Australia & New Zealand Regions Only

TECHNICAL BULLETIN

LIFT AXLE CONTROL VALVE INSTALLATION & CALIBRATION

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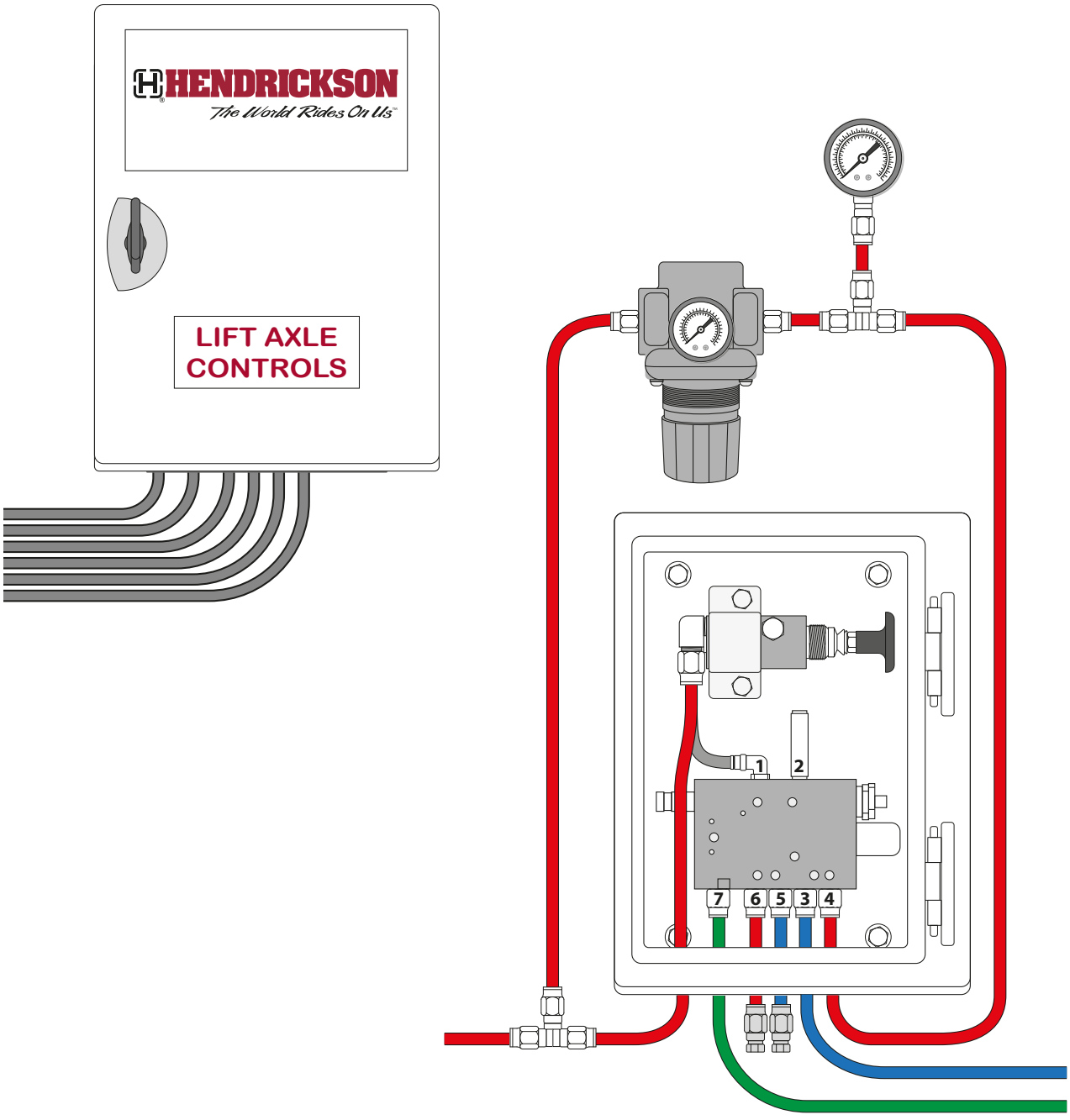

HENDRICKSON
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Document Interactivity

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INTRODUCTION

The maximum load an axle can carry is defined by legislation that varies between locality, state and country. The main reason behind this maximum axle load is to prevent damage to roadways. Lift axles enable vehicles to carry greater loads by sharing the load across more axles and can be lifted off the road when not required. Lifting an axle that is no longer required has several benefits such, as improved fuel consumption, reduced tyre wear and reduced road surface wear.

Almost all Hendrickson lift axle control valves are Auto/Auto in operation. This means that it will lift and lower automatically, without any need for the driver to intervene. This bulletin details operation, connection and troubleshooting of Auto/Auto valves. An optional Manual/Auto valve, which requires the driver to manually raise the axle after unloading, is not detailed in this document but uses similar principles of operation and adjustment.

