2022

Caster steer air lift

OPERATIONS

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1 Introduction

This manual is an introduction to the Air Lift systems utilized by Temisko trailers. It entails basic to intermediate identification and operational information on the air lift systems. Details on trailer setup, balancing, legally required configurations, control boxes, control modules, lifting mechanisms, and alignment procedures are included within.

2 Scope

This manual is meant to build on existing knowledge of an air lift Axle. It is expected that the user will apply mechanical best practices when executing the procedures therein.

Contents

3 Glossary

PSI: Pounds per square inch

Riding height: Distance between the axle center and the bottom of the frame given that the suspension is inflated to the design height.

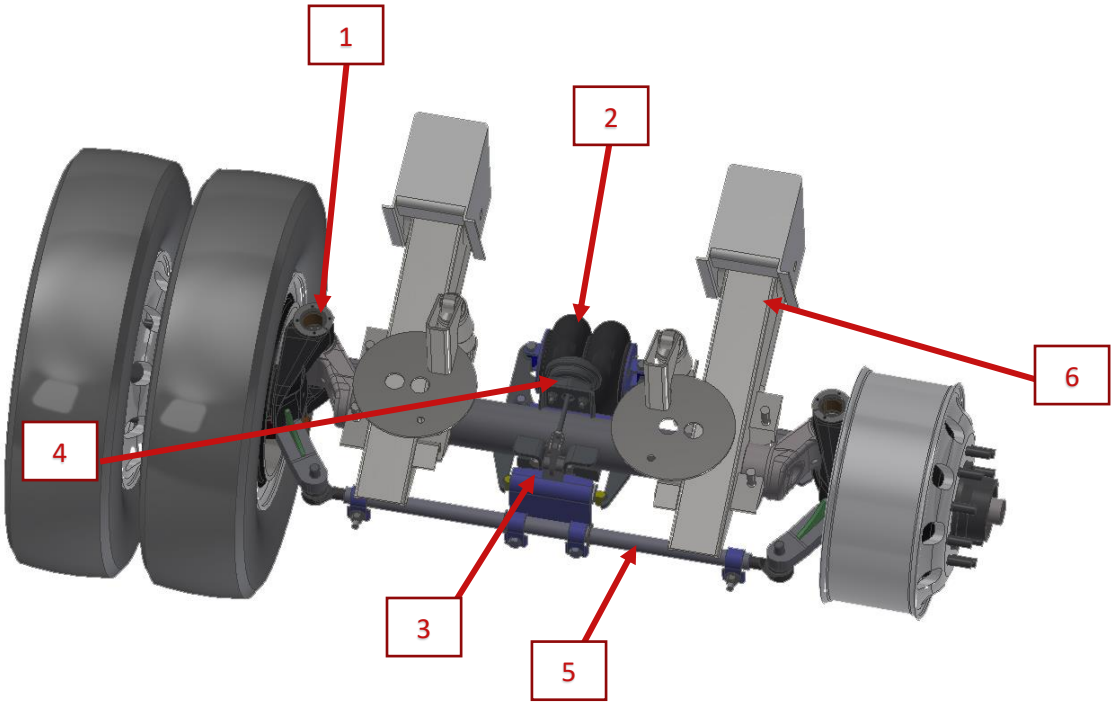
UBL: Under Beam Lift

4 Terminology

Presented below is the terminology utilized within this manual. The location and terminology of these parts are critical to the overall understanding of the trailer as a whole. Please take the time to familiarize yourself with all the parts as they will be discussed further in the manual.

4.1 Overall View

The following figures shows the air lift axle and its respective sub parts.



Item	Description
1	Knuckle
2	Return Air Bag
3	Steering Lock
4	Lock Actuator
5	Tie Rod
6	Suspension

5 Overview of Air Ride Suspensions

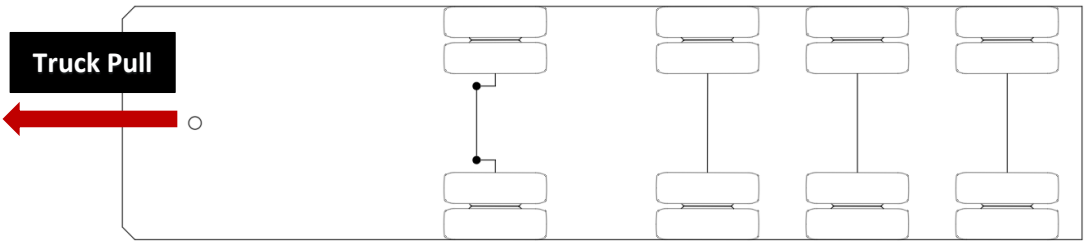
Air ride suspensions are required to be deployed at all times. The riding height is set by the levelling valve but the air pressure changes based on load.

Air ride suspensions that are plumbed together are self equalizing. This means that the load is always shared between all axles. The air pressure is equal between all suspensions. Trailers that use auto steer axles are sometimes equipped with a different suspension model.

