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January 17, 2024

Congratulations on your purchase of the Exosent Low Center of Gravity LPG Transport. The Exosent transport is a working machine incorporating moving parts and additional integrated mechanical equipment. Further, the transport will experience dynamic and kinematic motions and forces resulting in material fatigue and flexure. As with any mechanical equipment proper inspection, care, and maintenance will result with reduced potential down time.



Figure 1: *Exosent 12,000 gallon trailer*

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President
Exosent Engineering

Trailer Inspection, Planned Maintenance & Operation Manual

1 Recommended Inspection Schedule

Inspection Item	Frequency	Location	Part Number
Upper Coupler Bolts	Quarterly	Front	HHCS-58Xx212 Gr8 Blue
Upper Coupler Structure	Annual	Front	EXO-UC-2020
Nose Box fasteners	Monthly	Front Dish Head	
Glad Hands	Monthly	Front Dish Head	11452PB, 11451PB
Relief Valve Cap	Quarterly	Top of Trailer	122810
Fasteners	Weekly	All	NA
2" Jomar Valves	Monthly	Cage	501-308
$\frac{1}{2}$ " Jomar Valves	Monthly	Cage	501-308
Blackmer Pump	See Owner's Manual	Cage	TLGLF4B
Hydraulic Motor	Semi Annual	Cage	104-1023-006
Internal Valves	Monthly	Cage	NA
Pneumatic Actuator PIN	Semi Annual	Cage	NA
Lights	Daily	All	NA
Emergency Shut Off Valve	Monthly	Front/rear	Sealco 321160
Brake Interlock	Weekly	Cage	NA
Brake Interlock light	Weekly	cage	NA
Disc Brakes	Quarterly	Suspension	NA
Suspension Bushing Bolt	Monthly	Suspension	NA
Suspension Alignment	Quarterly	Suspension	NA
Spitter Valves	Monthly	Side well	NA
Landing Gear	Monthly	Cage front	A440.G8.17

2 Maintenance Description

2.1 Upper Coupler Bolts

The upper coupler structure experiences tremendous stresses during daily driving. The upper coupler is connected to the trailer with 16 bolts, 8 per side. The bolts are Gr 8 Teflon coated which helps reduce corrosion, see Figure 2. The bolts are installed with the nut on the top surface. Thus a visual inspection on the upper coupler bolts can quickly determine if any bolts are loose or missing.

It is recommended that a visual inspection of the bolts is performed daily, and retorquing bolts quarterly to 190 ft-lbs.



Figure 2: *Upper Coupler Bolts*

2.2 Upper Coupler Structure

The upper coupler structure should be inspected annually by removing the upper coupler from the trailer and inspect for cracks on the main plate, welded regions and king pin location, see Figure 3.

If any cracks are identified then the trailer must be removed from service until either repairs are made or upper coupler is replaced with a new one. On average upper couplers will last for about 5 years with normal highway driving. However, the longevity of the upper coupler will be reduced if the trailer is involved in an accident or is used in an off road environment.



Figure 3: *Upper Coupler structure, left: upper coupler welded ribs, Right: upper coupler King Pin welds*

2.3 Nose Box

The nose box is welded on the front dish head of the trailer and is produced from stainless steel, inhibiting corrosion. However, items connected to the nose box are the: Glad hands, 7 way harness connection, and other auxiliary items, see Figure 4.

1. The glad hands have a retaining nut at back side of the nose box. This should be checked for tightness once a month.
2. The glad hands rubber seal should be lubricated periodically to ensure proper seal and air delivery to the trailer air system.
3. There are two stainless steel nuts securing the 7 pin plug at the back of the nose box, those need to be checked for tightness periodically.



Figure 4: *Nose box, front and back*

2.4 Relief Valve Cap

The trailer equipped with either two or three internal relief valves (depending on design), installed on the top portion of the trailer. The relief valve has a soft plastic cap protecting the it from moisture and debris. Periodically ensure by visual inspection that the cap is installed, see Figure 5.