Auto/Auto lift axle control valves include an override valve that allows the driver or vehicle technician to lower the axle whenever necessary. Lowering the axle ensures that it does not move whilst any work is being carried out, which could cause damage or even injure someone. The instructions included in this technical bulletin are for the Hendrickson supplied Auto/Auto valve. Follow the component manufacturer's instructions if the axle is fitted with any other make LACV.

Australian Design Rule 43/04 (2006) states that the `prescribed transition mass' for dual tyre axles going from two to three axles is 13 tonnes. This requirement must be complied with and therefore should not be set higher. Incorrect Lift Axle Control Valve settings may prevent proper lift axle operation and render the vehicle non-compliant.

NOTICE: Diagrams used in this bulletin are representational only. Actual product may vary depending on truck/trailer options and specifications.

OLDER DOCUMENTS

This bulletin replaces other older LACV installation and calibration documents, including 49441-167.

IMPORTANT SAFETY NOTICES

Proper maintenance, service and repair is important for the reliable operation of the suspension.

All safety-related information should be read carefully to help prevent personal injury and to assure that appropriate methods are used. Improper servicing may damage the vehicle, cause personal injury, render it unsafe for operation, or void manufacturer's warranty.

Failure to follow the safety precautions in this manual can result in personal injury and / or property damage. Carefully read and understand all safety related information within this publication, on all decals and in all such materials provided by the vehicle manufacturer before conducting any maintenance, service or repair.

SAFETY PRECAUTIONS

⚠ **WARNING**: Lift Axle Rapid Movement

Lift axle rapid movement can cause severe personal injury or death. The lift axle is operated by an automatic lift axle control system and may cause the axle to automatically lift or lower under different conditions.

Read, understand, and comply with all applicable operating instructions and safety information provided by the vehicle manufacturer. Ensure all personnel are clear of the lift axle before and during vehicle loading and lift axle activation up or down.

⚠ **WARNING**: Air Springs

Prior to and during deflation and inflation of the air suspension system, ensure that all personnel and equipment are clear from under the vehicle and around the service area, failure to do so can cause severe personal injury, death or property damage.

Exhaust all pressure in lift axle air springs and vehicle air system before working on or around lift axle. Failure to do so can cause severe personal injury or death.

⚠ **WARNING**: Improper Jacking Method

Improper jacking method can cause structural damage and result in adverse vehicle handling, severe personal injury or death. Refer to vehicle manufacturer for proper jacking instructions.

⚠ **WARNING**: Personnel Protective Equipment

Always wear proper eye protection and other required personal protective equipment to help prevent personal injury when you perform vehicle maintenance or repair.

LIFT AXLE CONTROL VALVES

Lift axle control valves (LACV) allow for one or more axles to be lifted to reduce fuel costs and tyre wear, as well as wear and tear of roadways.

Several different lift axle control systems are available. Operationally there are Manual/Auto or Auto/Auto systems that can be controlled electronically by the EBS system or mechanically by adjustable pressure valves within the LACV unit. The Auto/Auto LACV is primarily discussed in this document because it is the most common valve now fitted.

All lift axle control valves have a manual function that overrides LACV operation and drops the axle permanently. This prevents the axle from raising or lowering at times when it could be unsuitable or dangerous (such as during service).

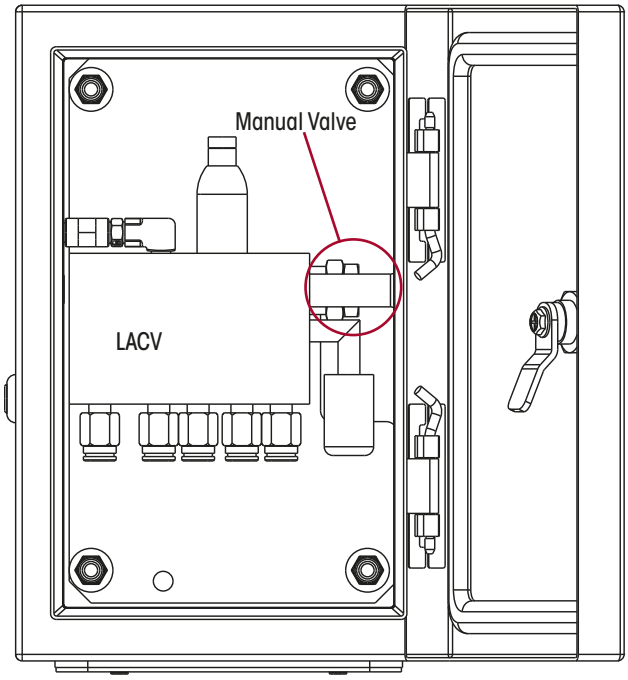


Figure 1: Manual/Auto Lift Axle Control Valve

- **Manual/Auto**: These systems rely on the driver to raise the lift axle when no longer needed. The axle will drop automatically when axle load reaches the set mass. The manual valve is integrated into the LACV. Refer Figure 1.