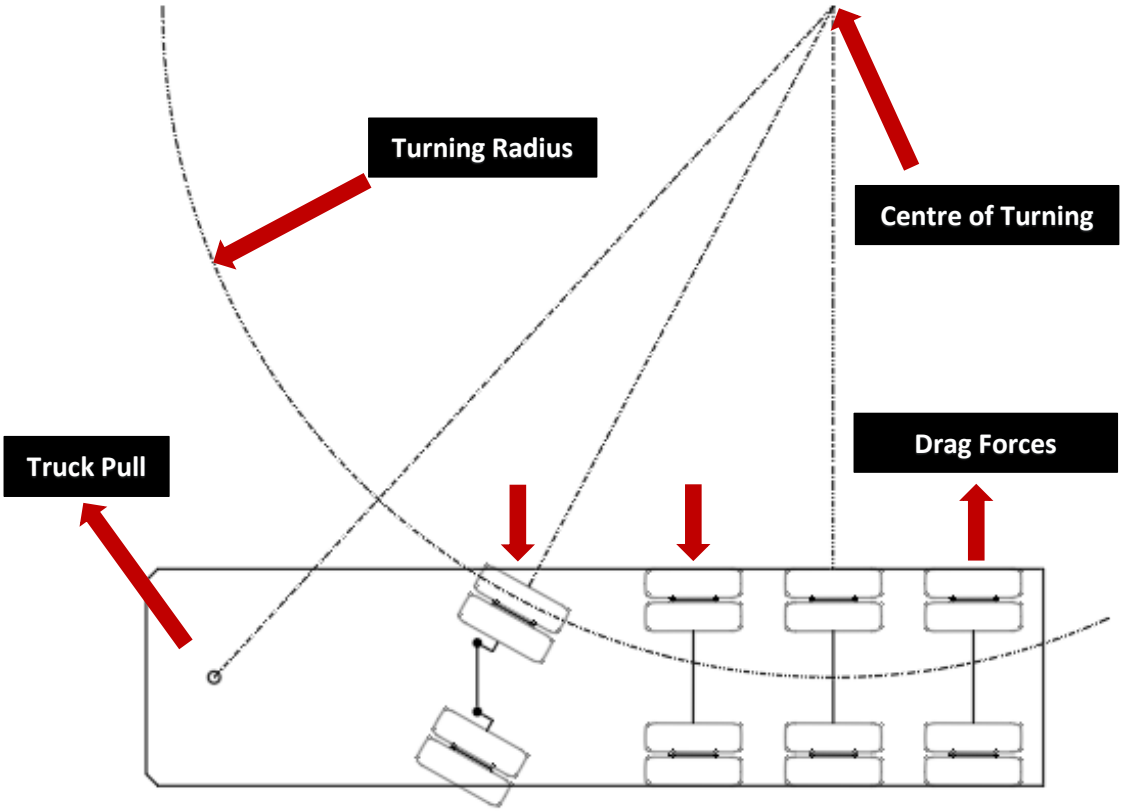
The differing models have different pressure to force gradient. This means that for a given air pressure the suspension will exert a force on the ground. This differential will create a variance between axle weights.

6 Overview of Steerable Air Lift

Overhead view of trailer being towed straight:



Overhead view of trailer during cornering operation:



Casters get pushed and pulled sideways to “steer” while turning.

7 Setup and Balance

It is critical that the trailer is level and the weight is distributed over the axles. This allows for a safe operation and optimal performance. The trailer level is leveled with the coupler height, while weight distribution is achieved through similar axles and/or ratio valves.

7.1 Coupler Height and It's Affect

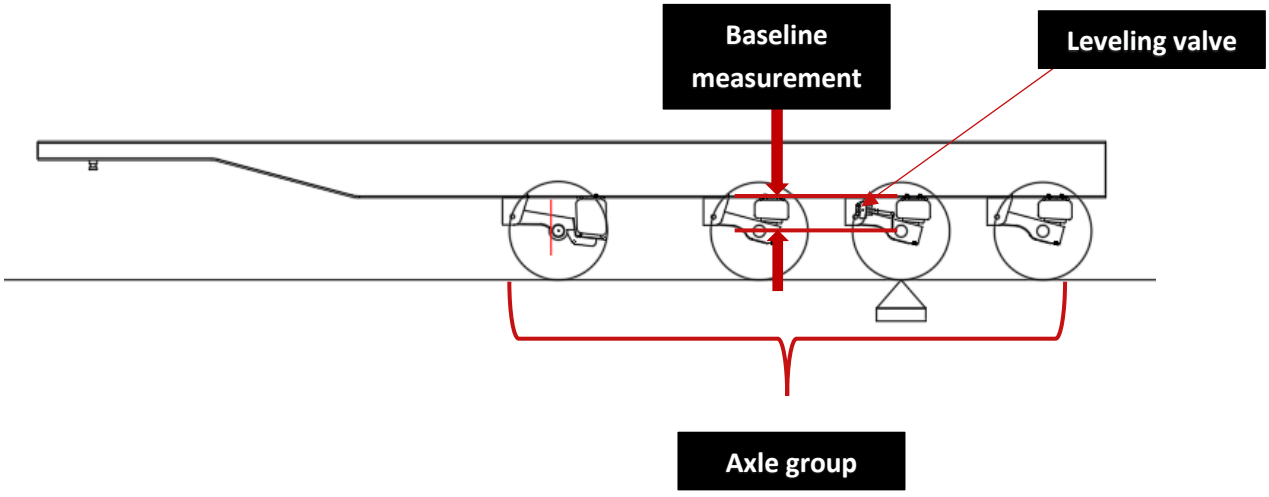
Coupler height affects the level of the axle groups to spread the load evenly on them. They must be level because the suspension only has a set amount of travel. For example, if the coupler height is not high enough (forward lean), the front suspension may be at its lowest level and the last axle may be at its highest point. This means that if the trailer travels over a bump in the road, the front suspension may bottom out and severely overloading it.

Another reason is that the air bags have a working curve. This curve is specific to every air bag model. What is important to retain is that all air bags push the same amount of force when they are at the same height. When the air bags are not at the same height, they will push differently. Adjusting the coupler height will re-position the suspension so that all the air bags are at the same height.

Leveling the whole trailer is done one group at a time. The fist step is to locate the axle with the leveling valve. On tridem axles the leveling valve is typically located onto the second axle. The valve`s location is important as it will be the baseline measurement for the group. This baseline measurement will be used to compare with the other axles.

TIP:

The leveling valve will always bring the axle to the riding height, unless the axle is overloaded or has insufficient air pressure.

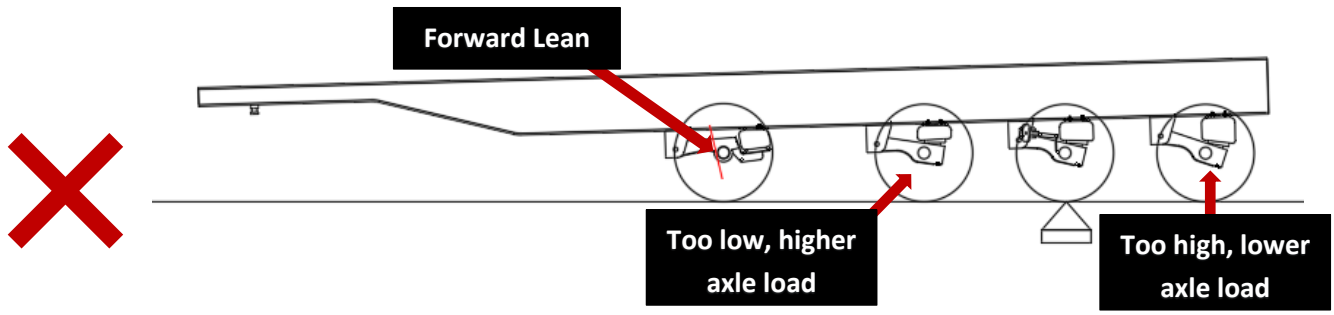


The baseline measurement is obtained though the following steps:

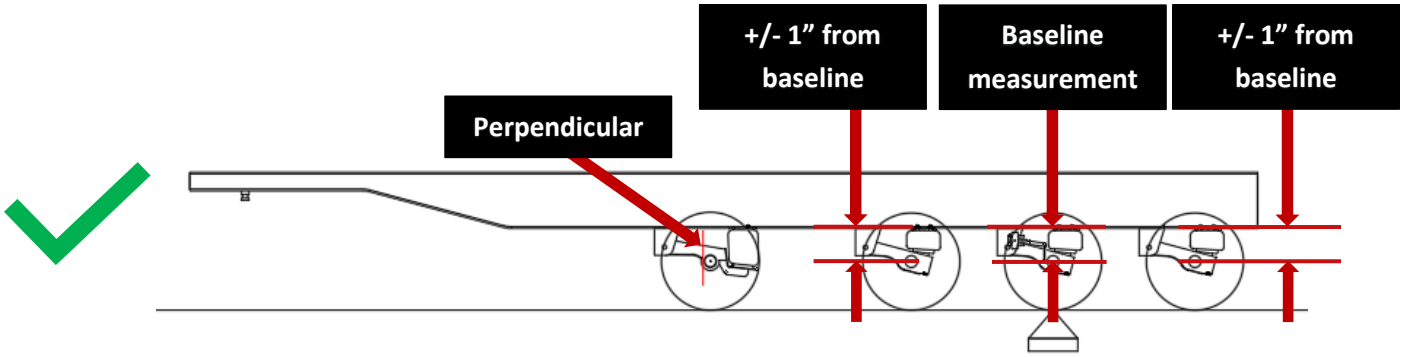
- Fill the trailer with air (90-120 psi)
- Allow the trailer to level
- Measure from the bottom of the frame to the top of the axle

Below are the 3 scenarios that indicate the possible conditions.

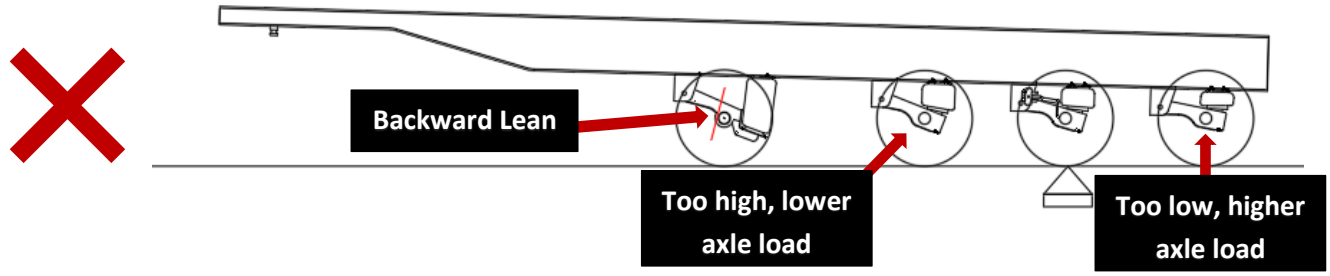
Situation 1: Incorrect height adjustment, trailer is dipping forward



Situation 2: Correct height adjustment, trailer is level



Situation 3: Incorrect height adjustment, trailer is dipping backward

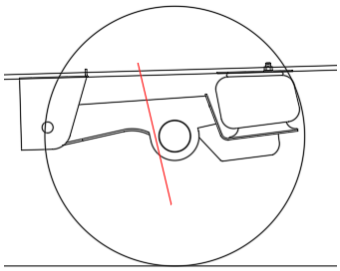
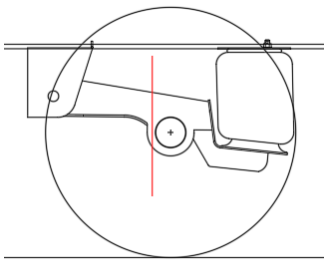
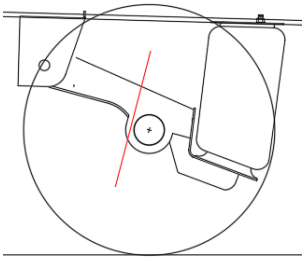


The baseline measurement and leveling principle is the same if there are 2,3 or more axles.

1. Locate leveling valve
2. Acquire baseline measurements
3. Measure all other axles heights (must all be within +/- 1” from baseline)

7.1.1 Air Lift Wheel Shimmy

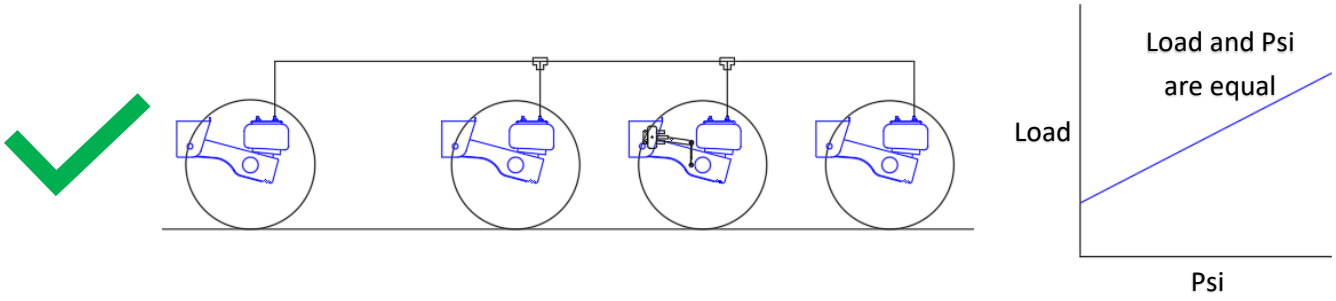
Incorrect height adjustment can also lead to wheel shimmy and wobble on the air lift axle itself. If the suspension is too high or too low, the air lift's pivot axis will not be perpendicular / aligned with the ground which will cause adverse shimmy and vibration.

