



Passive Steering Axle Set Up

Updated: November 2023
80273 Rev B

Passive Steering System

Introduction

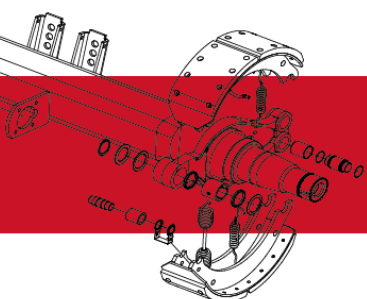
Granning Axles and Suspensions stock steer axles which can be integrated into a controlled steering system. Controlled steering systems are mainly used on agricultural vehicles with large wider tyres. Two hydraulic rams are mounted to each passive steer axle and are controlled by a hydraulic (drive) drawbar ram connected to the tractor and fixed to the trailer. The degree of axle steer angle is controlled by the amount of travel in the drawbar ram. The max steer angle degree can also be limited by the individual steer angle limiting bolts.

The main advantages Passive-steer axles have over Self-steer axles are outlined below:

- Passive-steer axles can turn when travelling forwards and also in reverse. Whereas, self-steer axles must be locked when reversing.
- The degree of steer angle in the steer axle(s) is proportionally controlled by the angle between tractor and trailer drawbar. Self-steer axles are freely allowed to steer and may engage in any furrows or unevenness in the terrain.
- There are 100 series (420x180 brake) and 300 series (310x190 brake) options available.

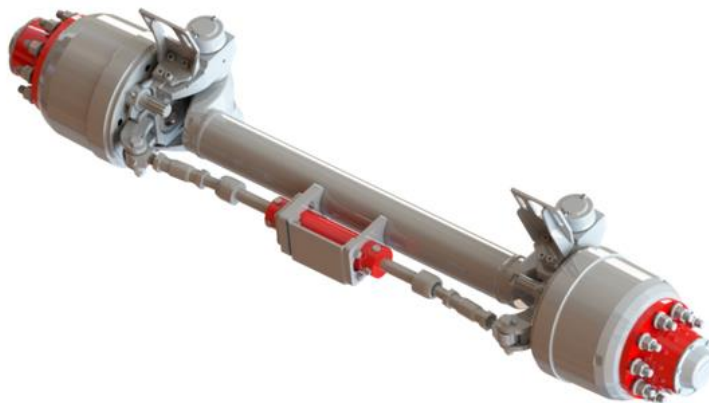


100 Series 420x180 Double Ram

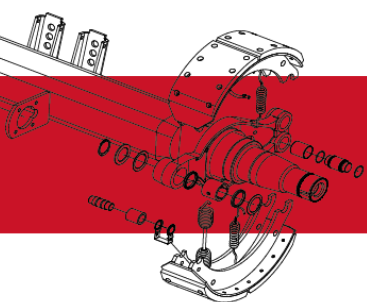




100 Series 420x180 Dual Ram



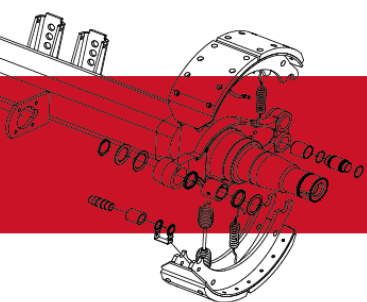
300 Series 310x190 Dual Ram



Hydraulic System Piping Diagram

There are two hydraulic systems available for customers.

1. Tandem Axle Trailers which include a single passive steering axle and one fixed. Figure 1 shows the hydraulic piping diagram.
2. Tri-Axle Trailers which include two passive steering axles and one fixed centre mounted axle. Figure 2 shows the hydraulic piping diagram.



TANDEM SETUP: FIXED + PASSIVE STEER AXLE

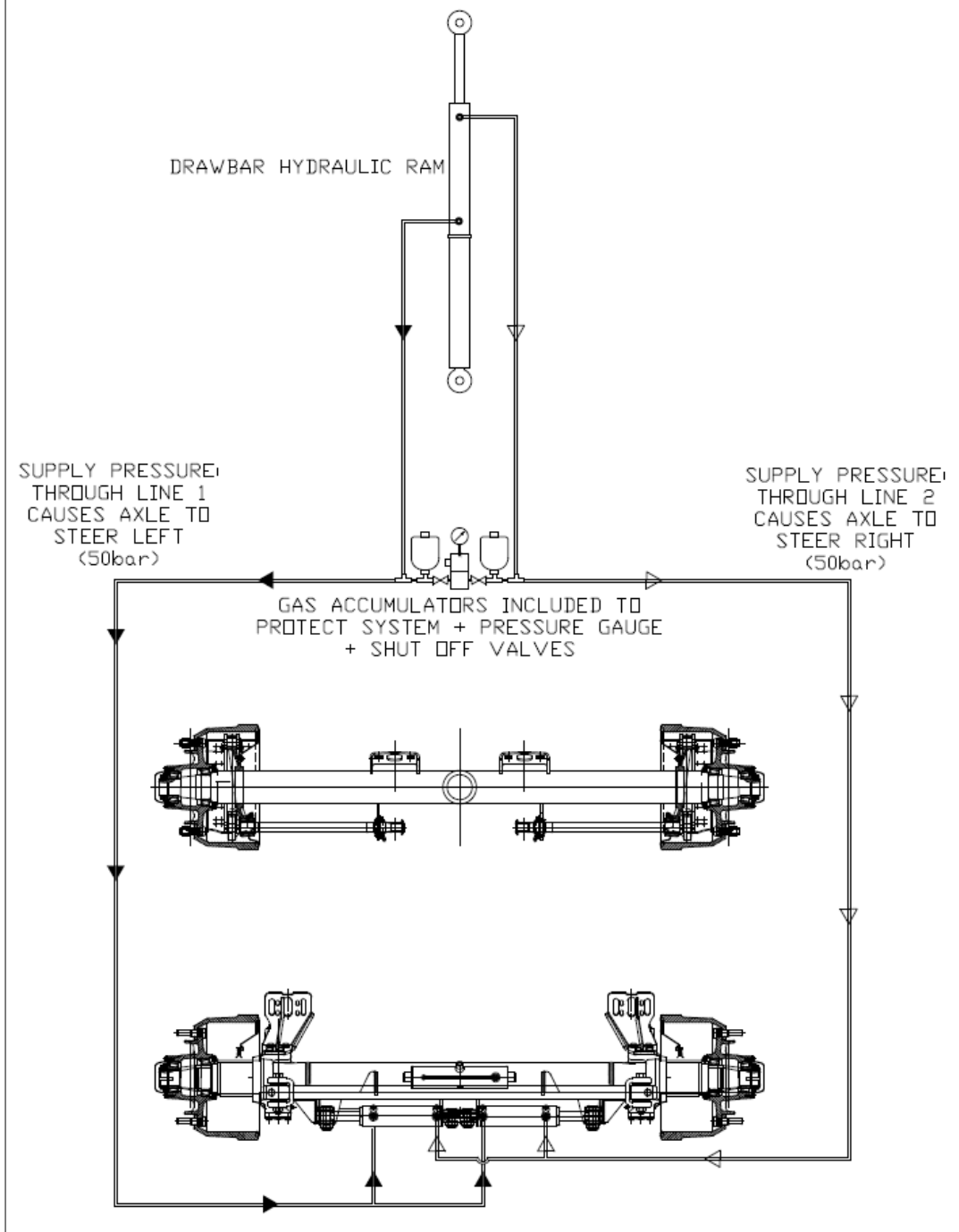
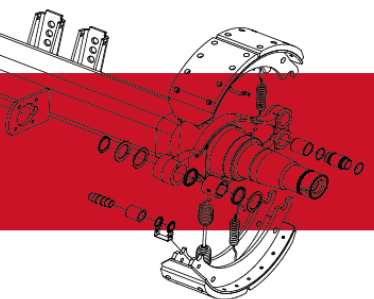