Figure 5: *Left: Relief valve located on trailer top. Right: Relief valve with black plastic cap*

2.5 Fasteners

Fasteners (nuts and bolts) are used extensively on the trailer. Some are used in a structural capacity while others retain various components on the trailer. Structural fasteners will always be from high grade steel and will not be less than grade 8 material. At no time

should a structural fastener be replaced with a lesser grade material than grade 8.

Most other fasteners used are stainless steel. Stainless steel fasteners do not corrode but their strength is minimal and the stainless threads can bind if over torqued.

Regular inspections should be made throughout the entire trailer to ensure no bolt or nut is loose by visual and hands on verification. A fastener that is found to be loose must be immediately tightened prior to trailer usage. Stainless steel fastener should be torqued to not less than 5 ft-lbs. Grade 8 fasteners should be tightened to torque specification charts.

2.6 Jomar Valves

Jomar stainless steel ball valves are used for control of product delivery. The valves will experience shrinkage and expansion with temperature gradients that result from product flowing through the valves. Opening and closing the valve will be more difficult during shrinkage caused by low temperature, this is normal.

Jomar valves are serviceable with Teflon seal replacement. It is recommended that the nuts securing the actuation handle be checked for tightness. This should be done on both the 2" and $\frac{1}{2}$ " drain valves, see Figure 6.

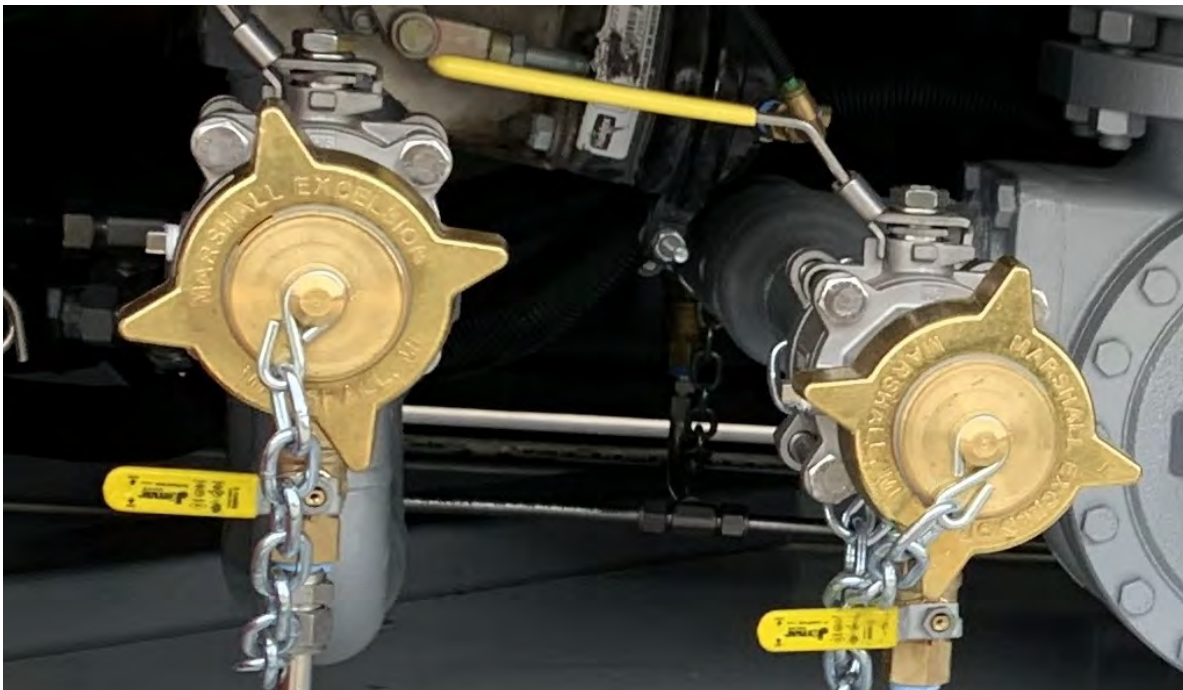


Figure 6: Jomar valves in cage area with yellow handle secured by stainless steel nut.