Situation 1: Incorrect height adjustment, suspension is lifted too high, axis is pointing forward	**Situation 2:** Correct height adjustment, trailer is level and axis is perpendicular	**Situation 3:** Incorrect height adjustment, suspension is too low, axis is pointing backward
		
		

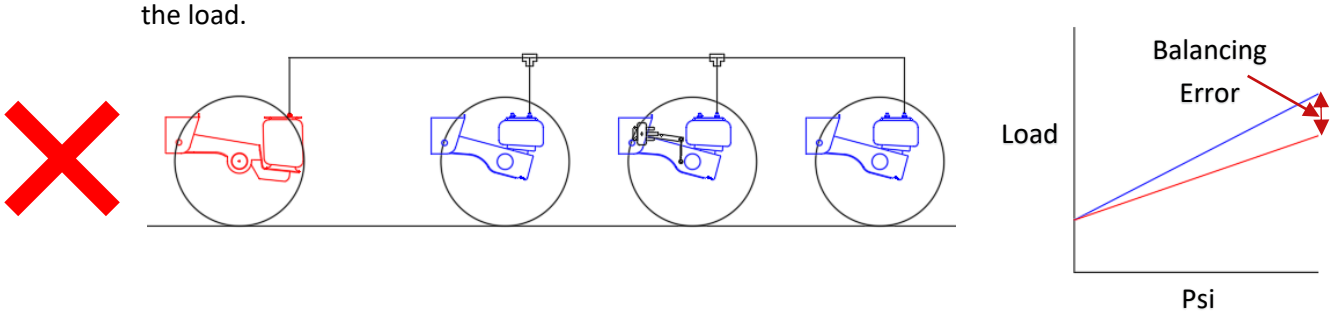
7.2 Suspension Adjustment

Correct weight distribution is achieved through the use of similar axles and / or ratio valves. A simplified diagram below explains three situations regarding suspension, valving and balancing loads.

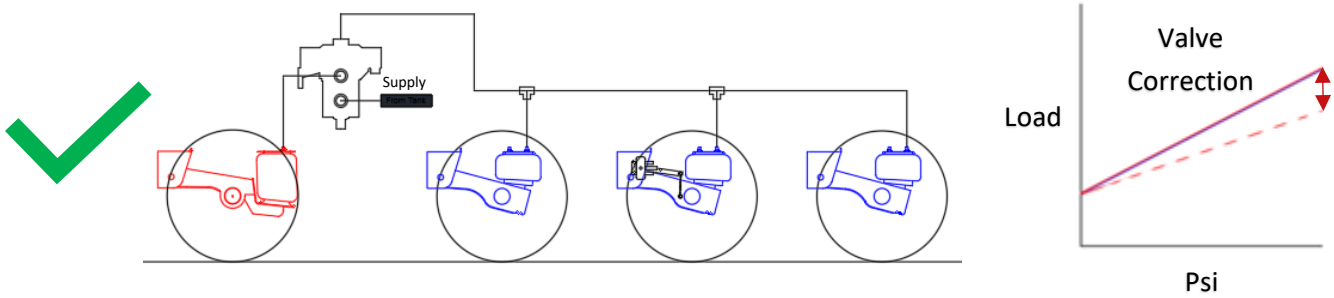
Situation 1: The same suspension type plumbed together will balance the load.



Situation 2: The first axle having a different suspension type plumbed together will not balance the load.

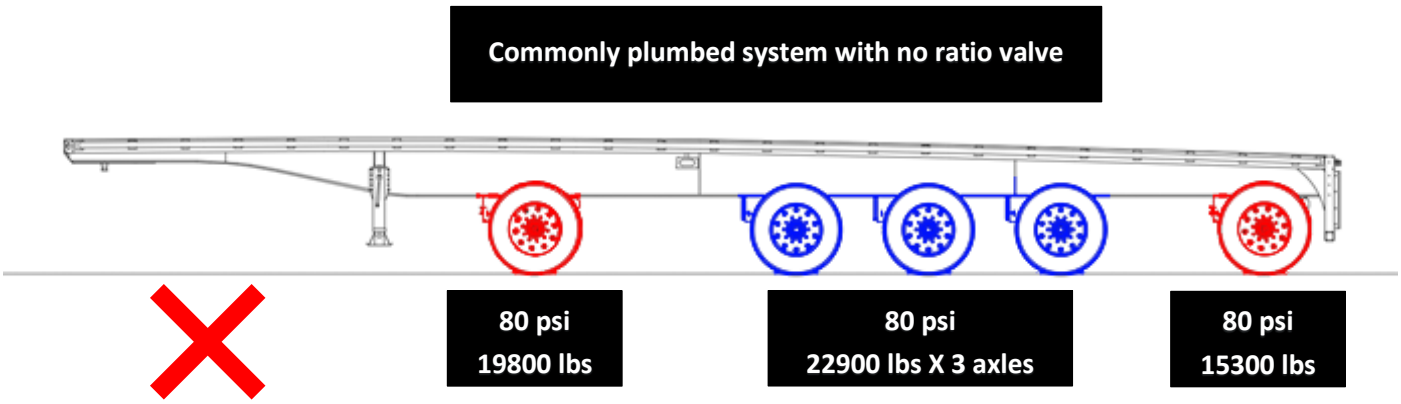


Situation 3: The differing suspension types require the installation of a ratio valve as indicated below. This will balance the load.



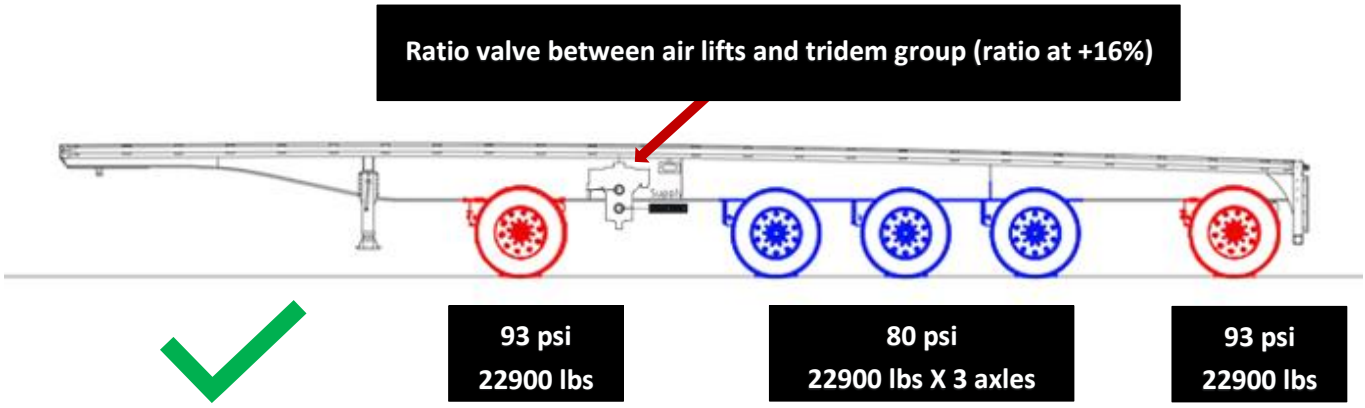
7.3 Example of Valve Application

The following is a detailed example of a trailer with 2 air lifts and a tridem group. The air lift has an HT250T suspension and the tridem group has a Intraax 30K suspension.



