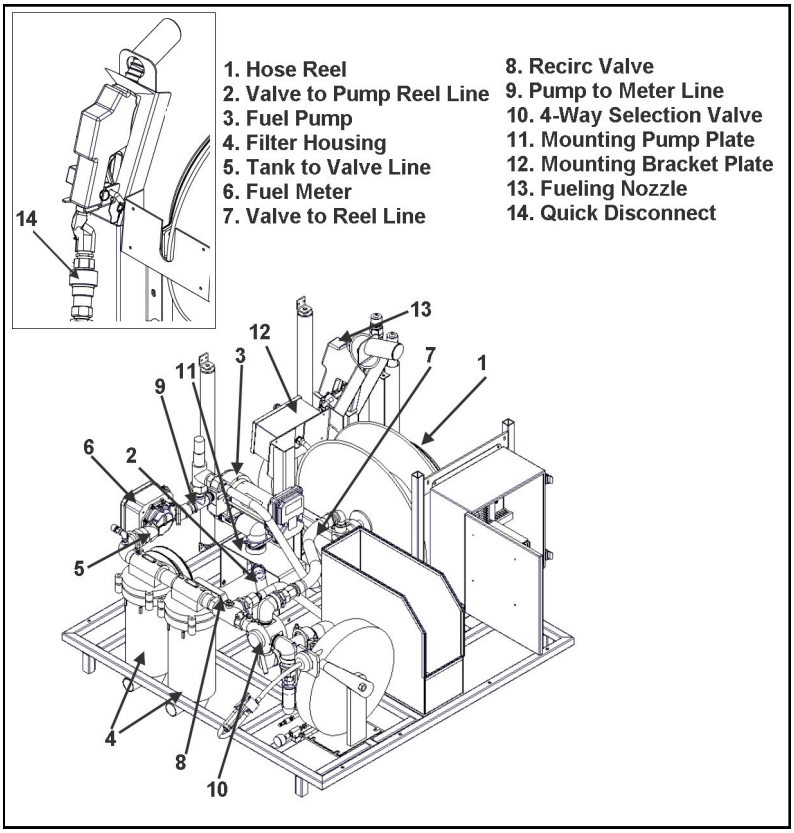


Figure 4-13 Pump Module

4.25 Changing Fuel Filter Elements

The fuel filter elements should be replaced whenever fuel flow is restricted or at least once per year. The following steps describe how to replace the fuel filter. See Figure 4-14.

a. Drain filter housing by opening the top and bottom petcock valves.
b. Remove the four bolts that secure the filter canister to the filter housing.
c. Pull downward on the filter element.
d. Replace O-ring (not shown.)
e. Install new filter element in reverse order.
f. Close bottom petcock valve.
g. Jog pump to purge air.
h. Close top petcock valve.

4.26 Changing Operator Console Indicator Lights

The only maintenance activity for the operator console is to change out indicator lights.

a. Identify the indicator light that needs to be removed.
b. Rotate lens counterclockwise and remove.
c. Remove circular diffuser disk (plastic) from housing.
d. Remove and replace light bulb.