Figure 1. Tandem Hydraulic Piping Diagram



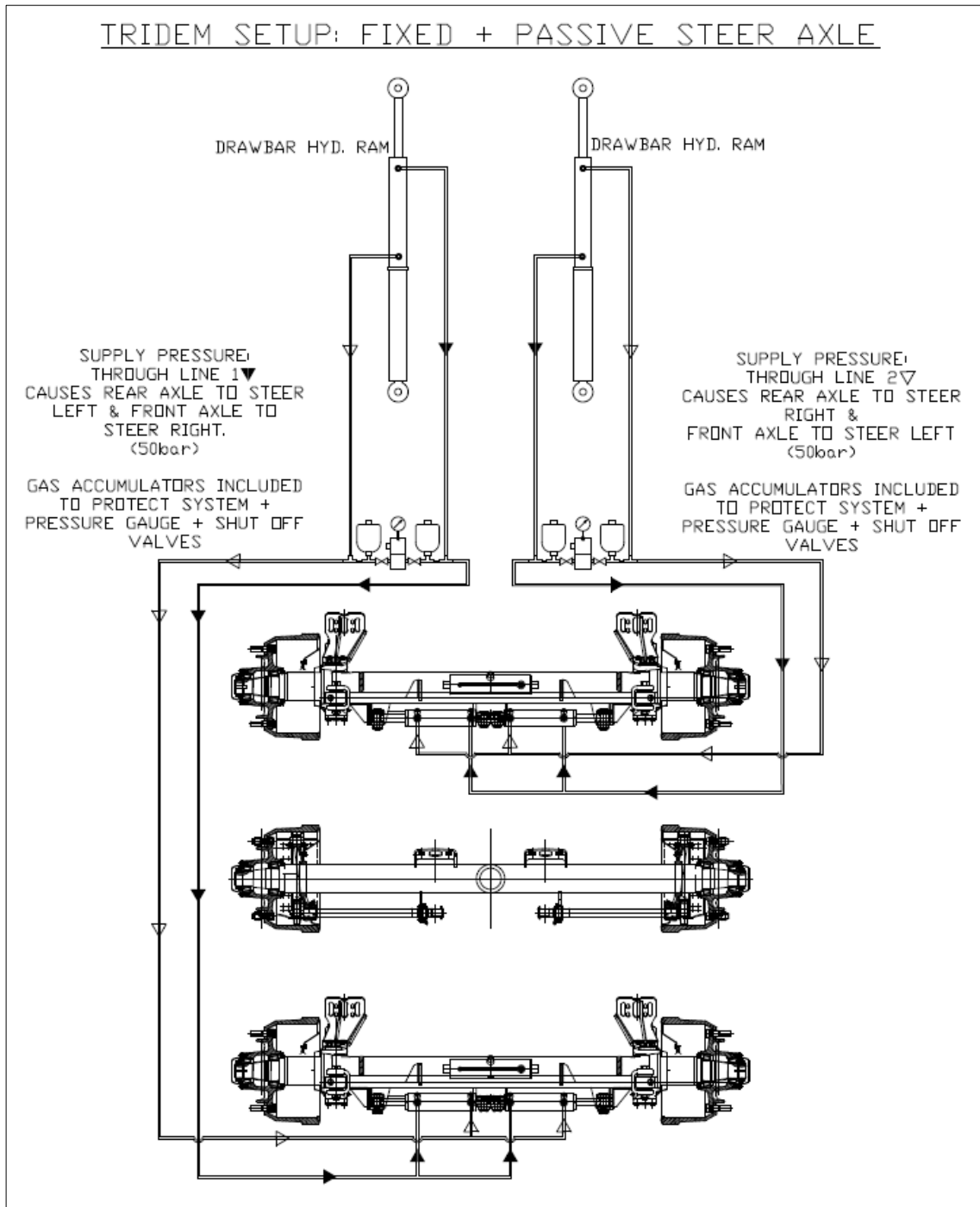
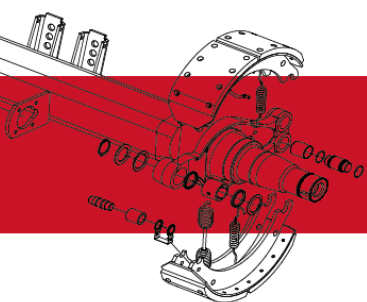
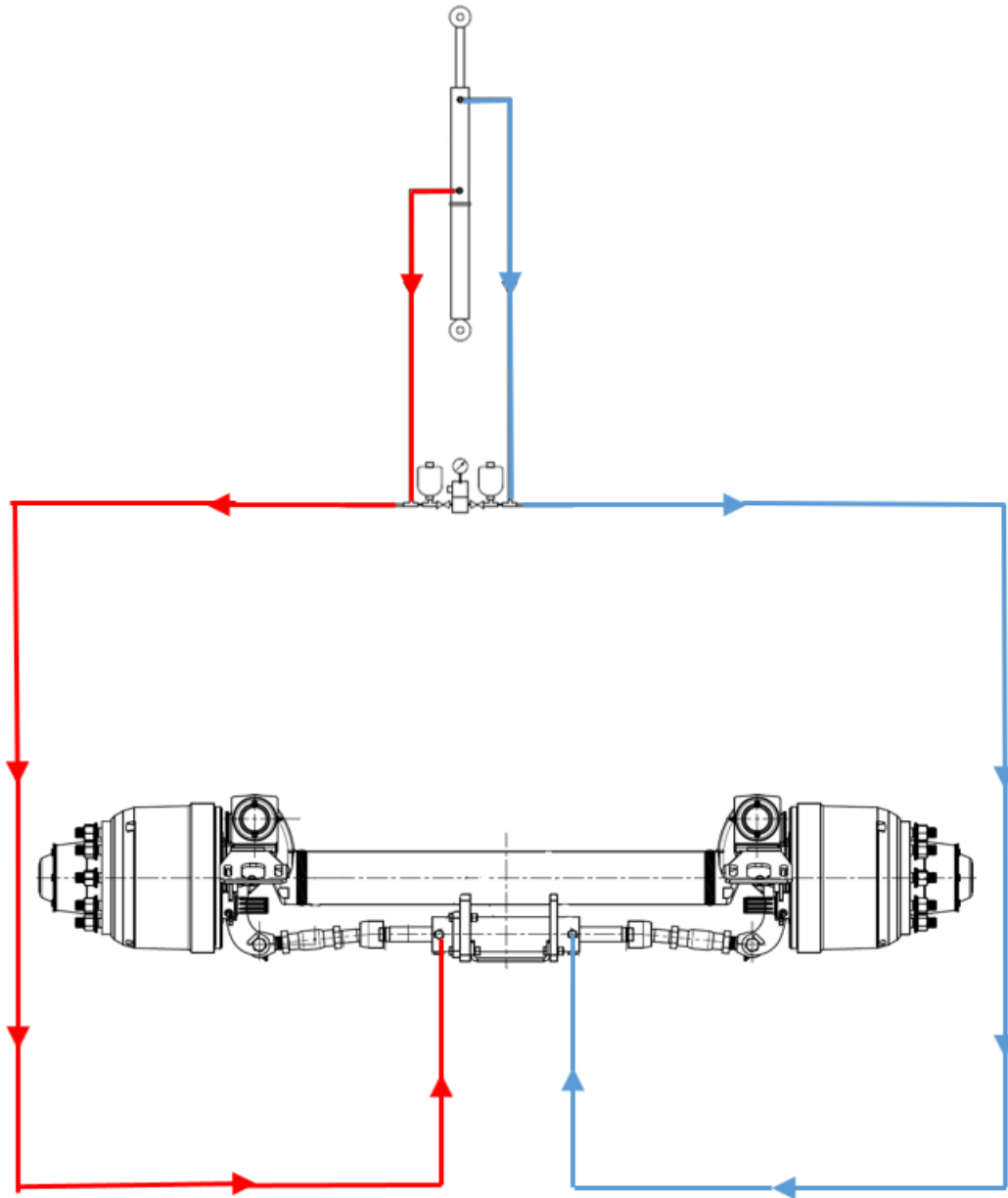
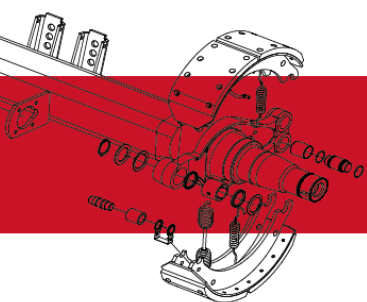


Figure 2. Tri-Axle Hydraulic Piping Diagram





Dual ram piping is nearly identical to the double ram piping except there is only one left and right port on each steer axle to connect to.

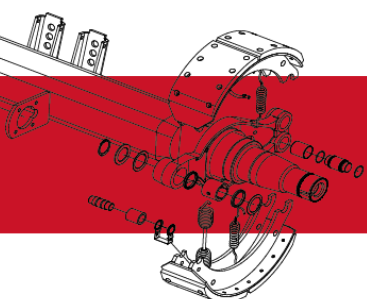


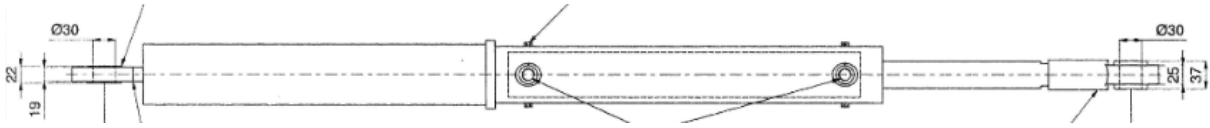
Passive Steer System Components:

1. **Drawbar Hydraulic Ram** – The drive cylinder is mounted to the trailer drawbar and is joined near the tow hook on the tractor. The drawbar ram should be mounted below the drawbar for clearance during headland turns. If mounted on the sides of the drawbar ensure there is no contact between the drawbar ram and drawbar and between the tyres and drawbar during a headland turn. Install drawbar ram guards for increased protection.

Examples shown below.