Although the pressure is equal across all axles, the weight is not distributed evenly over all axles. As indicated in the diagram, there is a variance of 3100 lbs. A ratio valve is required to adjust the air pressure accordingly to distribute the weight evenly over all axles.

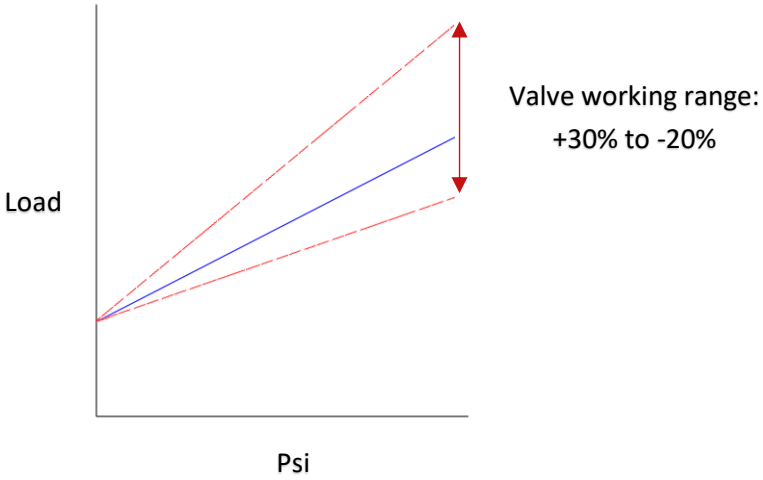
The figure below shows the same system but with a ratio valve that will increase the air pressure by a percentage to equalise the force between all axles.



The weight distribution above ensures safe trailer operation. The legal requirement to balance out between axles in a group is 500kg or 1102lbs.

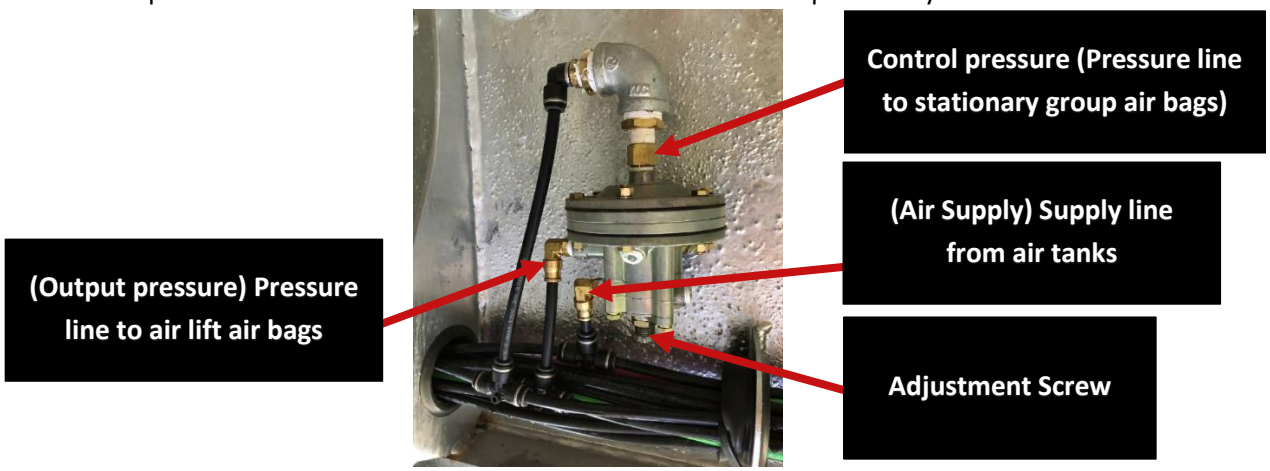
7.4 Operation of the Ratio Valve

The ratio valve (AIR\VAL\0041) is commonly available air valve. There are 2 inputs, one output and an adjustment screw. The valve adjustment range is -20% or +30% of the control signal.



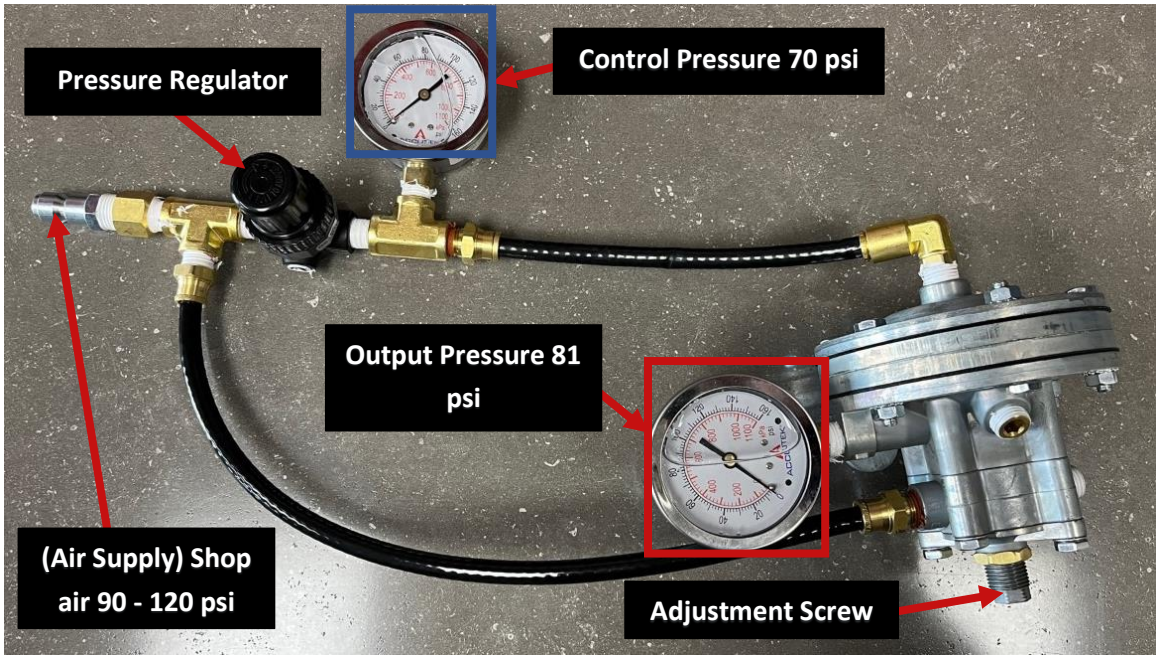
1. Inputs:
    - Air supply (Supply line from air tanks)
    - Control Pressure (Pressure line to stationary group, tridem group in this example)
2. Outputs:
    - Pressure line to air lift axles
3. Adjustment:
    - The adjustment screw to increase or decrease the ratio (tighten to increase, loosen to decrease)