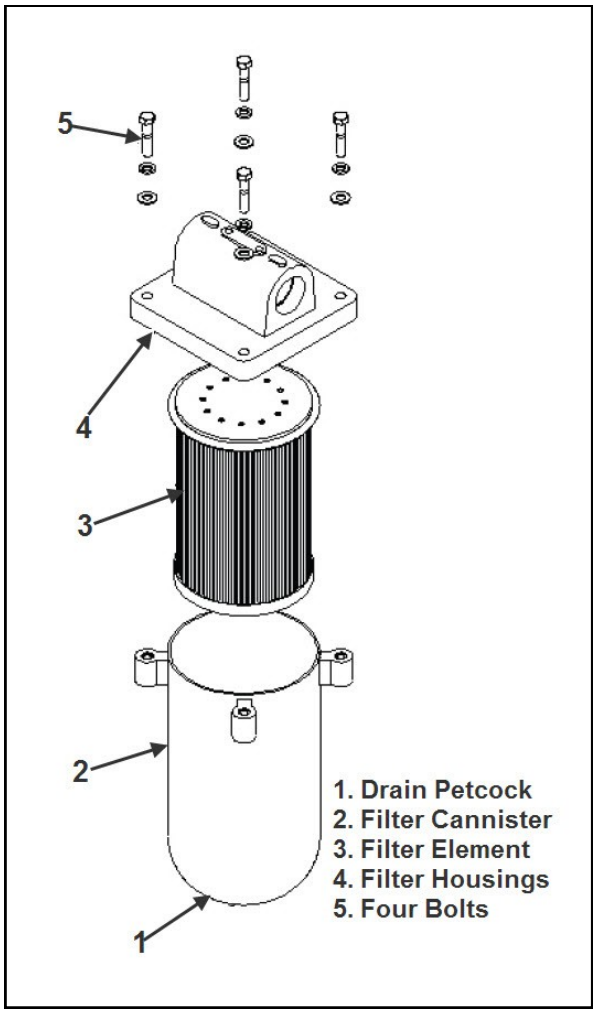


Figure 4-14 Fuel Filters

4.27 Troubleshooting the Helifueler DFC

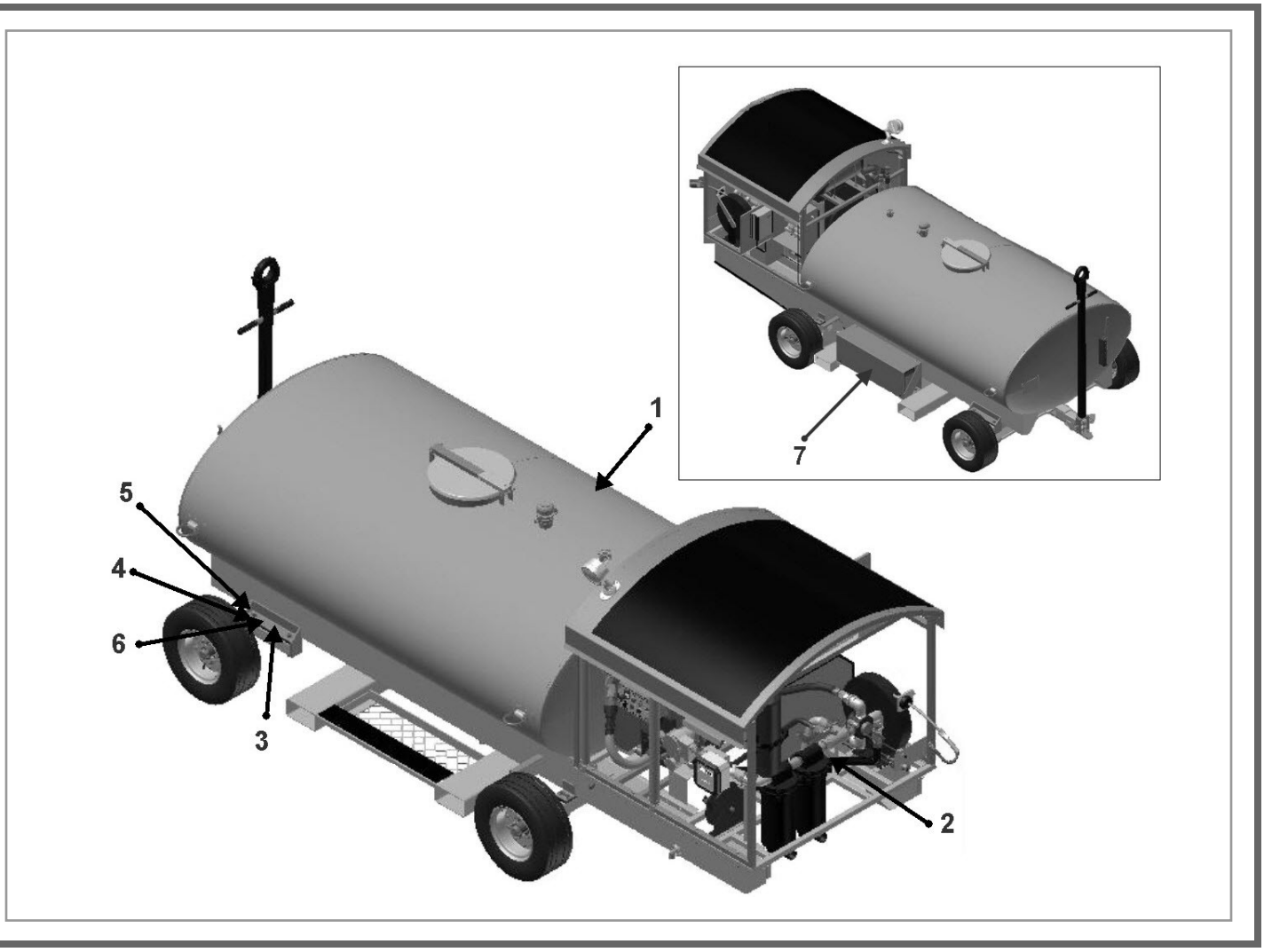
Problem	Probable Cause	Corrective Action
Threaded Connection leaking weeping	Loose fitting, bad seal, damaged fitting	Use Section 4.2 To fix condition
Valve Leaking, weeping, or doesn't operate	Internal damage to valve's ball, stem, or seat	Replace valve using section 4.2
Manway won't seal	Manway Assembly is out of adjustment or seal is damaged	Adjust manway assembly using section 4.3
Low/ No discharge pressure at fuel nozzle	Low battery charge	Charge batteries
	Fuel filter(s) restricted	Inspect and replace if needed
	Tank-to-Pump valve partially open	Ensure valve is open (handle vertical)
	Fuel/Defuel T-handle not pushed in	Ensure T-handle is pushed in completely
Low/ No Defueling Capability	Low battery charge	Charge batteries
	Fuel filter(s) restricted	Inspect and replace if needed
	Tank-to-Pump valve partially open	Ensure valve is open (handle vertical)
	Fuel/Defuel T-handle not pulled out	Ensure T-handle is pulled out completely
12 Volt pump – weak or will not work	Low/ No battery charge	Fully charge batteries
	Battery terminals/ cables corroded	Inspect & clean, replace if necessary
	Battery Cell(s) fluid low	Service cell(s) with distilled water
	Main Power switch in OFF position	Turn Main Power switch ON
	Pump has internal damage	Replace pump
	Pump has reached duty cycle	Wait 30 minutes and retry
	Circuit breaker has tripped	Wait 30 minutes and retry
Fuel Meter has no indication of flow	Main pump not turned ON	Turn ON pump
	Main tank empty	Load fuel into tank
	Fuel Meter internally broken	Replace fuel meter
Wheels won't steer properly	Steering arm assembly is damaged or tie rod assembly is damaged or misad-justed.	Inspect and repair when needed using Sections 4.9 and 4.10.
Wheels wobble or drag while rolling	Wheel bearings are damaged or loose	Inspect and Repair if needed
Towbar won't lock in upright position	Tow latch spring, damaged or missing	Inspect and replace when necessary
Brakes don't secure unit while engaged.	Brakes are out of adjustment o parking brake assembly is damaged or missing	Adjust brakes or adjust and repair using using sections 4.15, 4.16 and 4.17.

SECTION 5.0 PART BREAKDOWN DRAWINGS

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.

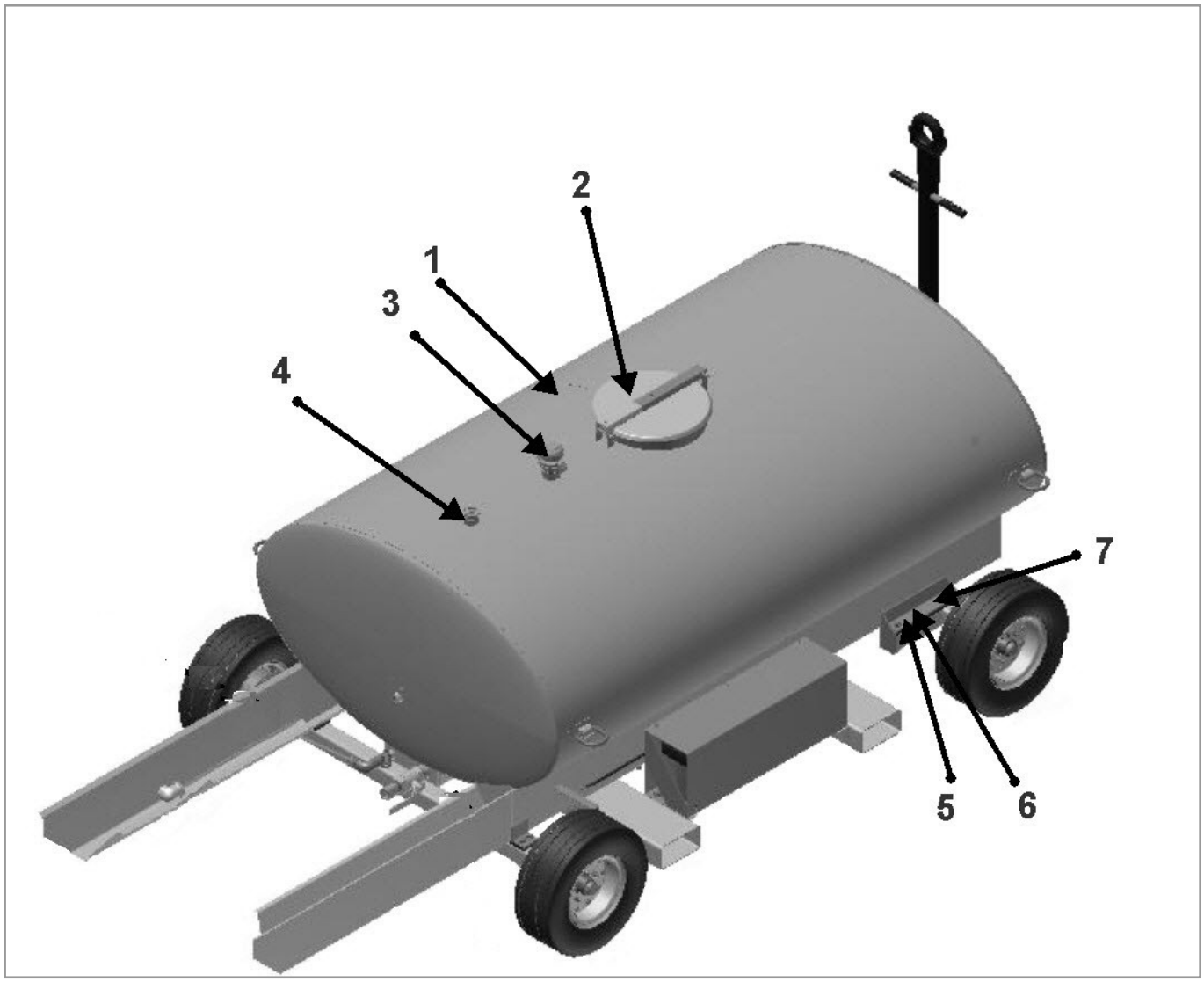
You may access customer service by contacting the Metal products Division at 800-541-3601, or 509-928-0720. (The toll free number does not work internationally). If you would like more information about the Spokane metal products division of Spokane Industries you may visit the website at www.spokaneindustries.com.