2.7 Blackmer Pump

In most cases the trailer incorporates a 4" Blackmer pump. The pump is driven by a direct coupling hydraulic motor. The hydraulic motor requires 20 gpm at about 2000 psi in order to spin the pump at the rated 640 rpms. These pumps require standard maintenance and the pump's owners manual should be referenced. The pump needs to rotate in the counter clockwise direction when viewed from opposite side of the hydraulic motor, see Figure 7.

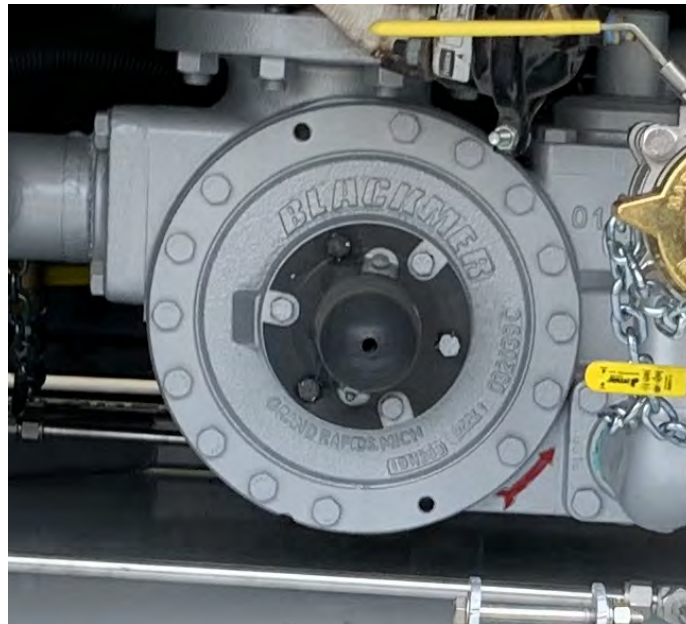


Figure 7: *Blackmer pump viewed from opposite side of hydraulic motor, red arrow indicates rotation direction.*

2.7.1 Rotation Speed Check

The Blackmer pump performs best at 640 RPMs. Slower rotation will result with reduced gallons per minute, and faster rotation could result in cavitation. It is recommended that pump rotation speed is calibrated accordingly. To do so follow the following steps:

1. Remove plastic cap as shown in Figure 7.
2. Start pump with truck engine in idle.
3. Verify pump rotational speed with a typical RPM gauge, record number.
4. If rotation is lower than 640, then gently increase truck engine rpm until satisfactory pump rpm is reached.

2.8 Hydraulic Motor

The hydraulic motor will heat up during operation; average temperature after 40 minutes of operation will reach around 120°F. Over time the motor shaft seals will fatigue and leak. Motor should be inspected during operation for small leaks which will indicate seal failure.

2.9 Internal Valves

Internal valves are used on the transport as required by C.F.R. These valves have complex springs which can brake over time. Internal valves must be checked for proper sealing once a month. Exosent predominately uses Fisher or MEC internal valves.

2.10 Pneumatic Actuator

The internal valve is actuated via a piston air actuator which rotates the internal valve shaft, see Figure 8 .The link which rotates the internal valves is secured with a cotter pin, this pin will fatigue over time and brake. Once broken the internal valve will no longer open. These pins should be replaced twice a year.



Figure 8: Shown actuator, black diaphragm piston pushes the rod which rotates internal valve clockwise via link.

2.11 Emergency Shut Off Valve

There are two Emergency shut off valves on the trailer; one on the driver side front and the second on the passenger side rear, see Figure 9.



Figure 9: Left: Emergency Shut off valve front. Right: Emergency Shut off rear.

The emergency shut off valve must be cycled once a month by law. Failure to perform emergency shut off valve test could lead to catastrophic accident in case of an emergency.