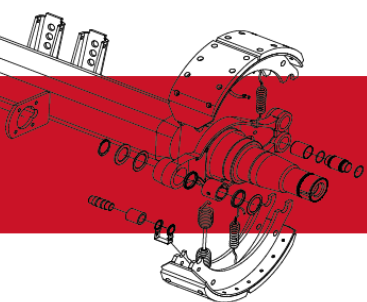
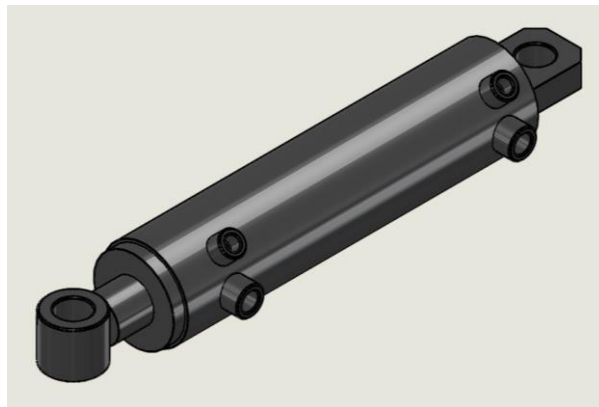
- Rod Diameter = 35mm
- Bore Diameter = 60mm
- Swivel Ball Joint Pin Diameter = 30mm
- Minimum eye-to-eye dimension = 1137mm
- Maximum eye-to-eye dimension = 1537mm
- Fitting = 3/8" BSP

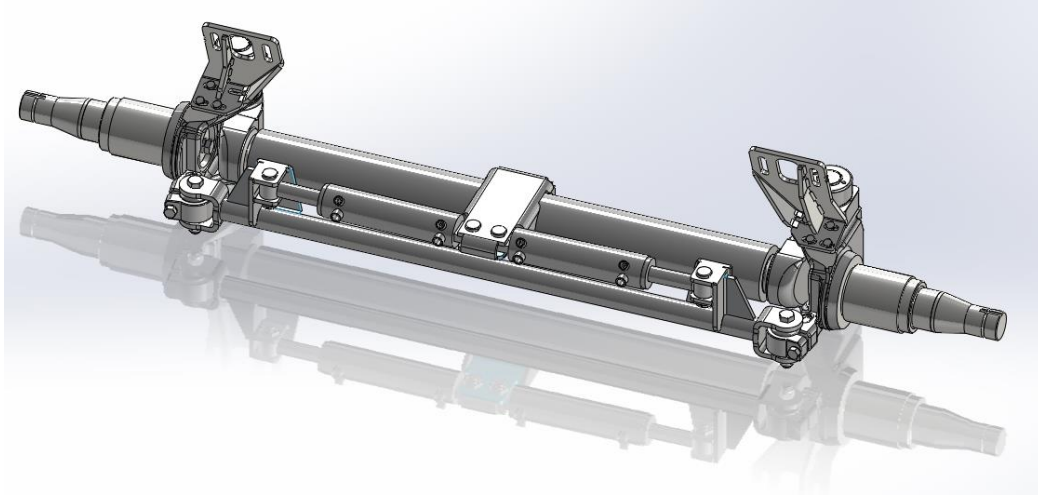




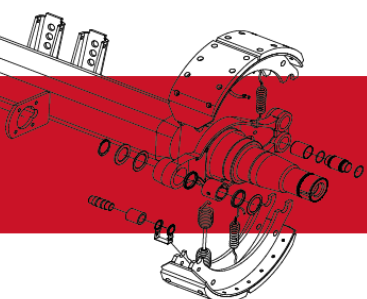
2. Axle Steering Hydraulic Rams – Two smaller rams are fitted to each steer axle and fastened to the steer axle track rod.

- Rod Diameter = 35mm
- Bore Diameter = 60mm
- Minimum eye-to-eye dimension = 380mm
- Maximum eye-to-eye dimension = 570mm
- Fittings per ram = 2 x 3/8" BSP and 2 x 1/4" BSP





3. **Hand Pump** – The hand pump is used to fill the system with oil and set the pressure within the closed system.
4. **Diaphragm Accumulators** – Each steer axle includes 2 accumulators in the system. Each accumulator acts as a safeguard within the system to absorb any accidental blows or jolts to the tyres which in turn relay them back to the hydraulic lines.



5. **Shut-Off Ball Valve** – These are used when filling and pressurising the system. They also allow for easily locating potential leaks in the system.



Passive Steer Component Assembly

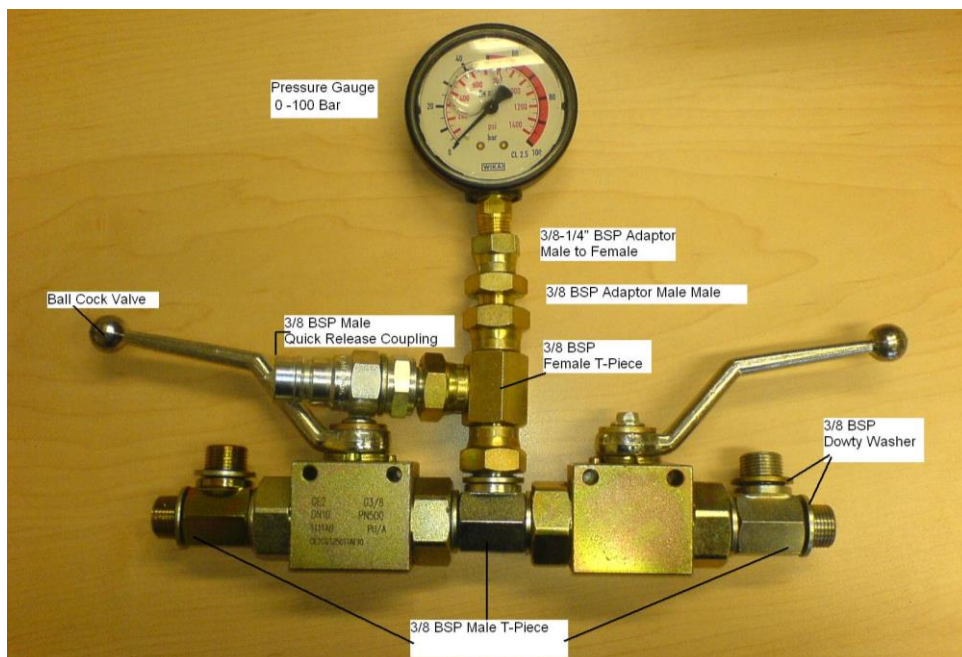
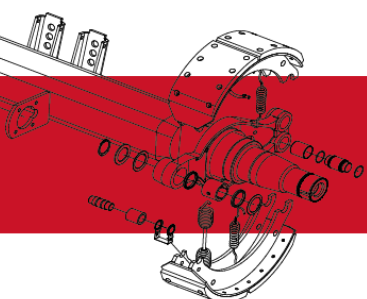