DRAWING NUMBER



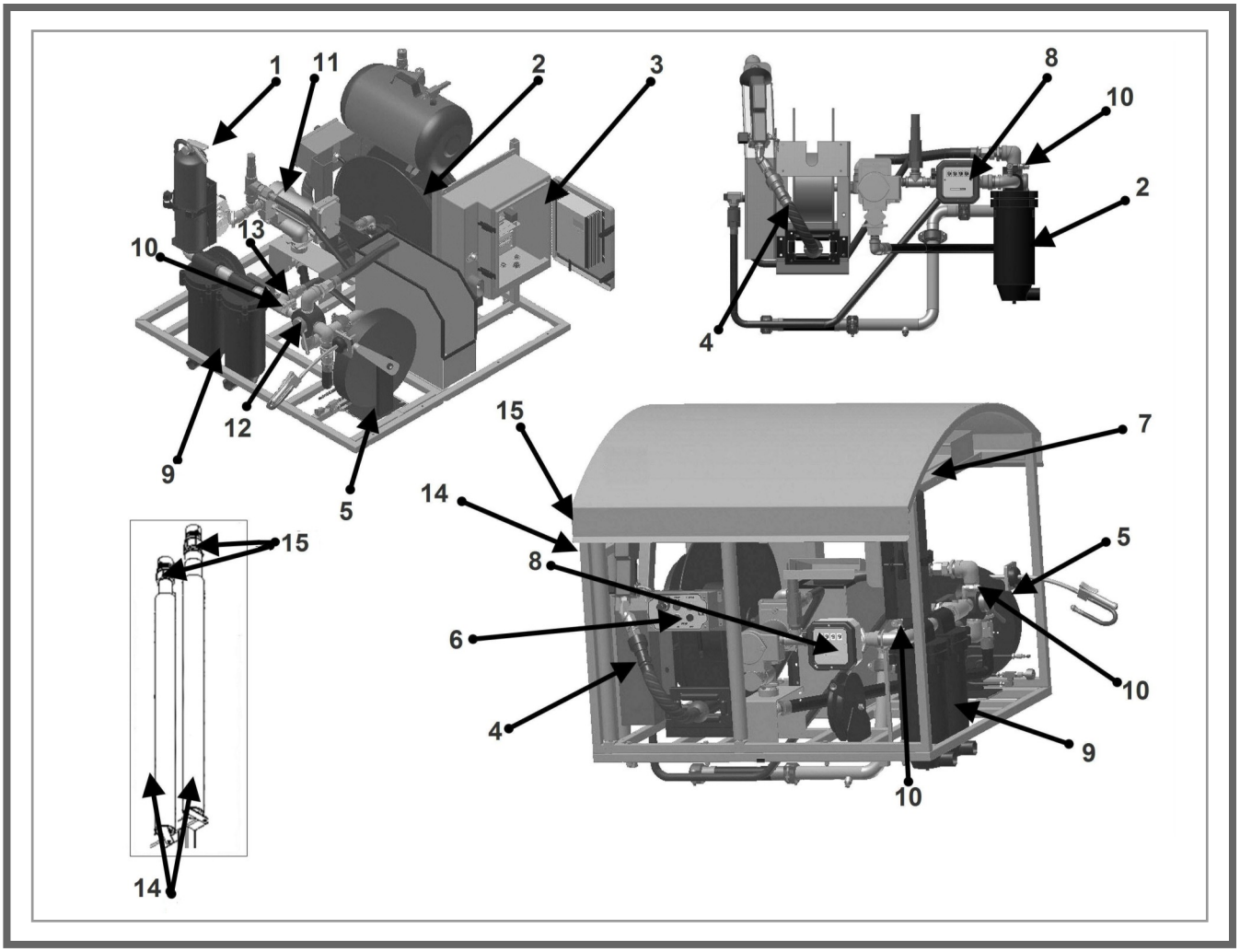
DRAWING 1.0 **Overview Component Identification**

ITEM	QTY	P.N.	DESCRIPTION	MATERIAL	WEIGHT
1	1	08-1901	Tank, Sub-assy,	Stainless Steel	2035.5lbmass
2	1	RD-040-02	Pump Module Assy,		972.8 lb.mass
3	1	06-1023	Mounting Pad		
4	4	02-3087	Nut, Nylon Insert, 1/2” UNC		
5	4	02-3025	Bolt 1/2-13 x 4 1/2 LG		
6	2	02-3093	Nut, Nylon Insert, 1/2-12		
7	1	04-0030	12x12x32 Black Utility Box	Aluminum	13.1lbmass