2.12 Disc Brakes

When equipped with disc brakes; quarterly inspections must be made on bolts that secure caliper to rotor, see Figure 10 left. Loose bolts must be tightened to OEM specifications. Brake shoe thickness should be inspected for proper wear using the verification plunger on the brake itself see Figure 10 right.

2.13 Suspension Bushing Bolts

Bushing bolts may loosen over time or as a result from striking a curb, or severe potholes. Loose bushing will lead to axle misalignment and excessive hanger wear which will result with the need to replace hanger and bushing. Proper bushing bolt torque is between 560 ft-lbs to 650 ft-lbs. A monthly visual inspection will indicate if a bolt is loose, see Figure 13. It is recommended that the bushing bolt is torqued semi annually.



Figure 10: The Caliper assembly is secured with bolts shown in blue, these must be inspected quarterly to ensure correct torque. Failure to do so may result with loose caliper or even loss of caliper.



Figure 11: Left: Suspension hanger with bushing bolt as seen from inside chassis frame. Right: Bushing bolt (bottom left) as seen from outside of chassis frame. This bolt is also used to adjust suspension alignment, see suspension alignment routine below.

2.14 Suspension Alignment

Suspension alignment will determine if the trailer tracks properly. A misaligned suspension will result with increased tire wear and off tracking. It is recommended that alignment is verified every quarter. One basic yet very effective method to verify trailer suspension alignment is to measure from outer extremes of the each suspension to the king pin of the trailer using the following procedure:

1. Disconnect trailer from tractor and set on level ground.
2. Use a plumb bob and make a mark on the ground right below king pin.
3. Use a 100 ft **STEEL** tape measure, and measure from one side of a fixed axle wheel center to plumb bob ground mark, and note.
4. Make the same measurement from the other side and note.
5. If the two measurements are within an $\frac{1}{8}$ " then carry on to next step. If not perform the following alphanumeric steps.
 - (a) Release trailer brakes but ensure trailer wheels are chocked.
 - (b) Loosen suspension bolt as seen in Figure 13 and adjust outer nut until suspension moves to desired location.
 - (c) Repeat measurements steps 3 through 5 until measurement difference is within $\frac{1}{8}$ ".
6. Use the verified axle as a datum point for the remaining axles.
7. Measure from the center of the axle wheel to the next axle wheel on both sides. Measurements should be within a $\frac{1}{16}$ ".
8. Alignment is complete after all axles measure satisfactorily and bolts are torqued to \approx 600 ft-lbs.

2.15 Spitter Valves

Every trailer is equipped with liquid level detection, this includes a float indicator, and percentage indicators. The percentage indicators are located in a recessed well on the side of the trailer at about four o'clock position. The percentage indicator is actuated by a small stainless steel T valve as seen on Figure 12.

The spitter valves must be cycled monthly in order to ensure proper operation when needed. The valves will seize up if not cycled.



Figure 12: *Spitter valves are shown in the well with percentage limits below the valves. The pressure gauge is located on the bottom and the temperature gauge is located on top.*

2.16 Landing Gear

Each trailer is equipped with a landing gear (Predominately Jost). The landing gear has internal gearing which require periodic greasing and cycling to maintain operability.



Figure 13: *Shown typical landing gear with grease zirc fittings located on the side of the leg*

3 Wheels and Tires

Exosent only utilizes aluminum wheels on its trailers. The following configurations are used:

Suspension Type	Wheel Configuration	Wheel width	Offset
77.5" track	Dual	8.5"	NA
77.5" track	Super Single	14"	2"
83.5" track	Super Single	14"	0"

When Super Singles are used it is imperative to know that Super Singles are directional mounted, and must be installed on the correct side of the trailer. Additionally, when Super Singles are used on 77.5" track it imperative that only a 2" Offset is used and is oriented correctly on the axle. Failure to install wheels correctly will cause the trailer to:

1. Lean to one side
2. Increase tire wear
3. Reduce proper braking
4. Reduce overall suspension longevity.

4 Systems

4.1 Electrical

Exosent DOES NOT utilize junction boxes, rather one single harness is used. Each trailer is unique and some modifications are made on the installed harness. however, all connections are made with weather proof butt connectors which are then wrapped with a weather proof seal. The electrical harness ground is located on the front of the trailer driver side between the chassis above the upper coupler. Figure 14 shows the obsolete harness used and Figure 15 shows the new harness used which is more robust and is modular and does not require any splicing or modifications.