  Use and operation of these valves is not discussed in detail in this bulletin. However, it similar to the operation of the Auto/Auto valve. Valve calibration only involves setting axle drop pressure, which is the same as for Auto/Auto but without a need to set raise pressure.

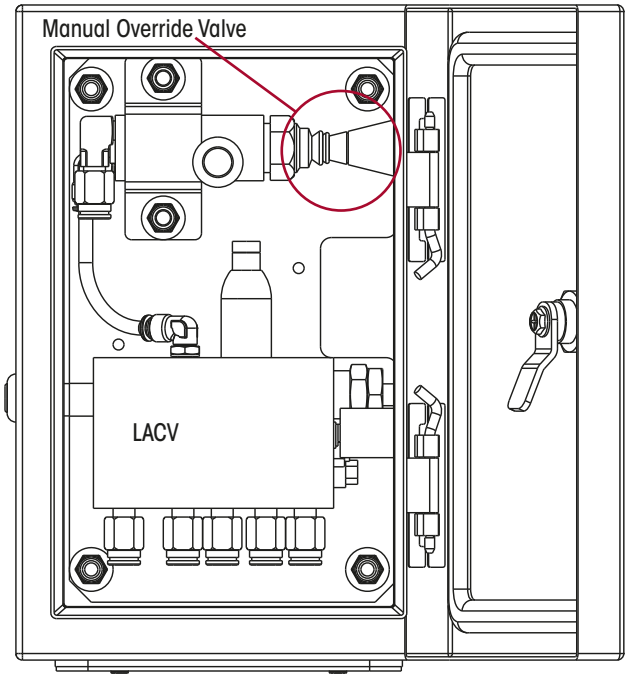


Figure 2: Auto/Auto Lift Axle Control Valve

- **Auto/Auto**: These systems will raise and lower the axle automatically depending on load. These systems have a manual override valve, which is separate from the LACV. Refer Figure 2.

Air suspension systems should have their own dedicated air tank to ensure sufficient pressure is available for all operations, particularly when raising a suspension that has been dumped. A pressure protection valve, set to between 4.5 and 5.8 bar (65 and 84 psi), must be fitted between the brake and suspension systems. This valve ensures there is sufficient pressure available to the braking system if there is a major air pressure leak in the suspension system. Refer to Figure 9 on page 7 and "Trailer Air Supply" on page 8. for more details.

The pressure in an air suspension is directly proportional to the load carried. Suspension design, air spring bellows operational diameter and positioning all influence the pressure and load relationship. However, once those factors are known it is possible to determine load from air spring pressure. This allows for relatively accurate operation of the lift axle drop and raise function.

All lift axles systems need to be programmed or calibrated for the application, whether they are electronically or mechanically controlled.

NOTICE: The axle lift air springs should be protected by a pressure regulator to prevent over-pressuring, which may cause severe damage. Hendrickson LACV kits are supplied with over-pressure regulators that are set to 5.5 bar (80 psi).

AUTO/AUTO OPERATION

The Hendrickson Auto/Auto valves are completely automatic in function and do not require intervention by drivers in normal operation.

If the axle is fitted with an LACV, which is not a Hendrickson Auto/Auto valve, then refer to the component manufacturer's instructions.

In certain situations, such as when changing a wheel or during vehicle maintenance, the lift axle must be dropped by operating the manual override valve located in the control box. This will ensure to axle does not move, which may cause component damage or even injury.

Audible Warning

An audible warning will be heard from the lift axle control box during automatic lowering of the axle.

ENCLOSURE

ADR 42-05 mandates that lift axle controls must be secured, either by using a lockable control or by placing them within a lockable enclosure. Use of a sealable enclosure is also important to protect valves from contaminants, water and dust, which can quickly damage an LACV. If fitted, a yellow plastic cap over the lift pressure adjustment also serves as a protection and must be reinstalled if removed.

MANUAL OVERRIDE

1. Chock any wheels of axles that will not be involved in repair, ensure the area around the lift axle is clear and that there is no likelihood of damage or danger to others when the axle moves.
2. With the parking brake applied, start engine and allow it to idle until the vehicle air system pressure has reached the compressor cut-out (usually 830 kPa or 120 psi).

⚠ **CAUTION**: The use of hearing protection is recommended, along with protective eyewear to prevent injury by flying debris caused by the release of compressed air.