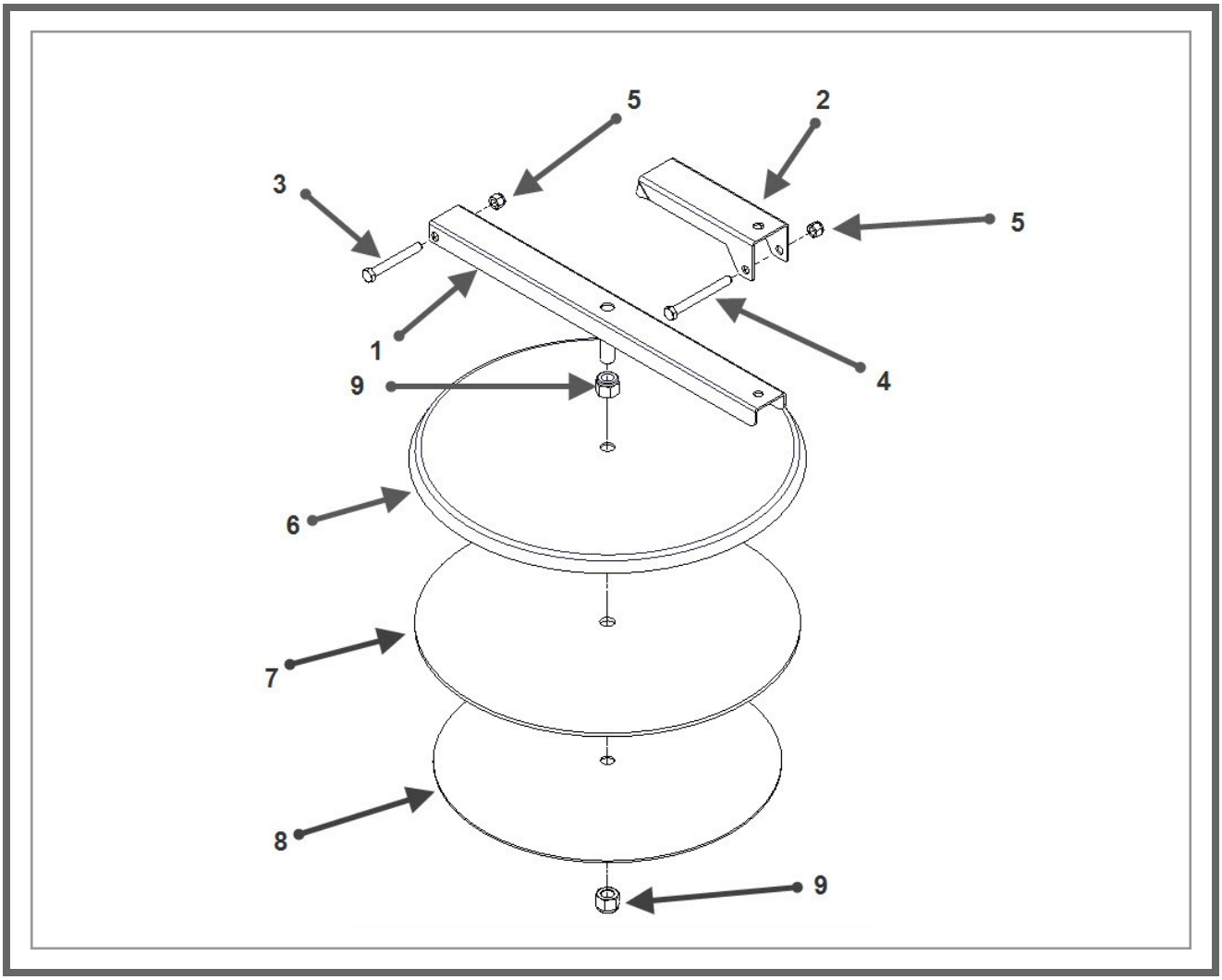
DRAWING 2.0 Overview, Component Identification (Tank)

ITEM	QTY	P.N.	DESCRIPTION	MATERIAL	WEIGHT
1	1	08-1901	Tank, Subassy, 600 S	Stainless Steel	2470.5 lb.mass
2	1	08-10251	Cross Arm and Lid Assembly	Stainless Steel	15.75 lb.mass
3	1	04-01545	Tank Vent, Fill, 2”	Brass	1.99 lb.mass
4	1	04-01540	Liquid Level Gauge	Various	.08 lb.mass
5	6	02-12041	Nut, Nylon Insert, 1/2” UNC		
6	4	02-1503	Hex Bolt, 1/2” UNC x 4 1/2” LG		
7	2	06-1023	Pad, Mounting		