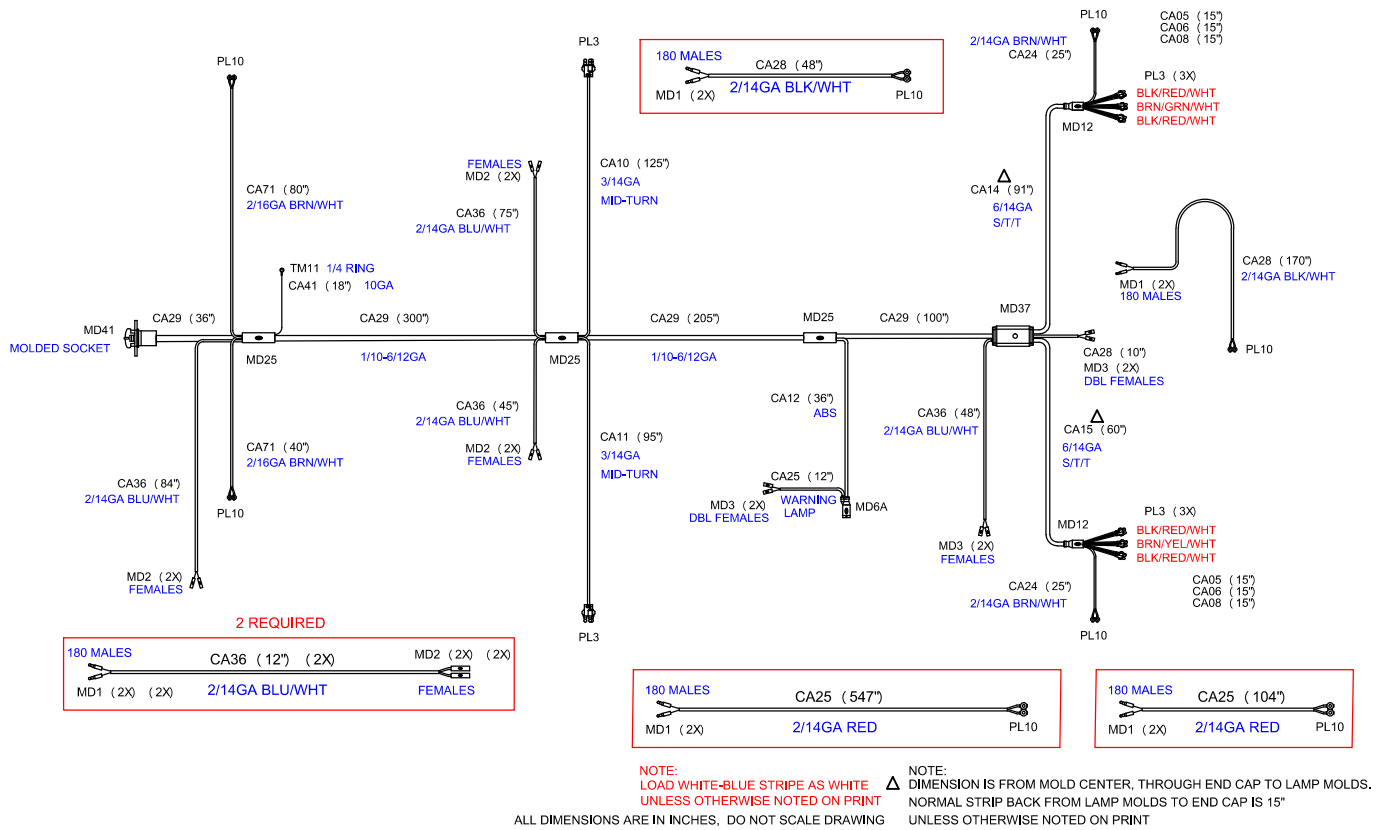


Figure 14: The above figure is obsolete

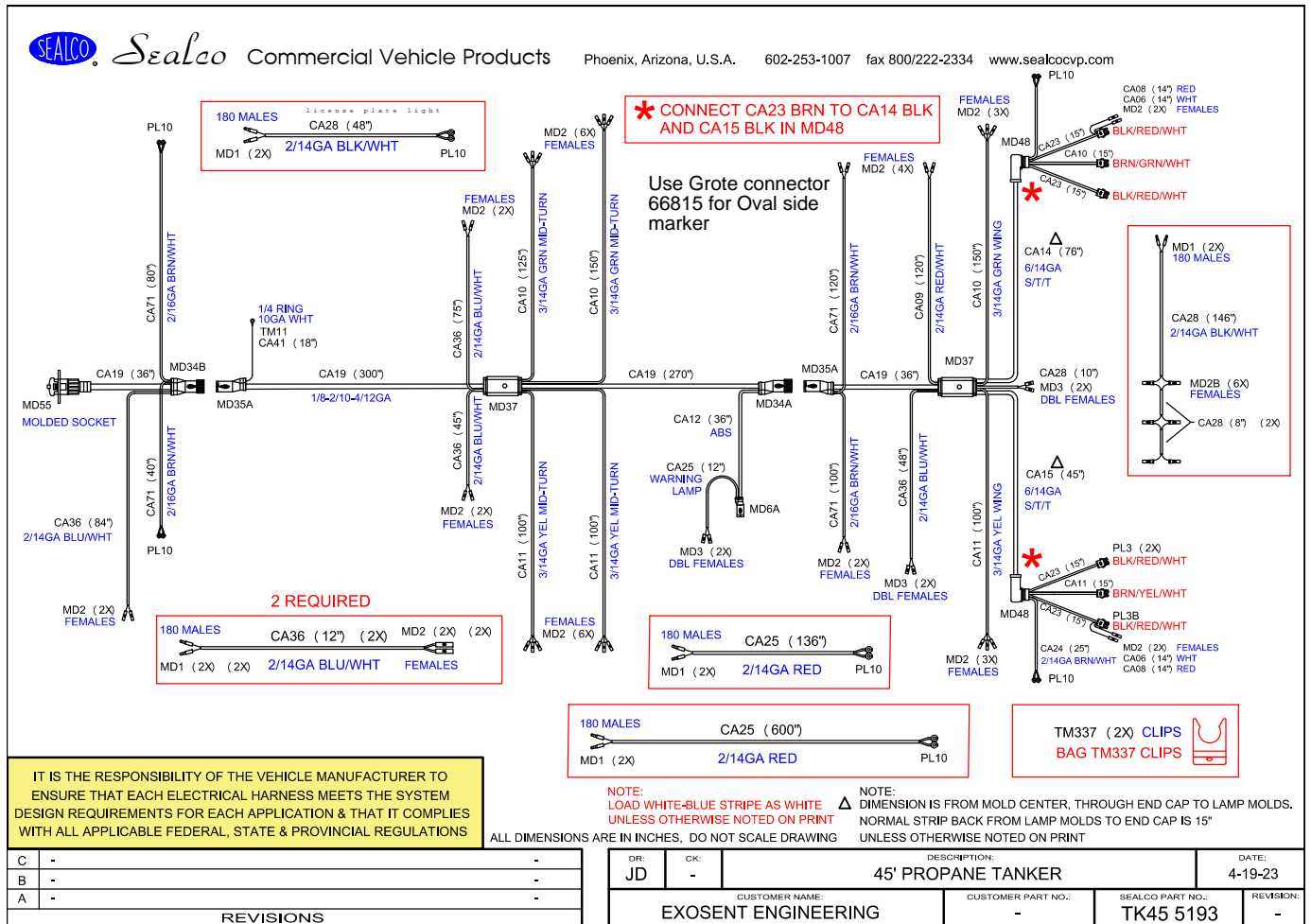


Figure 15: new harness are installed on all units starting in December 2023

4.2 Hydraulic

The hydraulic system utilizes $\frac{3}{4}$ " hoses and fittings rated at 2500 psi. Any truck powered PTO exceeding 2500 psi will result with a potential hydraulic line break and oil spills. The hydraulic lines communicating with truck PTO system are located on the passenger side and are encased within a 2" light gauge pipe. The lines are fitted with $\frac{3}{4}$ " male NPT fitting. Customer is responsible for final connection to truck.

4.3 Air

The basic air brake system shown in Figure 16 is used on all tri axles, quad axles and penta axles.