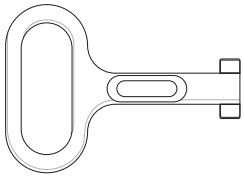


Figure 3: Enclosure Key

3. Insert enclosure key into control box cover and turn to open. Refer Figure 3.

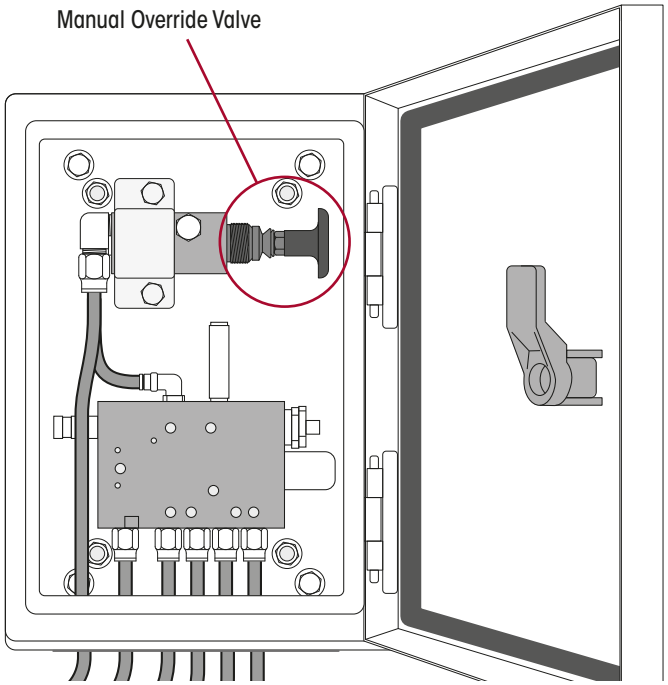


Figure 4: Manual Override Valve for Auto/Auto Lift Axle Control

4. Pull out the manual override valve, which will lower the lift axle. Refer Figure 4.

RESTORE AXLE OPERATION

Normal automatic axle operation may be restored after repairs or service is completed.

NOTE: The axle may not lift immediately when restoring operation if there is sufficient load on the axles.

1. With the parking brake applied, start engine and allow it to idle until the vehicle air system pressure has reached the compressor cut-out (usually 830 kPa or 120 psi).

⚠ **CAUTION**: The use of hearing protection is recommended, along with protective eyewear to prevent injury by flying debris caused by the release of compressed air.

2. Open control box and push in the manual override valve.
3. Close control box cover, remove key and store in a practical location.
4. Remove any chocks from the wheels.

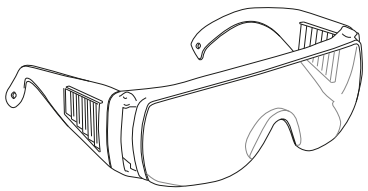


Figure 5: Wear Safety Glasses When Operating with Compressed Air

LACV INSPECTION

Lift axle control valves (LACV) rely on atmospheric air vents for correct operation of the internal valving. It is therefore vital to valve operation that the enclosures be free of water, dust and dirt. Additionally, the fine valve tolerances require an air supply that is free of any moisture, dust or other contaminants.

Inspection

LACV operation should be checked and have the components inspected at regular intervals. There are no components that require regular maintenance, lubrication, or adjustment. However, a clean dry air supply is essential to LACV operation, and so it is important that the vehicle air supply dryer is inspected and replaced at regular recommended intervals. Refer "Trailer Air Supply" on page 8.

⚠ **CAUTION**: Appropriate PPE, including safety glasses, hearing protection and gloves must be worn when working on or operating the LACV.

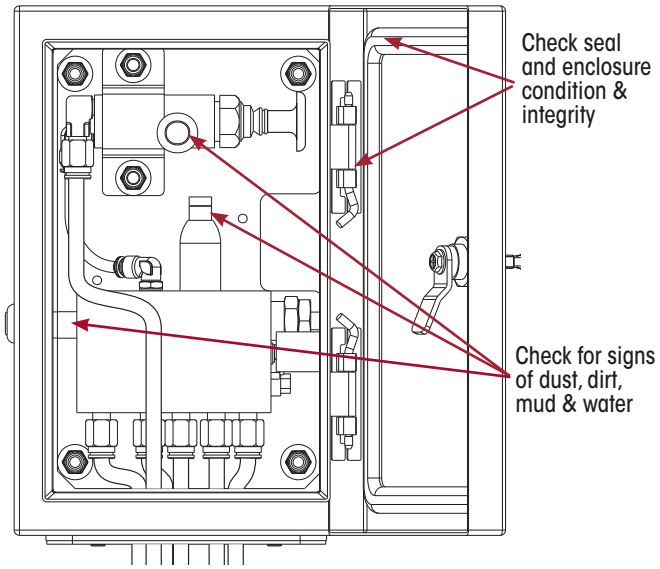


Figure 6: Inspect LACV & Enclosure

Check the following items, after ensuring the trailer is unladen, wheels chocked, connected to a suitable air supply and clear of any people or equipment that could come into contact with axle movement.

1. The lift axle should be in its raised position when the trailer is unladen.
2. Open enclosure door and pull out the manual override valve. The axle should lower.