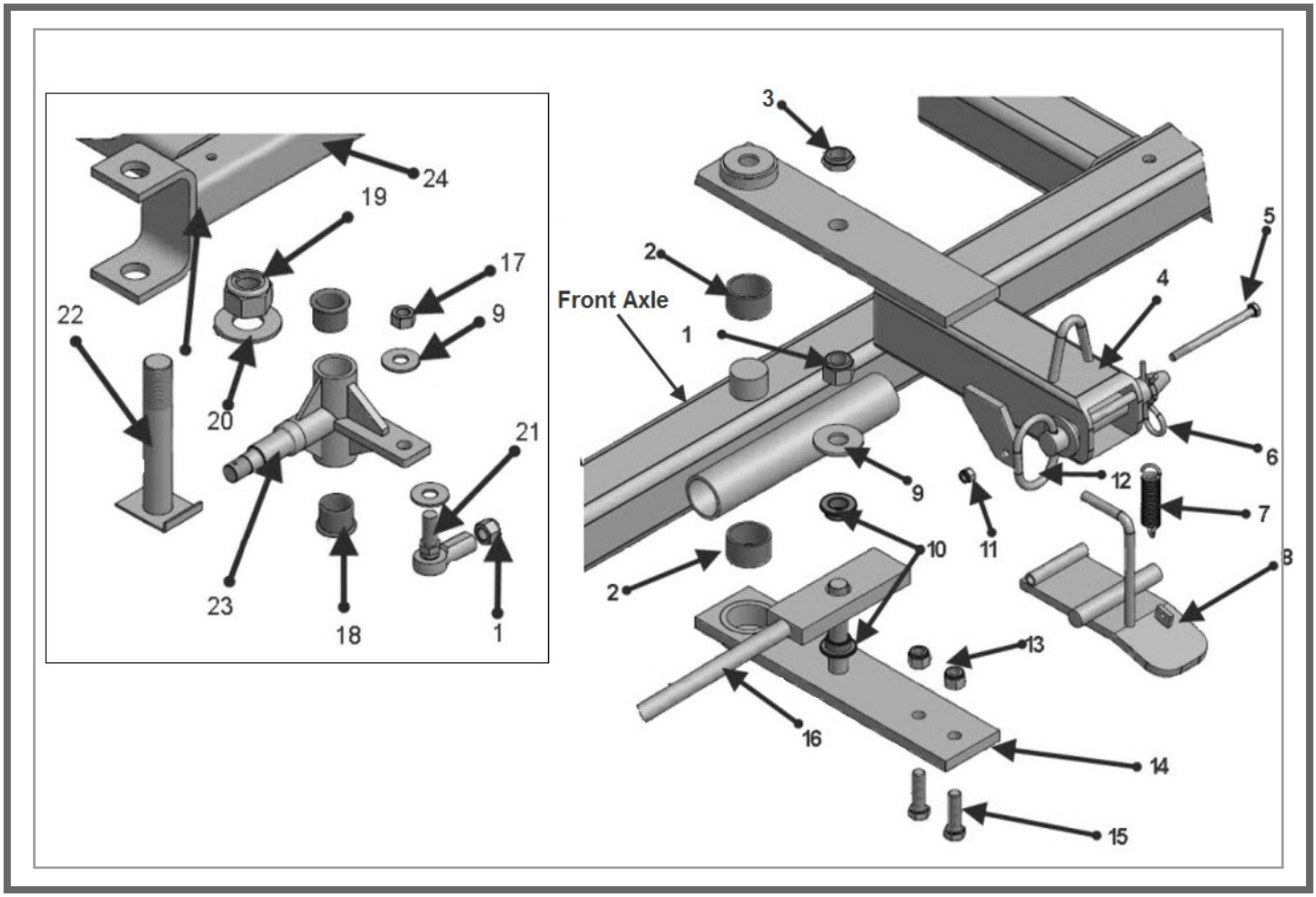
Drawing 3.0 **Pump Components**

ITEM	QTY	P.N.	DESCRIPTION
1	1	04-0702	Fire Ext. 5# Purple K
2	1	04-10361	Grounding Reel, Red, With Clamp
3	1	105-00004-A024	Electrical Box Assembly
4	1	ED-041-25-5031	Hose Assy, 1-INx38 IN
5	1	25-5020	Plumbing Kit, Air Tank X Hose Reel
6	1	15-0010	3x2 Operators Conso;le
7	1	04-8025	Spill Response Kit #420
8	1	04-0143	Meter, MR 5-30N GPI, 1 1/2 IN # 126300-25
9	2	04-8043	Filter Housing, Facet VF-225B-PGS
10	2	04-8040	Fuel Sampling Port
11	1	04-0174GP	Pump, Fuel, 12VDC, 25GPM, 35 AMP, GPI 1333262-03
12	1	04-10310	Valve, 4-Way Lever Operated, 1– 1/2 IN. Ports
13	1	04-10350	Valve, Ball, 3-Way, 1 1/2 IN NPT
14	2	25-5008	Suction Hose Assy, 1” x 30 “
15	1	25-5009	Suction Wand



Drawing 4.0 **Manway Assembly**

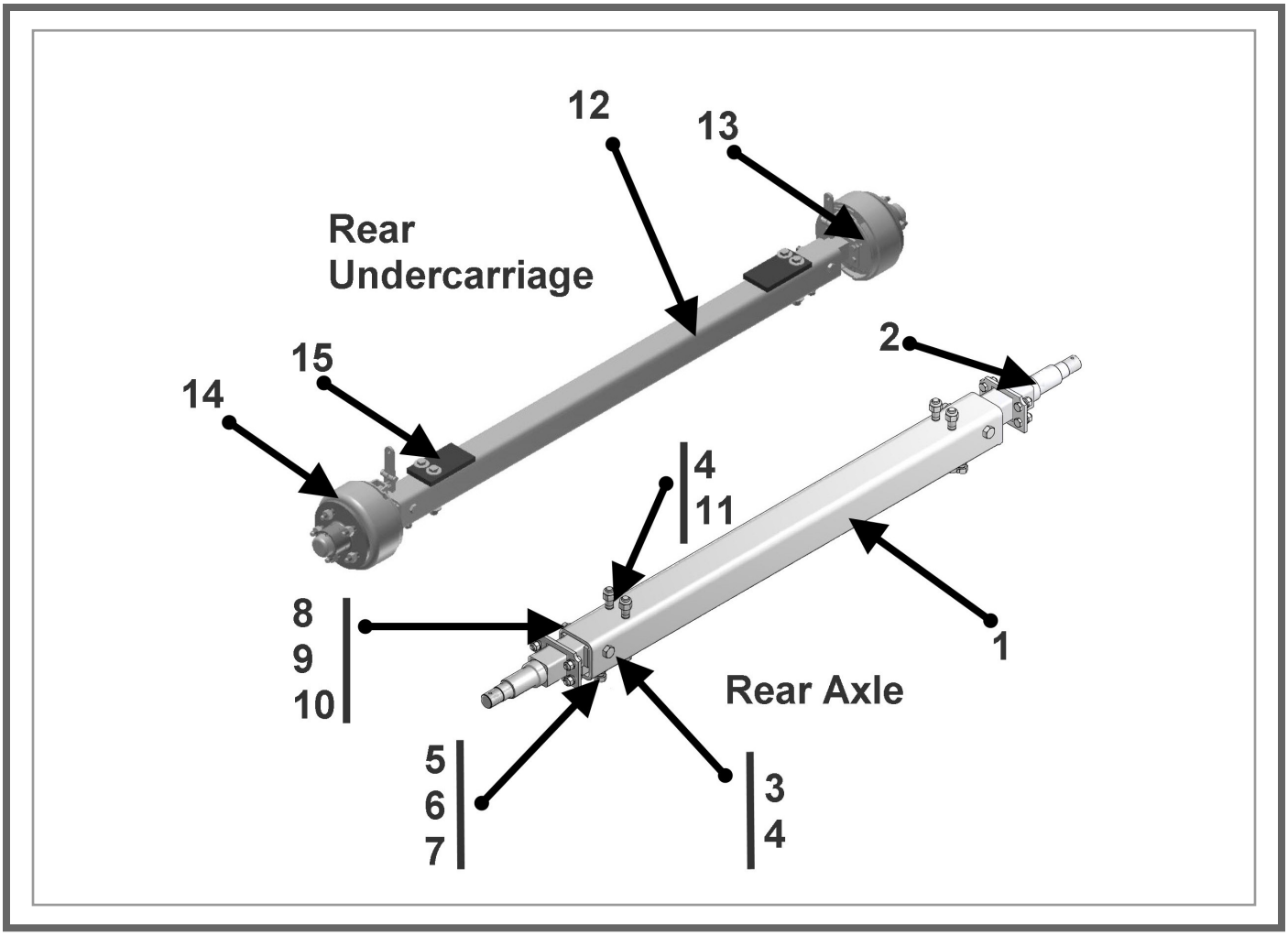
ITEM	QTY	P.N.	DESCRIPTION
1	1	07-1039S	Cross Arm
2	1	01-8222S	Flip Lock
3	1	02-3042	Bolt, 3/8-16 x3 " LG (AP)
4	1	02-3044	Bolt, 3/8-16 x3 1/2 " LG (AP)
5	2	02-3089	Nut, Nylon Insert, 3/8-16 (AP)
6	1	01-86001	Manway Lid, 16"
7	1	06-25025	Manway Gasket
8	1	01-8710	Retainer Gasket, SV
9	2	02-3091	Nut, Nylon Insert