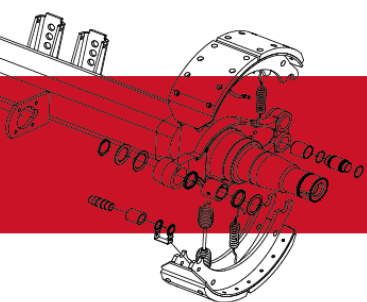
Figure 3 Setup of the Pressure Gauge and fittings supplied for the Gas Accumulators and Hydraulic hoses



- The hand pump, accumulators, and ball valves can be mounted on the trailer in any position. Ensure they comply with the system's hydraulic diagram and to the manufacturers overall dimensions and requirements.
- The steer axle(s) is typically supplied with the rams already mounted. The large drawbar hydraulic ram is supplied loose.
- The drawbar hydraulic ram is mounted to the drawbar depending on trailer manufacturer's fasteners.
- The hand pump can be mounted to the trailer and left connected via hoses to the system or can be connected to the system via the quick-attach BSP fitting supplied during filling and pressurizing the system. It can be put to one side then.



Figure 4 Example of Tri-Axle Gas Accumulator + Pressure Gauge + Hand Pump setup



Tandem Trailer

The drawbar hydraulic ram should be mounted on the Right-Hand-Side of the drawbar.

Tri-Axle Trailer

Each steer axle in the trailer requires 1 drawbar hydraulic ram to control the degree of steer angle. Preferably, the drawbar hydraulic rams should be mounted either side of the drawbar.

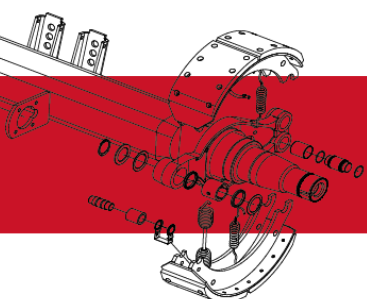
Drawbar Hydraulic Ram Mounting

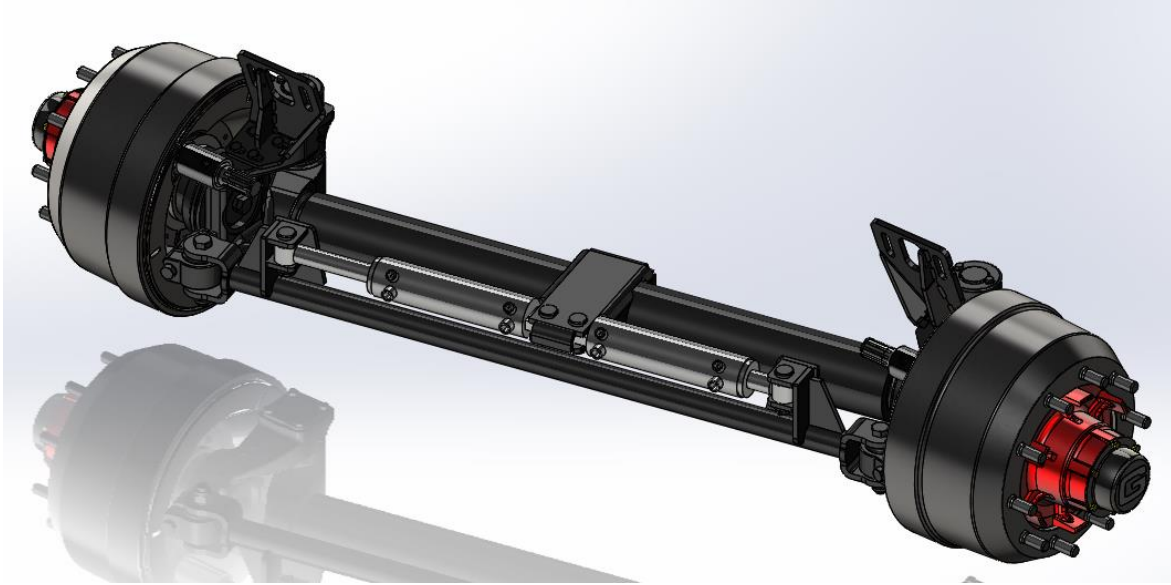
The following Instructions must be adhered to in order to correctly fasten the drawbar (drive) cylinders.

Before mounting the drawbar ram, the degree of travel should be determined in the steer axle(s):

1. Manually steer the axle to max steer angle permissible on the trailer setup with the tyres mounted.
2. Measure the steer axle ram eye-to-eye dimension on the extended ram "X". "X" – 476.5mm will give you the value required for setting the drawbar travel.

Due to the Drawbar & Steer Axle rams having the same rod and bore diameter; **2mm of travel in the Drawbar Ram** will result in **1mm of travel in EACH of the Steer Axle rams.**