⚠ **CAUTION**: The manual override valve must be pulled out, even if the axle is already lowered due to a fault in the LACV system, to prevent inadvertent movement during repair.

3. Check that the enclosure is clear of dirt and moisture. If necessary, vacuum or blow out dirt. Refer Figure 6.
4. Check the door seal and enclosure to ensure they are clean and in good condition.
5. Check hose connections for air leaks in both raised and lowered conditions.
6. Inspect axle lift air springs for dirt build up and condition of bellows.
7. Check lift air springs for secure mounting.
8. Check suspension mounting, connections and pivot components to ensure they are stable and in good condition.
9. Repair or replace any issues or components as necessary to return system to correct operating condition.
10. When check is complete, push in manual override, lock LACV enclosure and return to trailer to operating condition.

LACV Fault Diagnosis

NOTE: Refer also to the "LACV Troubleshooting Guide" on page 21 to assist in determining fault causes.

The most common issue faced by LACV are contamination, either from internal or external sources. So, first check for contamination before trying to recalibrate the unit. If the valves are sticking because of moisture, corrosion or dust ingress, then recalibration will simply be a waste of time. See box "Calibration Check" on page 7.

1. Check for signs of fine dust, dirt, mud or moisture build up in and around the LACV. Damage caused by contamination through the vents is irreparable. The cause of the contamination will need to be identified and rectified, and the LACV will need to be replaced.
2. Release pressure to the LACV.

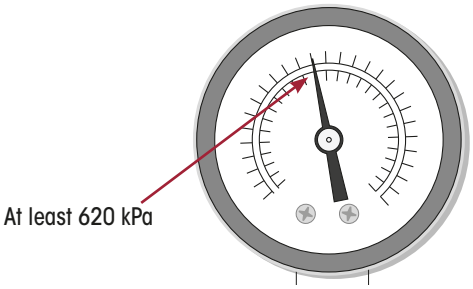


Figure 7: Test Pressure to HCV

3. Install a pressure gauge into the line going to the HCV and ensure that it is getting at least 620 kPa (90 psi). This is because air supply to the air springs is after the

brake pressure protection valve and may not always be the same as system pressure. Refer Figure 7.

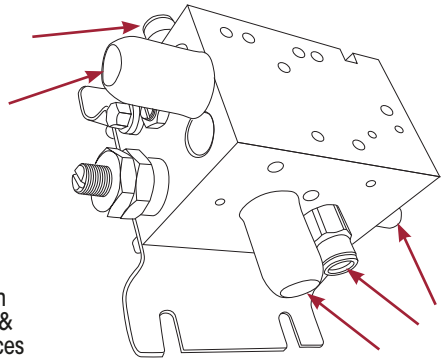


Figure 8: Check for Signs of Contamination

4. Release pressure again and remove hoses from LACV and inspect for signs of moisture, dirt, dust or sludge. Damage caused by internal contamination is irreparable. The cause of the contamination will need to be identified and rectified, and the LACV will need to be replaced. Refer Figure 8.

5. If the LACV is operating at the wrong moment, and there are no signs of contamination and the pressures are correct, then it could be that the valve needs recalibration. Determine the required pressures by referring to the trailer manufacturer or to "Air Spring Load-Pressure Charts" on page 22.

6. Attempt to carry out calibration by referring to "LACV Adjustment" on page 16. If the valve is still not operating as expected, then replace the LACV. Ensure the new unit is calibrated to suit the trailer before restoring vehicle to active service.

Calibration Check

The calibration of these lift axle control valves will not change significantly over time. If the LACV is not working as expected, then it is unlikely to be rectified by a simple adjustment. This does not mean that the calibration should never be checked. However, if checking calibration, it is vital that it is only carried out with the use of air pressure regulator and pressure gauges as shown on page 17. Simply moving the adjustment settings in the hope that it will start operating can cause two problems.

- Firstly, you will waste considerable time with little likelihood of success.
- Secondly, the axle may stay raised when the remaining axles are over their legal mass limit. This would breach road regulations and may result in the issuing of a penalty notice.