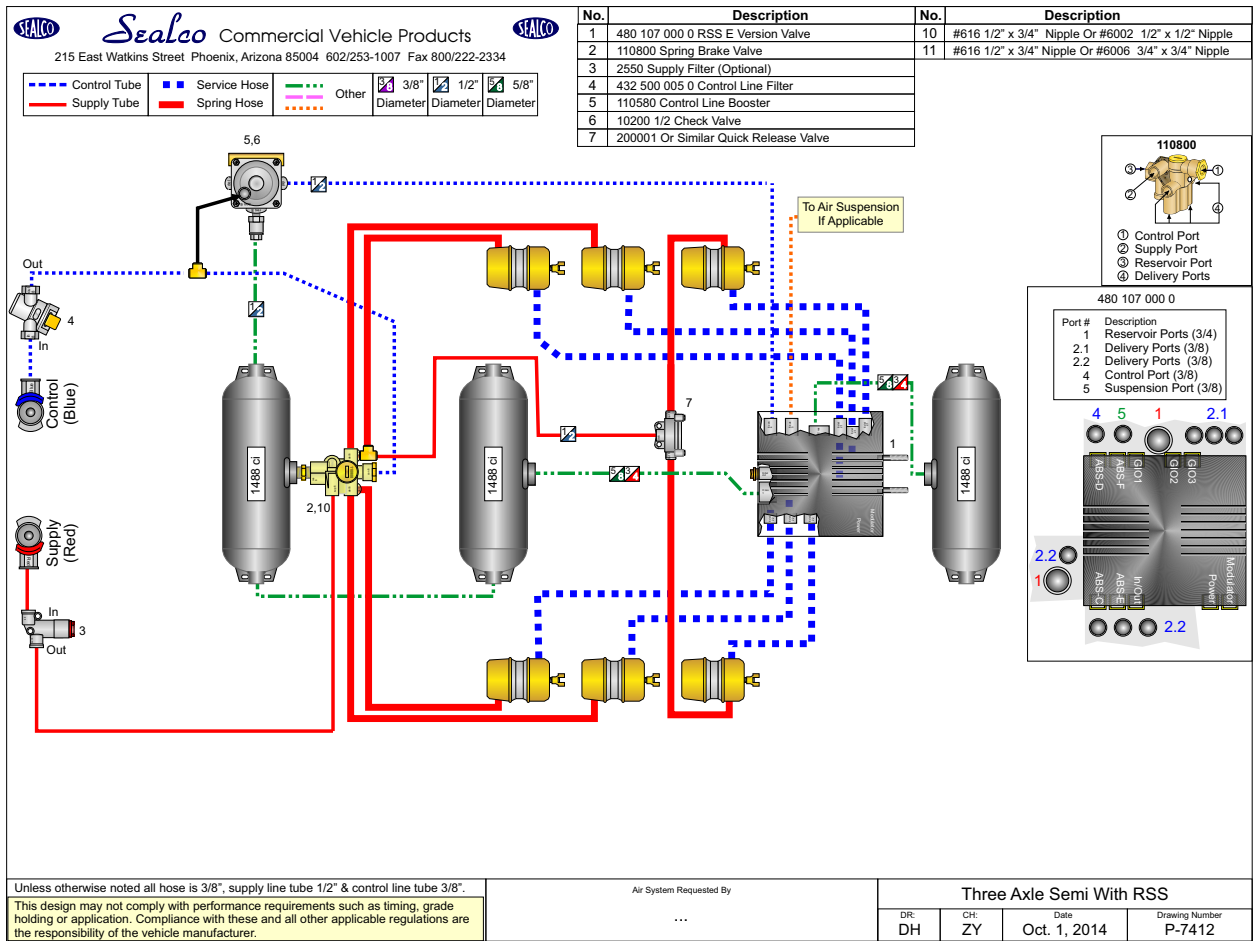


Figure 16: The Figure shows the basic air system for the brake components used in the trailer braking system. All the components are purchased from Sealco Corp in Phoenix, AZ.

4.4 Ride Height

Trailer standard ride height is 34 inches as measured from the ground to the bottom of the chassis. When the suspension bags are dumped the ride height is about 31 inches as shown in Figure 17. Ride height adjustments can be made using the ride height valve, but do not exceed 36.5" from the ground or below 33 inches from the ground.



Figure 17: The Figure shows the way to measure trailer ride height from the ground to the bottom of chassis. The current figure shows the ride height in bag dump condition.

4.5 On Board Tire Inflation

On Board tire inflation is a standard item on all Exosent units. The system is manufactured by PSI and ensures proper tire inflation on all axles except steerables. The system is set to 110 psi, however, the pressure can be adjusted if necessary.

4.6 Brake Interlock

When equipped, a brake interlock is installed on units utilizing the Roll Stability ABS Module. This system is designed to engage the trailer brakes when an open signal is received from the electro-mechanical switch. The signal is transmitted by wire to the RSS module to port GIO3 and power is supplied by the RSS module GIO1 as seen in Figure 18. The switch is connected to the door frame or gate, when the door is opened the switch sends a signal. Unique to this system is the added safety which prevents brake actuation while the trailer is in motion over 4 mph.



Figure 18: Left: Yellow Sick mechanical sensor is located on cabinet door. Right: RSS Module showing the wires connected to GIO3 and GIO1.