Below is a picture of a ratio valve that is installed onto a trailer suspension system.



7.5 Valve adjustment

New valves will need to be adjusted to balance the differing suspensions. Below is a picture of a temporary adjustment apparatus that can be made from readily available parts.



Load charts to be used in this section as example.

Air lift axle (red)

Required psi	Load per axle (lbs)	Load per axle (kg)
96	25,000	11,340
88	23,000	10,433
80	21,000	9,525
72	19,000	8,618
65	17,000	7,711
56	15,000	6,804
48	13,000	5,897
40	11,000	4,990
32	9,000	4,082
24	7,000	3,175

Output pressure 72psi

Group (blue)

Required psi	Load per axle (lbs)	Load per axle (kg)
95	23,000	10,433
88	21,000	9,525
80	19,000	8,618
71	17,000	7,711
61	15,000	6,804
52	13,000	5,897
43	11,000	4,990
34	9,000	4,082
25	7,000	3,175
16	5,000	2,268

Control pressure 80psi

1. Locate the load chart for both suspension types, posted within the control box
2. Find the same axle weights on the chart, if the value is in between those listed in the tables (i.e.: 18,000), ensure to add together the psi values above and below (air lift axle is 72 for 19,000 and 65 for 17,000) and divide by two (68.5 psi) to determine the correct value for both the air lift axles and the group axle
3. Set the regulator (output pressure) to 72 psi
4. Tighten the adjustment screw on the air valve until the control pressure is 80 psi
5. Reinstall the jamb nut and install the valve in the trailer. Validate the setting by weighing the axle weights on a scale.

8 Control Modules

Control modules are utilized to managed air lift regulations and operational needs. Temisko trailers use either the RM-60 or Ecad.

8.1 RM-60

The RM-60 control module is a stand-alone device that is independent of the cab. The system automatically locks and/or lifts a self steer axle. The RM-60 Lift Axle function will also lift the forward axle when the four-way flashers are activated and a speed is under 60 Km/H this transfer's weight onto the drive axles for increased traction during slippery uphill conditions. The system has an output, which will turn on backup lights and/or beeper while reversing for safety.

Part number: AIRZZZ0006

8.2 Ekad

The Ekad control module is a unit that automatically lifts the system when the trailer is moving in reverse.

Part number: SUSHEN0503

9 Legally Required Configuration Details

The most stringent Canadian law that Air Lift Systems are required to conform to is Ontario law: O. Reg. 413/05.

9.1 Configuration Table

The following details are the required configurations for an airlift equipped trailer.

Configuration	Steering lock at 60km/h	Axle management module	Reverse on lifting
1+2	on front axle	RM-60	Yes
1+3	None	EKAD	Yes
1+3+1	on rear axle only	RM-60	Yes
1+1+3	None	EKAD	Yes
1+4+1	on rear axle only	RM-60	Yes

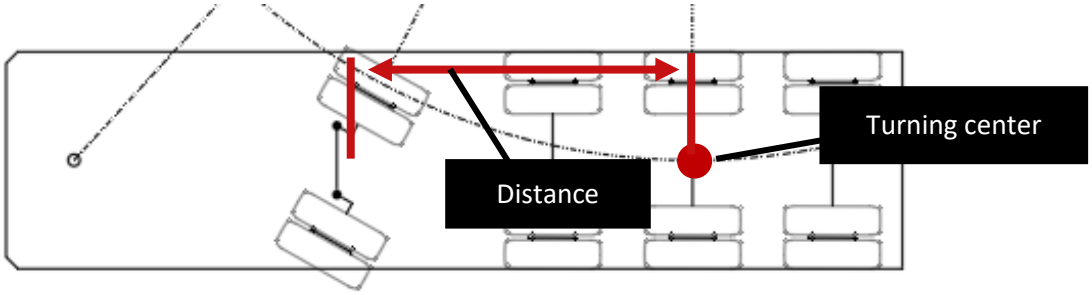
9.2 Operational Centering air bag pressure issues

The centering axle air bag must be set to 32 psi.

- If the pressure is Too low, adverse shimmy and vibration can occur
- If the pressure is too high, the axle will be difficult to steer or not steer

9.3 Legal Angle of cut requirements given diameter of turn

The is a minimum amount of turning degree (wheel cut) given the distance from the turning circle.