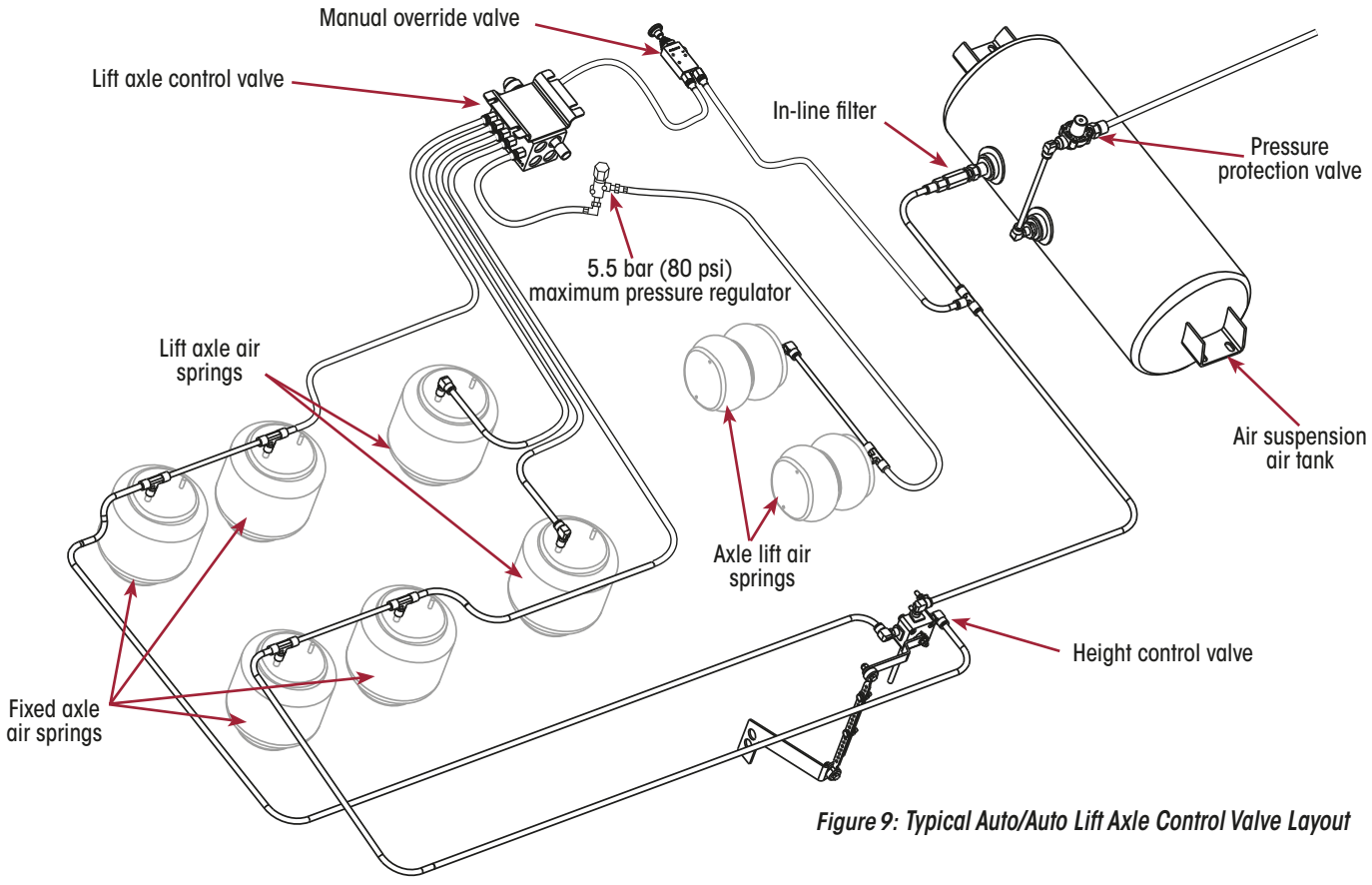


Figure 9: Typical Auto/Auto Lift Axle Control Valve Layout

TRAILER AIR SUPPLY

With extended truck service schedules and greater vehicle reliability, it becomes easy to overlook what used to be a daily chore for drivers, which is checking that the air supply is dry and without leaks.

The demand on the truck air supply has increased over the years with more axles and longer trailers. Then when you add additional functionality, such as a tyre pressure inflation system, lift axles, steer axles and supplementary equipment, that load is even greater. It becomes a challenge to provide clean, dry air at sufficient pressure through these extended circuits to enable correct operation of these various systems. Refer to Figure 9 and Figure 10.

Compressor

The compressor is the starting point for the air supply system. It needs to be able to supply sufficient air pressure and flow to ensure all systems can operate correctly. The drive belt, air filter, lubrication and air dryer cartridge all need regular checking and replacement where necessary.

Trailers having difficulties with air springs or associated systems should have the pressure checked at the rear-most point on the trailer system when it is connected to the truck and in operation. Check the pressure when the system in under load, such as when the system raising the suspension.

Often, the pressure at the truck's compressor is nowhere near the pressure reaching the last axle on the trailer. The system must be checked for air leaks, kinked or damaged air lines. If everything is in serviceable condition, a simple solution to low available pressure may be to raise to pressure setting of the compressor. However, that is not always possible, especially on an older truck and even then, it may not overcome insufficient air volume capacity from older air pumps. In these cases, a new air compressor with higher flow rate and/or higher-pressure setting would be advisable.