Drawing 5.0 **Front Undercarriage**

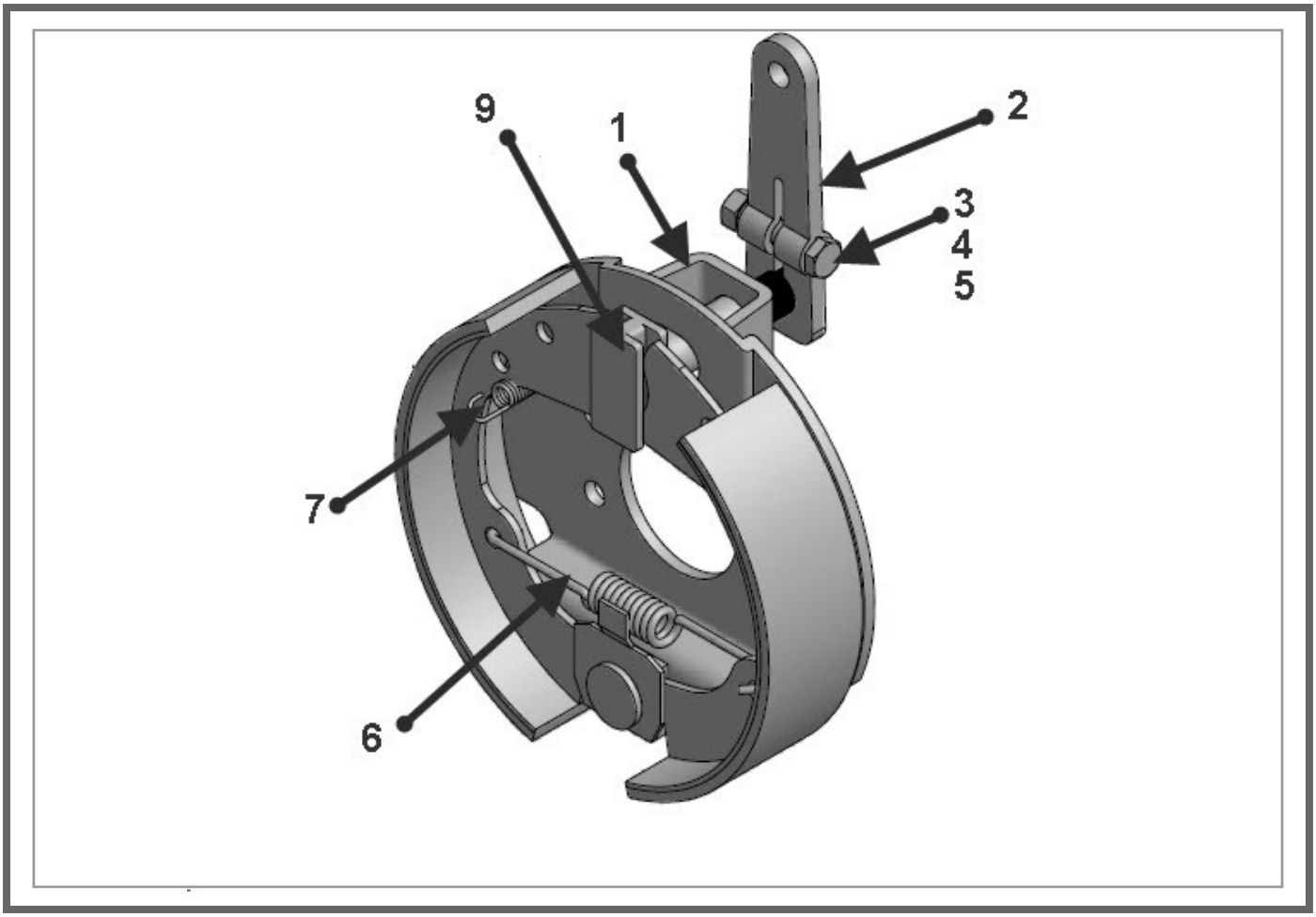
ITEM	QTY	P.N.	DESCRIPTION
1	1	02-12071	Nut, Nylon Insert, 3/4-16 UNF
2	2	03-1014	Bushing, Stewering Arm
3	1	02-12141	Jam Nut, Nylon Insert 3/4-16" UNF
4	1	07-1052	Steering Arm, (400 & 600 Only)
5	1	02-1501	Hex Bolt, 5/16-18 x 4 1/2" LG
6	1	02-1300	Pin, Cotter
7	1	03-1013	Bushing, King Pin
8	1	07-10105	Toe Latch
9	1	02-11072	Flat Washer
10	2	03-1015	Bushing, Tie Rod
11	1	02-1201	Nut, Nylon Insert, 5/16-18
12	1	02-1304	Hitch Pin

ITEM	QTY	P.N.	DESCRIPTION
13	2	02-12041	Nut, Nylon Insert, 1/2" UNC
14	1	07-1046	Steering Arm, Lower Plate (400, 600 Only)
15	2	02-1502	Bolt, 1/2-13 x 1 3/4" LG
16	1	07-1005	Tie Rod (400, 600 Only)
17	1	02-12141	Nut, 3/4-16 UNF
18	2	03-1013	Bushing, King Pin
19	1	02-12131	Nut, Nylon Insert,
20	2	03-1014	Bushing, Steering Arm
21	1	02-12141	Jam Nut, Nylon Insert 3/4-16" UNF
22	1	07-1052	Steering Arm, (400 & 600 Only)
23	1	07-1009	Housing, King Pin
24	1	07-11071	Front Axle