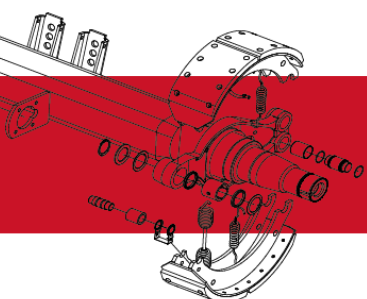


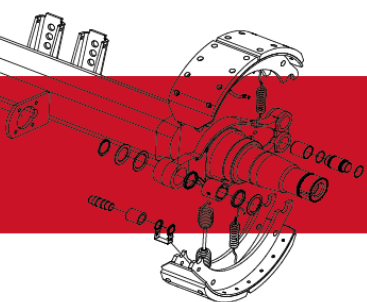
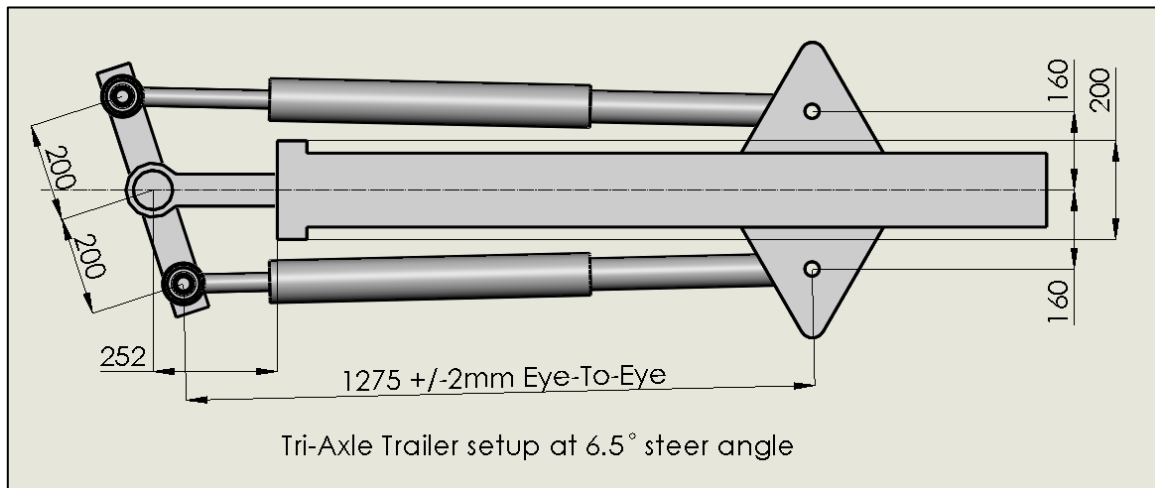
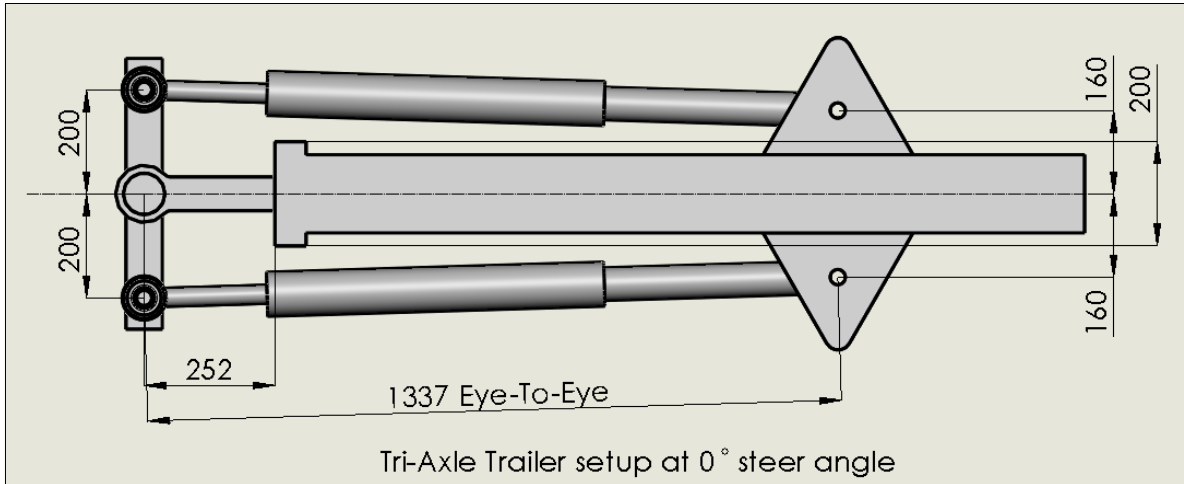


- The drawbar ram should be mounted below or above the drawbar in order to remove any potential instance of drawbar/ram or tyre/ram contact during a headland turn.
- The drawbar hydraulic ram should be at half the working length eye-to-eye (1337mm \pm 5mm) at 0° steer angle between tractor and trailer.
- The eye holes for the drawbar ram must fit the pins precisely. There should be no play between the pins and eye holes.
- Clearance checks between the hydraulic rams, drawbar and tyres at maximum steer angle between tractor and trailer should be performed prior to fully fixing the mounting brackets in place.

Example 1: Drawbar rams mounted on the side of drawbar

Shown below is an example with the drawbar ram(s) mounted on the side of the drawbar. The steer axles are capable of max 13° steer angle.





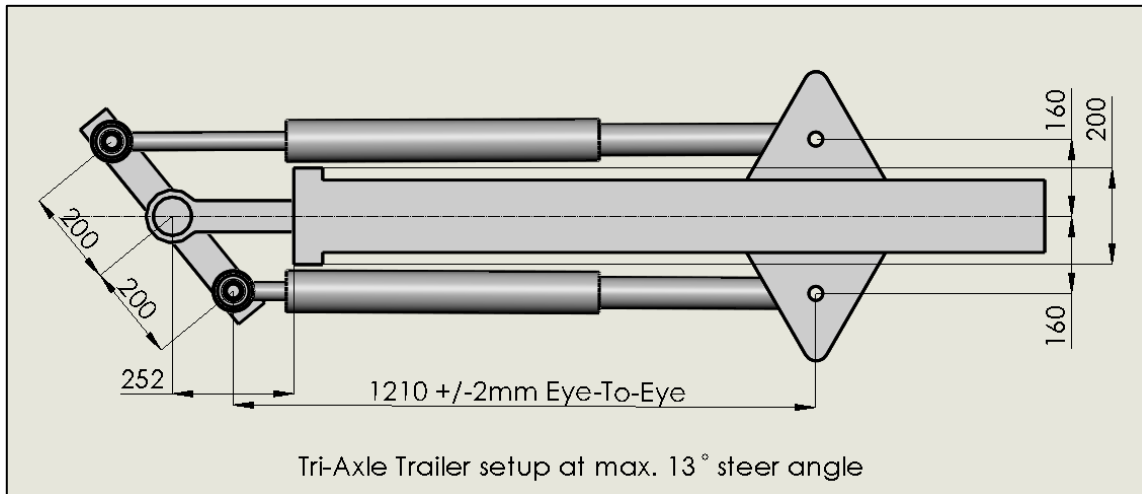


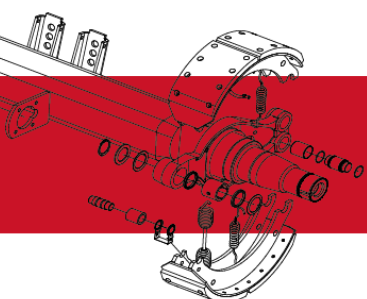
Figure 5 Plan View of an example drawbar setup at 0, half, and max steer angles.