Contamination

The air system should be checked regularly for contamination by oil or moisture. Traces of oil coming from the compressor are normal, but it must not be any greater than that. Moisture in the system is difficult to eliminate entirely. However, most moisture should be removed by the dryer and regular (daily) draining of the air supply tank. Most trucks now use automatic drain valves but the operation of these needs to be checked regularly. The system air dryer should be inspected or replaced at regular intervals, as recommended by the vehicle manufacturer or earlier.

It is important to rectify any problems quickly or it will result in corrosion in brake valves, brake chambers and other pneumatic systems. Lift axle control valves are particularly susceptible to dust and moisture contamination.

Regular checking, cleaning and examination is a vital part of regular air supply maintenance. It is important to remember that the driver plays a vital part in these precautions.

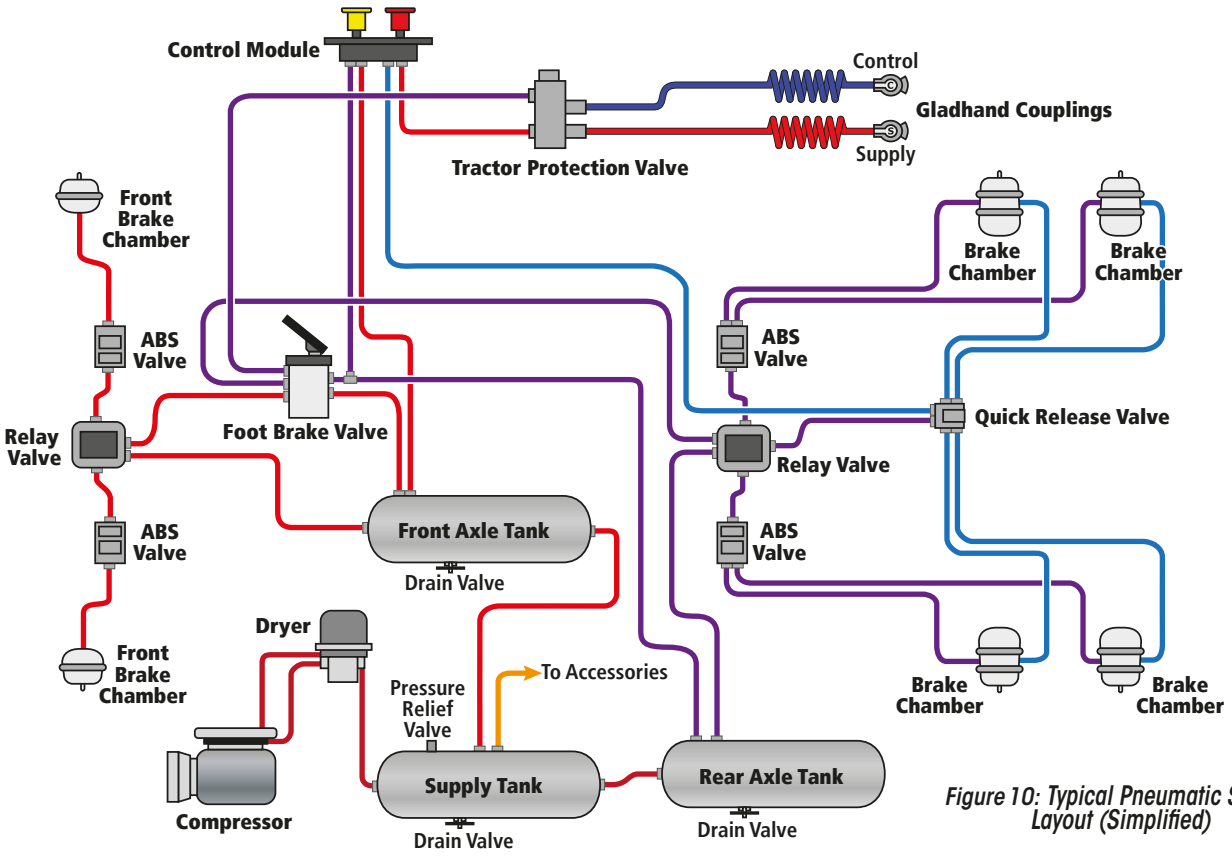
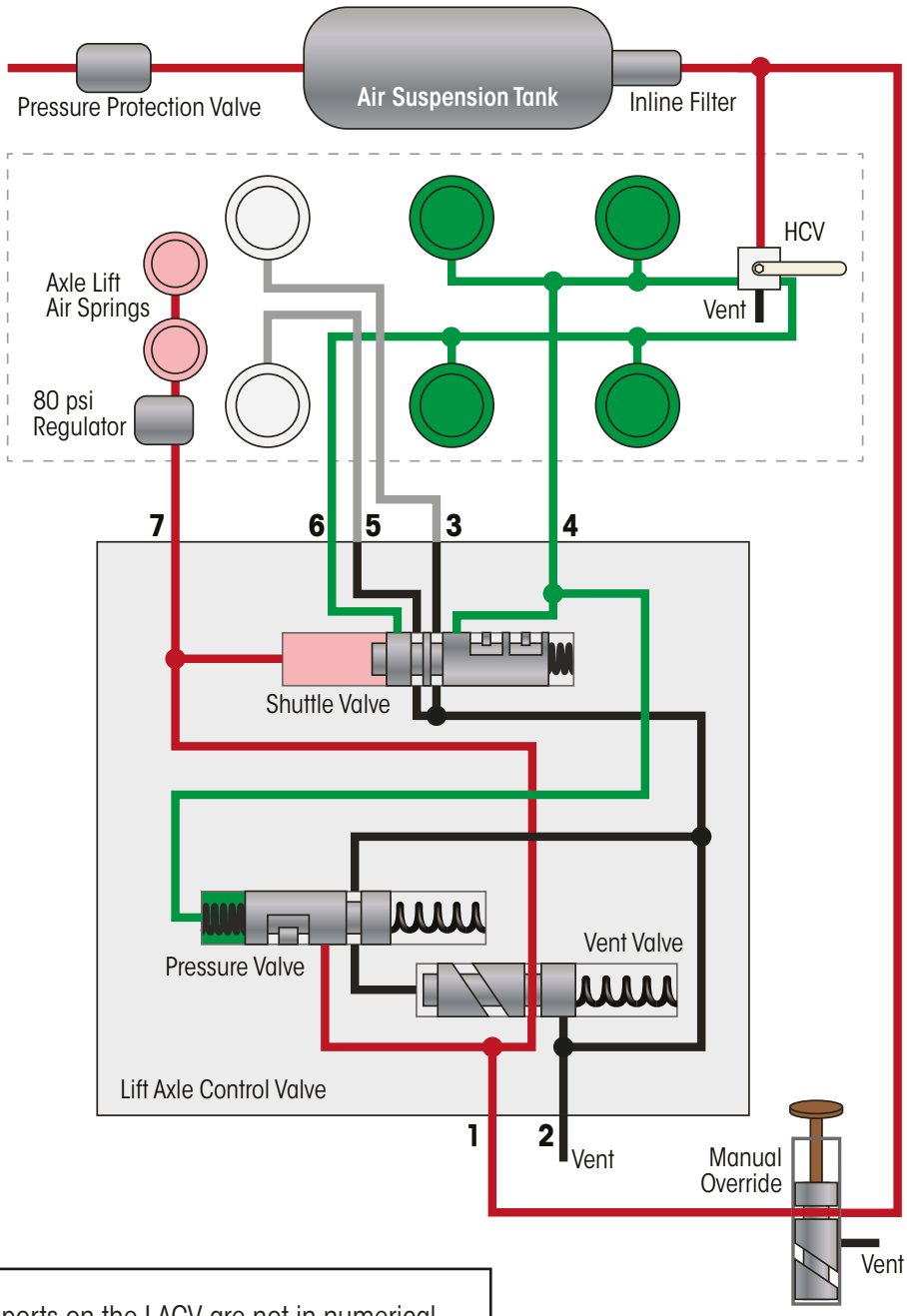