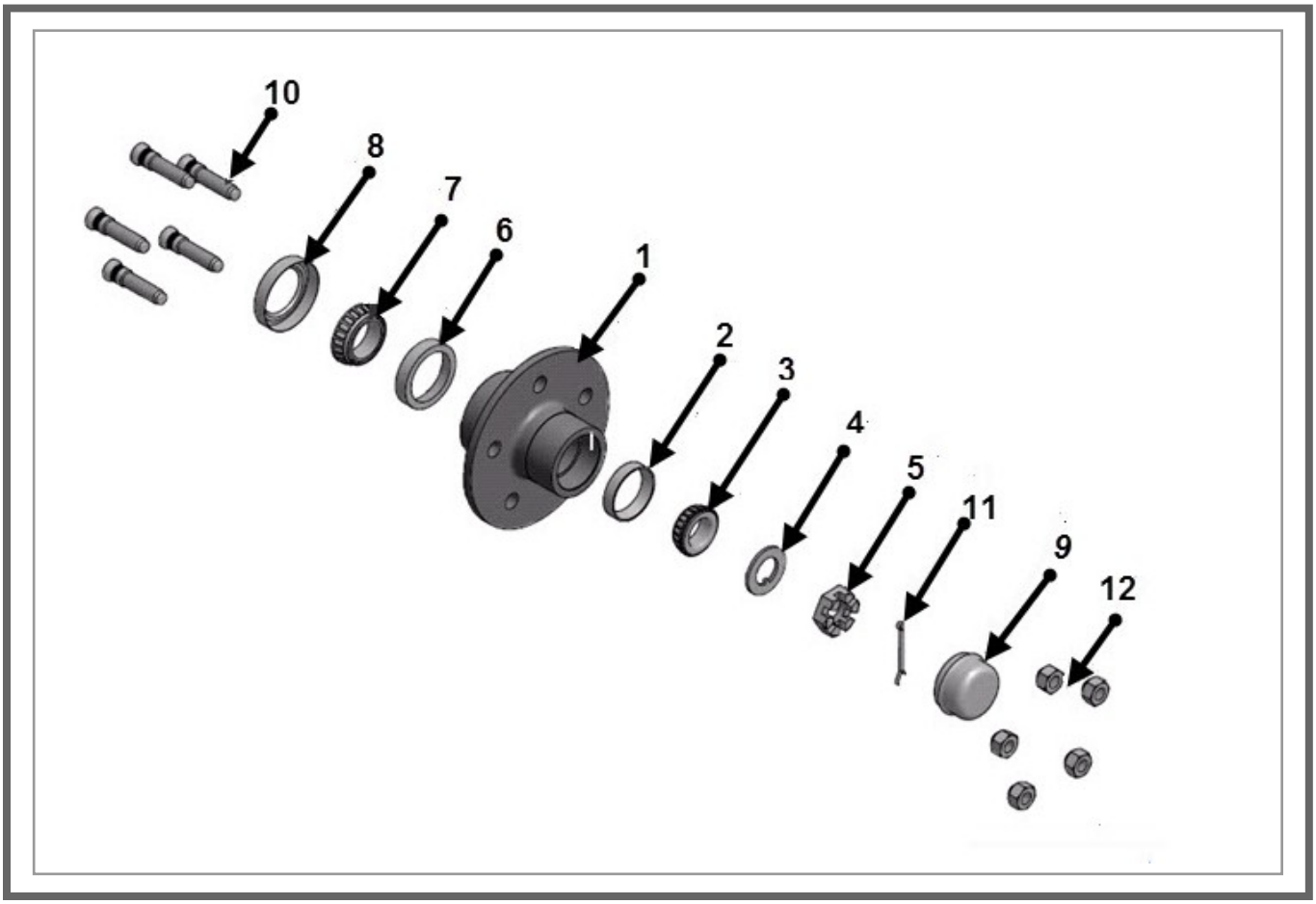
Drawing 5.0 **Rear Undercarriage and Axle**

ITEM	QTY	P.N.	DESCRIPTION
1	1	05-1023	Rear Axle Tube 400/600 Gallon
2	1	07-1010	Rear Spindle Weldment
3	8	02-3024	Bolt 1/2-13 x 4 Inch LG
4	2	02-3087	Nut, Nylon Insert 1/2-13
5	8	02-3072	Nut, 1/2-13 Plated
6	2	02-3068	Nut, 1/2-13 Plated
7	8	02-3026	Bolt, 1/2-13 by 1 1/2 Inch LG
8	8	02-3050	Bolt, 3/8-16 AP
9	8	02-3143	Lock Washer
10	2	02-3024	Bolt, 1/2-13 x 4 Inch
11	4	02-3025	Bolt
12	1	08-10301	Rear Axle Assembly
13	2	08-1007R	Brake Assembly
14	2	08-12050	Rear Hub and Drum Assembly
15	2	06-1012	Rear Mount Pad