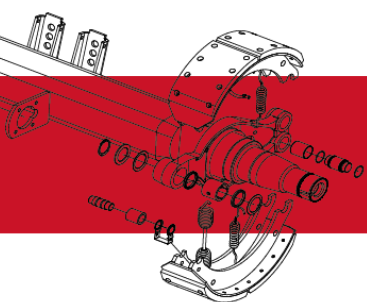
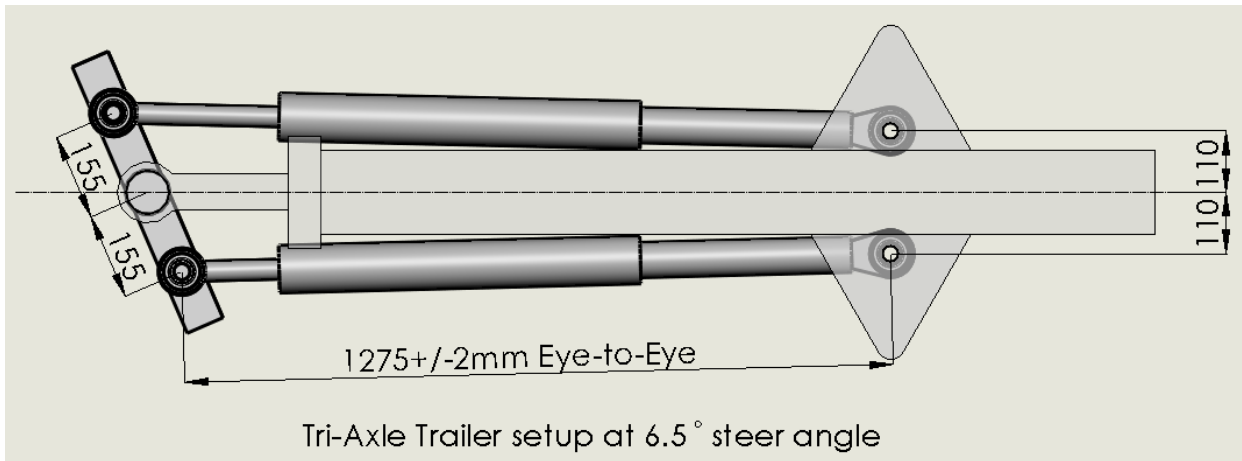
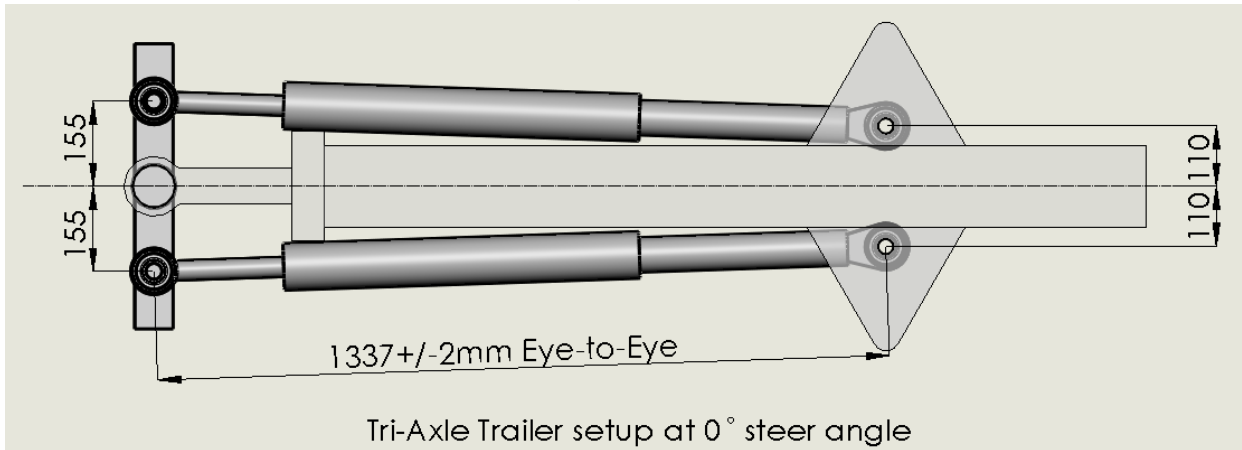
Steer Axle(s) in this example are able to turn max 13°.

Disclaimer: The diagrams above in Fig. 5 are only an example of drawbar ram(s) setup. The individual trailer manufacturer is to ensure clearance checks and drawbar ram travel are performed prior to signing off on a trailer build.

Example 2: Drawbar rams mounted above or below the drawbar

Shown below is another example with the drawbar ram(s) mounted either above or below of the drawbar. The drawbar rams are able to travel without any possible instance of drawbar contact. The steer axles are capable of max 13° steer angle.