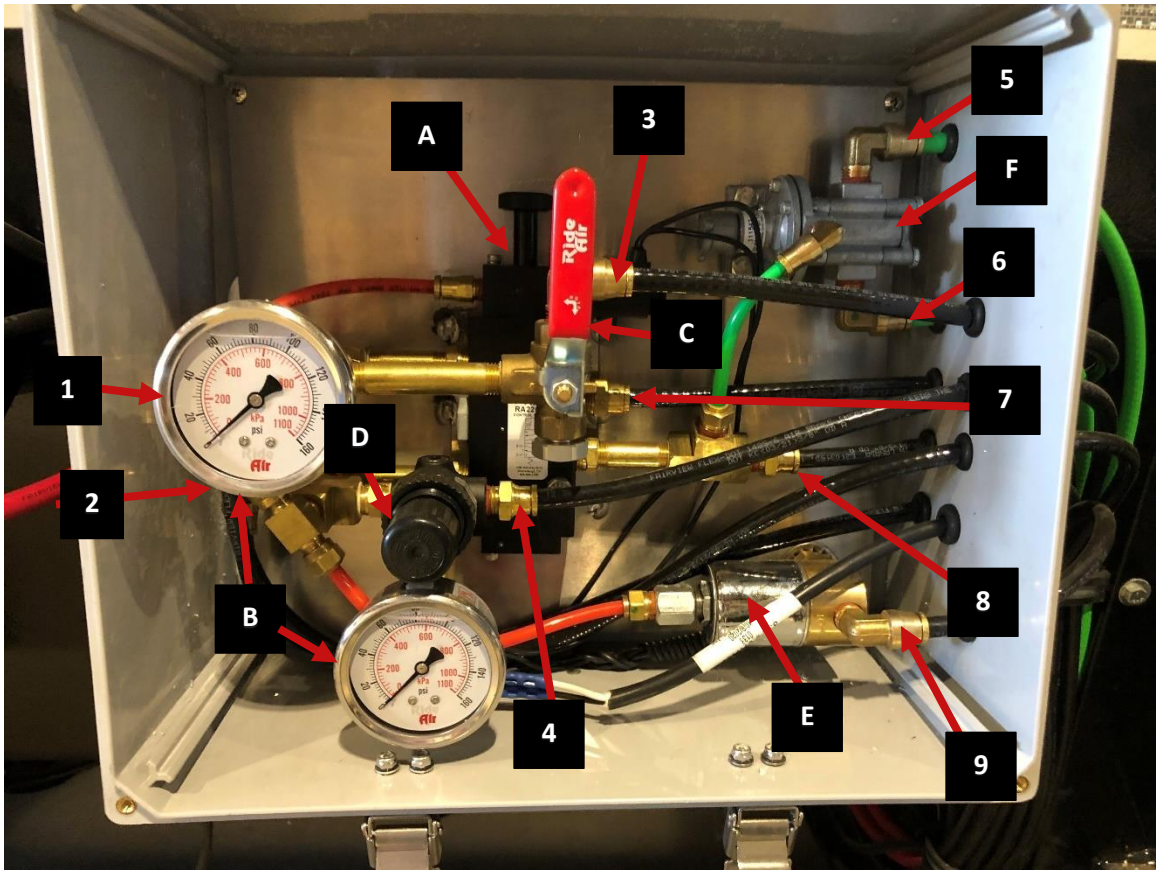
The following table outlines the minimum requirements:

Distance from Turn Centre to Self-steering Axle	Wheel Cut
4.65 metres or less	20°
More than 4.65 metres and less than or equal to 5.85 metres	25°
More than 5.85 metres and less than or equal to 7.10 metres	28°
More than 7.10 metres	30°

10 Control Box

10.1 Component details

The control box for the air lift control is outlined below.



ID	Control Line Descriptions
1	Fixed Axle Suspension Supply – Line out
2	Air Tank Supply Line in
3	Height Control Supply Line In
4	Steering Axle Bag Supply
5	Lift Axle Service Brake Line in
6	Lift Axle Service Brake Line Out
7	Lift Axle Ride Bag Supply
8	Lift Axle Lift Bag Supply
9	Steer Axle Lock Supply

ID	Part Number	Description	Function
A	AIRVAL0120	5 port spring return solenoid valve	Switch between lift and lower
B	AIRGAU0001	Pressure Gauge 2-1/2"	Displays pressure
C	AIRVAL0119	3-way Ball Valve	Dumps air ride
D	AIRVAL0011	Regulator	Air bag centering pressure
E	AIRVAL0073	Solenoid	Steering lock
F	AIRVAL0039	Pilot Valve	Blocks the braking signal to the brake valve

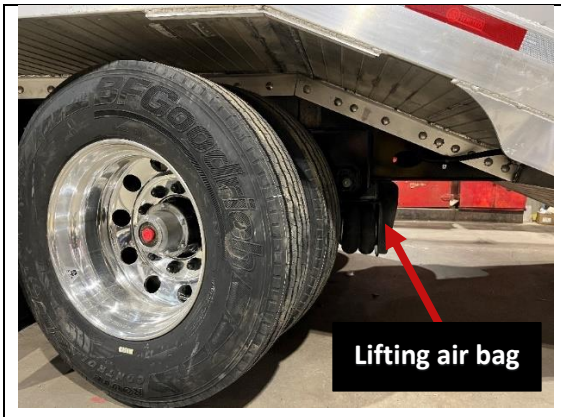
10.2 System Operation

The following operations can be performed with the system:

- To fill the suspension, rotate the handle (C) to the right
- To perform a suspension dump, rotate the handle down
- To move the lift axle down, pull up the manual control knob (A) and the steer / lift ride bags will fill to the system pressure
- To move the lift axle up, supply 12-volt DC power to the solenoid (the manual control knob must be up) OR manually push the control knob down, twist to lock

11 Lifting Mechanisms

There are two lifting mechanisms in use, the Under Beam Lift (UBL) and the CL-12 lifting mechanism which are detailed below.

	
The UBL lifting mechanism requires regulation to 80 psi.	The CL-12 lifting mechanism does not require regulation

12 Alignment Procedure

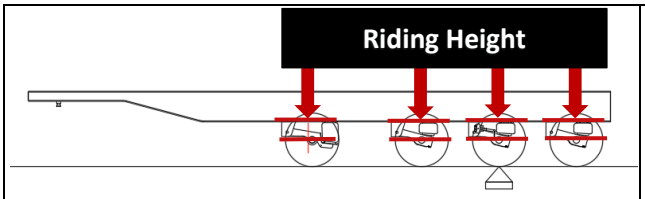
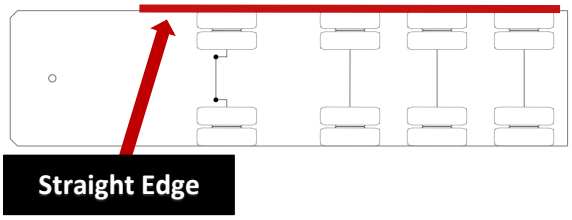
12.1 Setup

The following steps should be verified before the alignment is started:

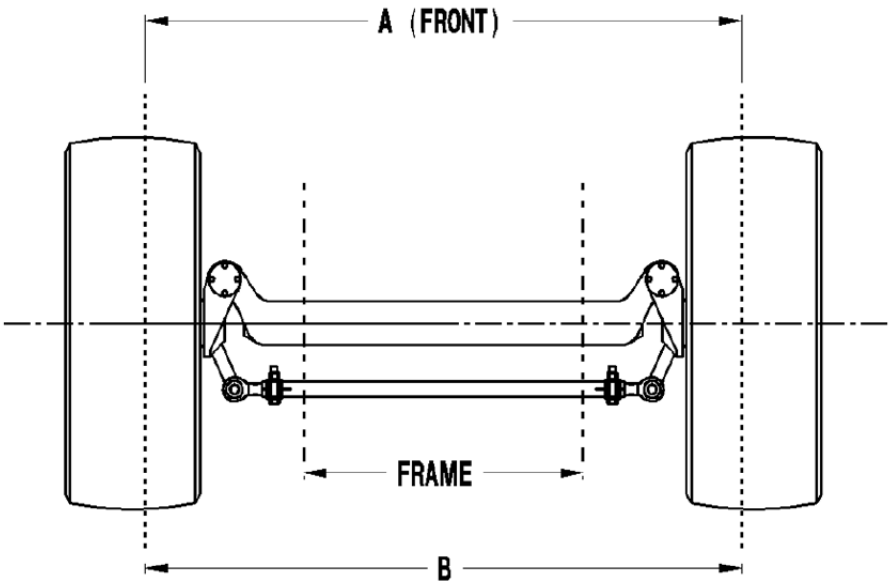
1. Tires must be of the same size, pressure, and tread pattern.
2. The hubs, drums and brakes must be identical.
3. All suspension bushings and parts must be in good mechanical order and correctly adjusted.
4. Ensure centering bag is set at 32 psi.
5. Ensure the trailer is unloaded as this affects the toe dimensions on the caster steer axle

12.2 Axle alignment

The alignment technique presented may seem simplistic and low tech, but it has been proven to give the best performance. Earlier trials of laser alignment have not yielded a satisfactory result. The technique detailed below has given the best tire longevity and road performance.

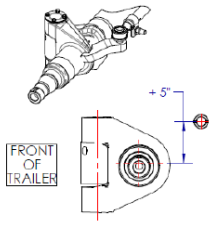
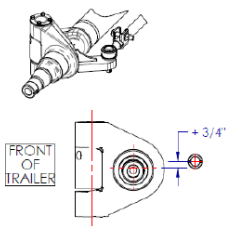
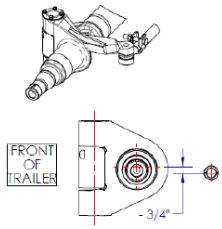
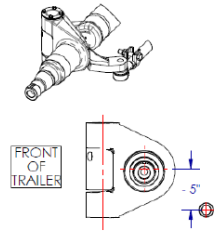
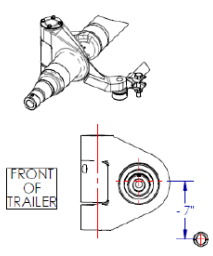
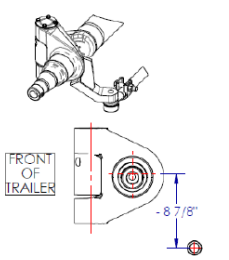
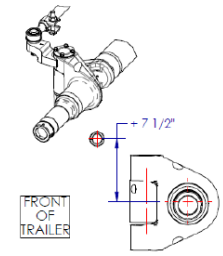
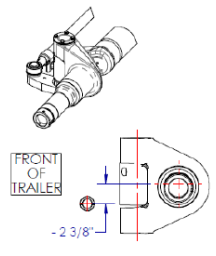
	
Set the suspension at its correct riding height. Tolerance: ±3/16” or ±3mm.	Place a straight edge halfway up the tires on one side. Adjust the tie rod tubes until all the sidewalls or the tires. That will set the first side straight. Tolerance: ±1/64” or ±0.25mm. Ensure the toe in is adjusted as per the next section.

12.3 Toe-in Adjustment



6. Scribe a fine line on the tire tread all around the tire.
7. Measure between the scribed lines on tires in front and on the back, on axle center line.
    a. "A" is always measured in front, when axle/suspension is normally loaded.
    b. “B” is always measured behind the axle.
    c. TOE-IN: “A” is smaller than “B”.
    d. TOE-OUT: “A” is larger than “B”.

Pick the correct tow value from table:

			
+5" TIE-ROD HEIGHT TOE OUT: 1/4" to 5/16" TOE OUT ANGLE: 0.40°	+3/4" TIE-ROD HEIGHT TOE IN: 0" TOE IN ANGLE: 0°	- 3/4" TIE-ROD HEIGHT TOE IN: 1/8" to 3/16" TOE IN ANGLE: 0.22°	- 5" TIE-ROD HEIGHT TOE IN: 3/8" to 7/16" TOE IN ANGLE: 0.58°
			
- 7" TIE-ROD HEIGHT TOE IN: 1/2" to 9/16" TOE IN ANGLE: 0.76°	- 8 7/8" TIE-ROD HEIGHT TOE IN: 5/8" to 11/16" TOE IN ANGLE: 0.94°	+7 1/2" TIE-ROD HEIGHT TOE IN 1/2" to 9/16" TOE IN ANGLE: 0.76°	- 2 3/8" TIE-ROD HEIGHT TOE IN: 1/4" to 3/8" TOE IN ANGLE: 0.45°

FORWARD FACING TIE-ROD SSA

8. Adjust by rotating the tie-rod with axle unloaded. Tie-rod ends must be square with stud, and guide plate must be centered in u-bracket before tightening the clamps.

9. Tighten all the clamp bolts and the tie-rod end nuts to 150/200 ft-lbs. of torque.
10. Check toe-in after each adjustment until the axle is within specification.
11. When setting up on a LOADED trailer, all axles should have a Toe-IN setting of +1/16”, -0”.
12. It is recommended to verify your toe setting with a loaded trailer when possible.

12.4 When to check toe settings

- Before releasing all new installations
- Whenever the vehicle experiences unusual vibration or when the axle is unstable
- When tires experience unusual edge wear
- Each time new tires are installed
- Each time the tractor steering is aligned
- Each time repairs are done to the axle