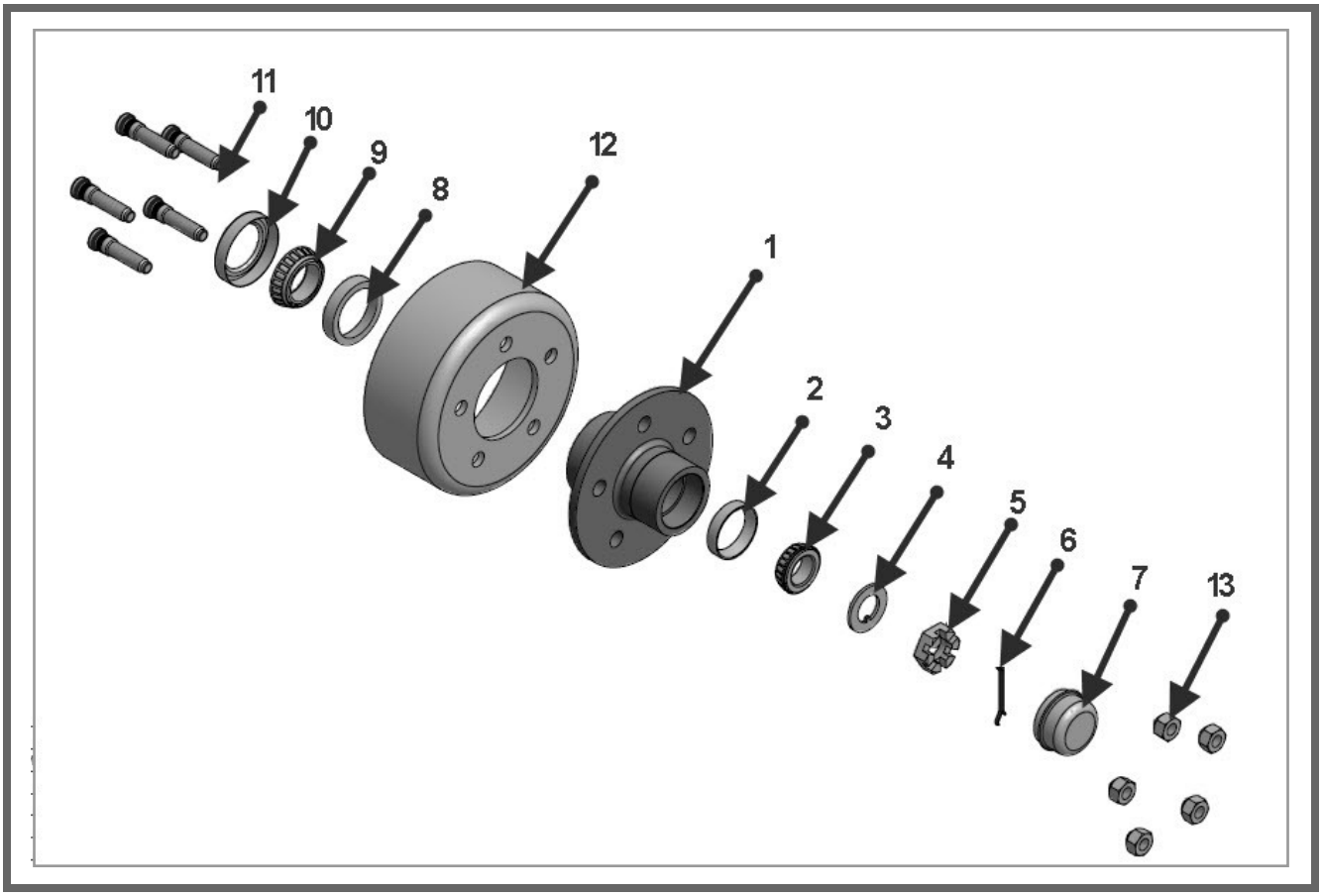
Drawing 7.0 **Brake Assembly**

ITEM	QTY	P.N.	DESCRIPTION
1	1	04-1064R	Back Plate
2	1	04-1030R	Cam Lever
3	1	02-10017R	Hex Head Cap Screw, 5/16”-UNF 1 1/2” LG
4	2	02-12011	Lockwasher 5/16”
5	1	02-11011	Return Spring
6	1	04-10265R	Brake Shoe Hold Down Spring
7	2	04-1026R	Bushing, King Pin
8	2	04-10265R	Brake Shoe
9	1	0401928R	Cam



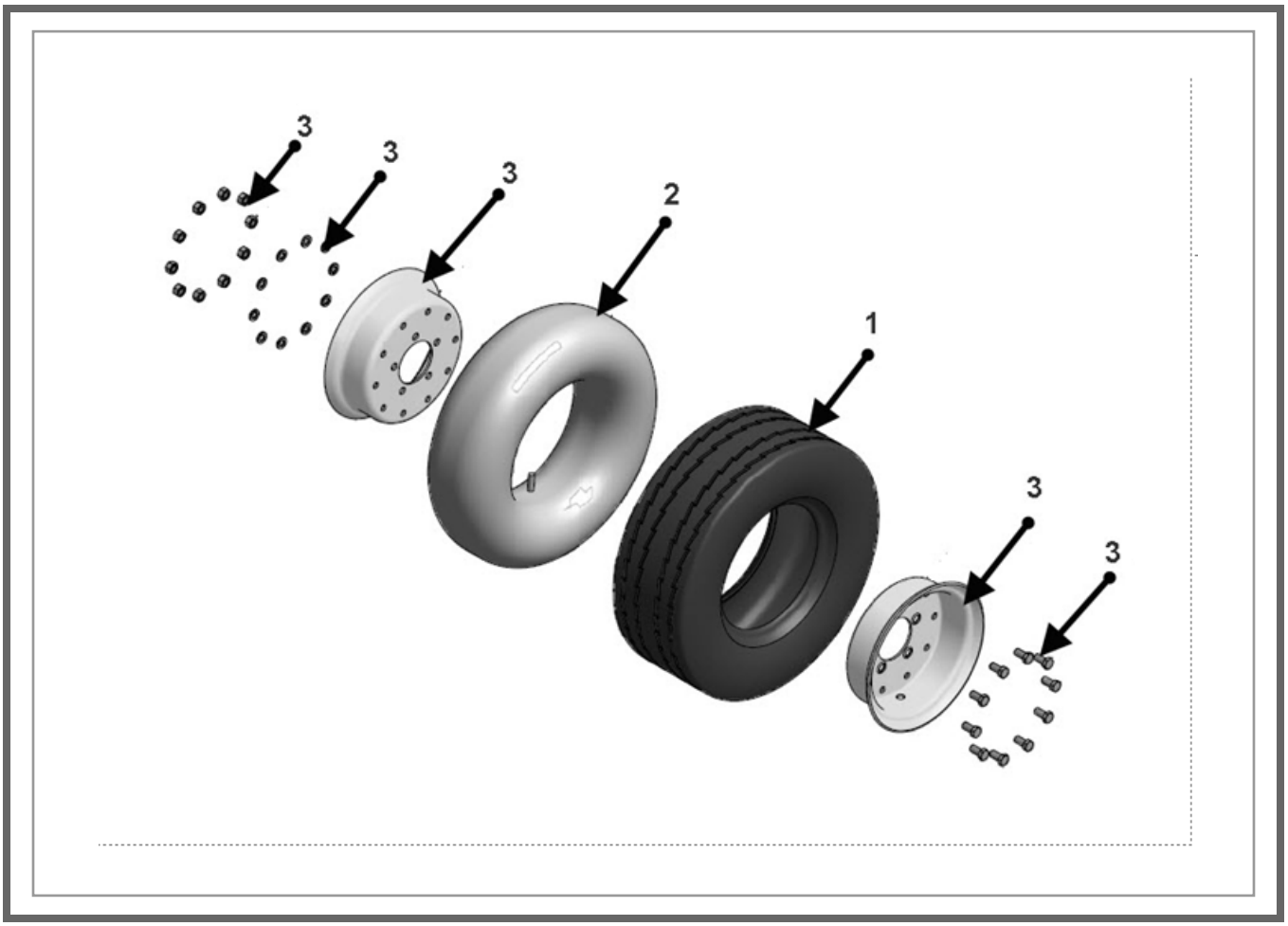
Drawing 8.0 **Front Hub Assembly**

ITEM	QTY	P.N.	DESCRIPTION
1	1	04-1017	Hub, Front 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	04-1015	Cup, Inner Bearing
7	2	04-1013	Cone, Inner bearing
8	2	04-1012	Seal bearing
9	1	04-1019	Cap, Hub
10	1	04-1017	Stud
11	5	02-1303	Pin, Cotter
12	1	05-1021	Nut, lug



Drawing 9.0 **Rear Hub and Drum Assembly**

ITEM	QTY	P.N.	DESCRIPTION
1	1	05-1020	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	02-1017	Stud
12	1	05-1021	Drum, Brake
13	5	04-1021	Nut Lug



Drawing 10.0 Wheel and Tire Assembly

ITEM	QTY	P.N.	DESCRIPTION
	4	07-10201	Complete Wheel Assembly (All Numbers)
1	1	04-10221	Tire, 20.5x 8.0-10, E-Range
2	1	04-1045	Inner Tube
3	2	04-1020	Split Rim Wheel Assembly