4.6.1 Troubleshooting

If for some reason the brakes are engaged and will not release regardless of the door position, all the driver has to do is to remove the wire connectors from the GIO3 and GIO1 located at the RSS Module as shown in Figure 18 on the right. To remove the wires:

1. Locate the RSS at the rear of the trailer.
2. Using a flat screw driver gently slide the yellow brackets to the left for GIO1 and GIO3.
3. With a downward motion slide the wires out of the RSS Module.

For further understanding of the system select the link below. (TBD)

5 Additional Parts

Some of the below items maybe purchased from third part distributors and some can be purchased from Exosent. To purchase items from Exosent simply email to parts@exosent.com

Item Location	Name	Source	Part Number
Rear Manway	O-ring (large)	Mcmaster -Carr	9452K461
Rear Manway	O-ring (small)	Mcmaster -Carr	9452K456
Tank belly	Blackmer Pump	Blackmer	TLGLF4B
Tank belly	Blackmer pump rebuild Kit	Blackmer	899022
Tank Belly	Blackmer Pump Motor Adapter	Blackmer	BLK892037
Tank Belly	Hydraulic Motor	Eaton	104-1023-006
Tank Rear	Roll Stability ABS	Sealco	4RVCCF
Tank Rear	Tire Inflation	PSI/ Meritor	31092-00
Tank Rear	Lift axle control valve	Sealco	527063
Suspension	Standard ride height valve	Meritor	MPS-5169
Suspension	Dual Stage ride height valve	Barksdale	52334R-QA54F1
Suspension	25k lbs Meritor Bushing	Meritor	A 1225C1537
Suspension	25k lbs Meritor wear Washer	Meritor	21226663
Suspension	25k lbs Meritor shock	Meritor	A 7805F1020
Chassis	Fender Bracket standard	Exosent	FS101
Chassis	Fender Bracket Flat	Exosent	FS103
Chassis	Fender Bracket welded	Exosent	FS104