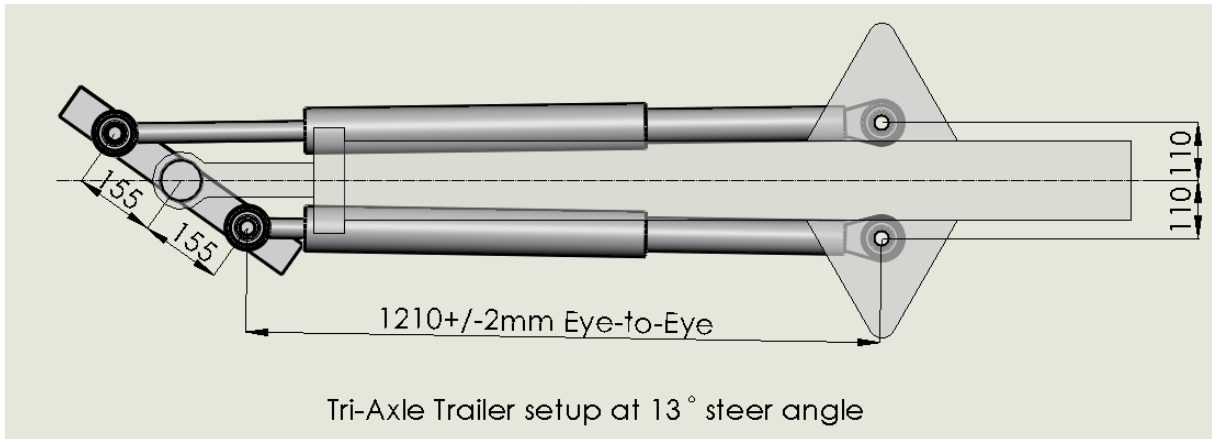
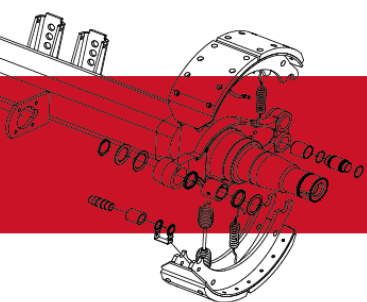


Figure 6 Plan View of an example drawbar setup at 0, half, and max steer angles.

Steer Axle(s) in this example are able to turn max 13°.



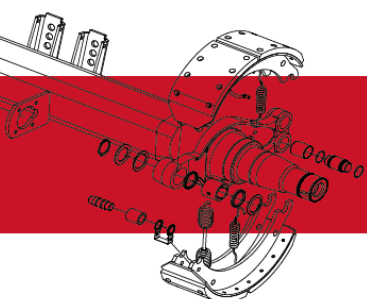
Filling and Pressurizing the system

After assembling the various components and connecting up the hoses the system needs to be filled with hydraulic oil. Hydraulic oil ISO 46 can be used to fill the system.



Figure 7 Connecting point for the hand pump + Shut-off valves

1. Align the tractor and trailer so that the steer axles are at 0° steer angle and that both drawbar rams have the same eye-to-eye measurement. Both eye-to-eye dimensions on the steer axle rams should be measured to ensure the axle is at 0° steer angle.
2. Connect the hand pump to the system via the quick attach BSP fitting.
3. Open the shut-off valves in the system and slightly loosen the blank ports/bleed valves (not supplied) on the hydraulic cylinders.
4. Pump the hydraulic oil into the system using the hand pump until it starts to come out around the blanks/bleed ports.
5. Retighten the bleed valves/blank ports.

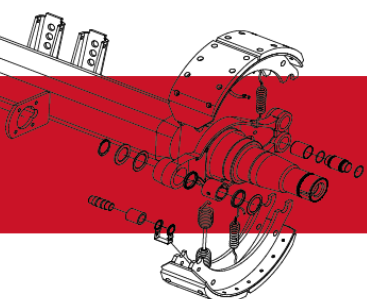


6. Pump up the pressure in the system to 10bar and bleed the lines again to remove any remaining air pockets. Retighten them again.
7. Pump up the oil in the lines to operating pressure of 50bar.
8. Walk around the trailer and inspect for any leaks in the system. Ensure the pressure in remains constant at 50bar.
9. Close the shut-off valves and disconnect the hand pump.

NOTE: When both shut-off valves are closed the pressure gauge is only showing the pressure in the small tee fitting between the two shut-off valves and pressure gauge. This is not indicative of the working hydraulic oil pressure in the system.

NOTE: If the quick attach fitting is used, the pressure gauge should constantly read 50bar unless the pressure has been allowed return to the hand pump prior to being disconnected.

NOTE: If the hand pump is still connected to the system as per the setup in figure 4, the pressure gauge may read a lower value over time. With the shut-off valves closed, the pressure gauge is only reading the pressure in the line coming from the hand pump. The oil may leak back into the hand pump tank over time thus giving a lower reading than 50bar. If the vehicle operator is unaware of system operation, he/she may incorrectly read this as a leak in the system. It is advised to disconnect the hand pump from the system entirely.

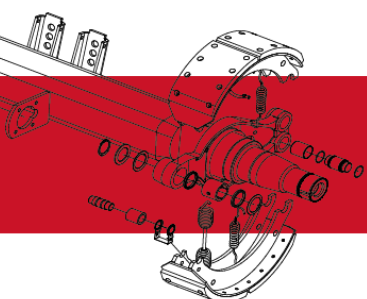


Purging the system

Purging the system is similar to pressuring the system. The only difference being that in Step 3, one shut-off valve on the Connecting Point in Fig. 8 below should be open and the other closed when expelling air from the system. This will expel any air trapped in lines of the system. Once oil starts to come out of the bleed ports on the rams, tighten them up again and increase the hydraulic pressure to working pressure of 50bar. Close the “open” shut-off valve and then open the “closed” shut-off valve to purge the other side of the passive steer system. Once all the air has been purged from the system, close all bleed ports and increase the pressure to 50bar. Close the open shut-off valve so both taps are now closed. Disconnect the manual pump from the quick-attach fitting.



Figure 8 Connecting Point setup on a Tandem axle trailer with one passive steer axle



Operating Test

Once the system has been pressurised, a practical test with a tractor should be carried out:

1. Perform a headland turn with the tractor and trailer in both directions.
2. At max steer angle between the tractor and trailer, check that the drawbar rams are not in contact with the any part of the tractor or drawbar.
3. Check that the tyres are not touching the chassis. Adjust the steer angle limiting bolts if required and tack weld to fix them in place.
4. Measure the eye-to-eye measurement on each of the drawbar rams at headland turn. Ensure that the rams have not exceeded the min and max eye-to-eye measurements.
5. Finally, check that the wheels are parallel when the tractor and trailer are aligned.

The pressure in the hydraulic lines should be check regularly to ensure optimum operating efficiency of the trailer.