Figure 10: Typical Pneumatic System Layout (Simplified)

LACV OPERATION

Trailer at Tare Weight

At tare weight the pressure in the air springs is relatively low and may be around 1 bar (15 psi). Air spring pressure is shared with the lift axle control valve (LACV). In Figure 11, the low air spring pressure (in green) feeds into port 4 and acts on one side of the pressure valve. At this low pressure there is not enough force to compress the spring on the other side of the pressure valve. This allows the pressure coming past the vent valve to pass through the passages of the LACV to port 7. Inside the LACV, this pressure pushes the shuttle valve to the right and vents any pressure in the lift axle air springs through the vent at port 2. Meanwhile, the pressure from port 7 activates the axle lift air springs and lifts the axle.



IMPORTANT: The ports on the LACV are not in numerical order. The valve will not operate if the air lines are routed incorrectly, such as by swapping lines to ports 3 and 4.

Figure 11: Auto/Auto Operation at Tare Weight

Axle at Transition Weight

According to local regulations, lift axles must lower at a certain transition mass. In Australia for example, clause 9 of ADR 43/04 2006 states that the third axle on a tri-axle group "must come down no later than when the load imposed on the ground reaches 13.0 tonnes." This load will correspond to a certain pressure when the suspension is at ride height. This pressure varies depending on both air spring and axle design.

In Figure 12, when the axle load reaches the set point, the pressure pushing on the pressure valve is sufficient to move the valve against spring force. In this position the pressure valve supplies air pressure to the vent valve. The vent valve moves and vents air pressure, through port 2, from both the shuttle valve and the axle lift air springs. The shuttle valve spring moves the valve and allows air spring pressure to reach the air springs from the liftable axle. At the same time, the pressure vents from the axle lift air springs and allows the axle to come down.

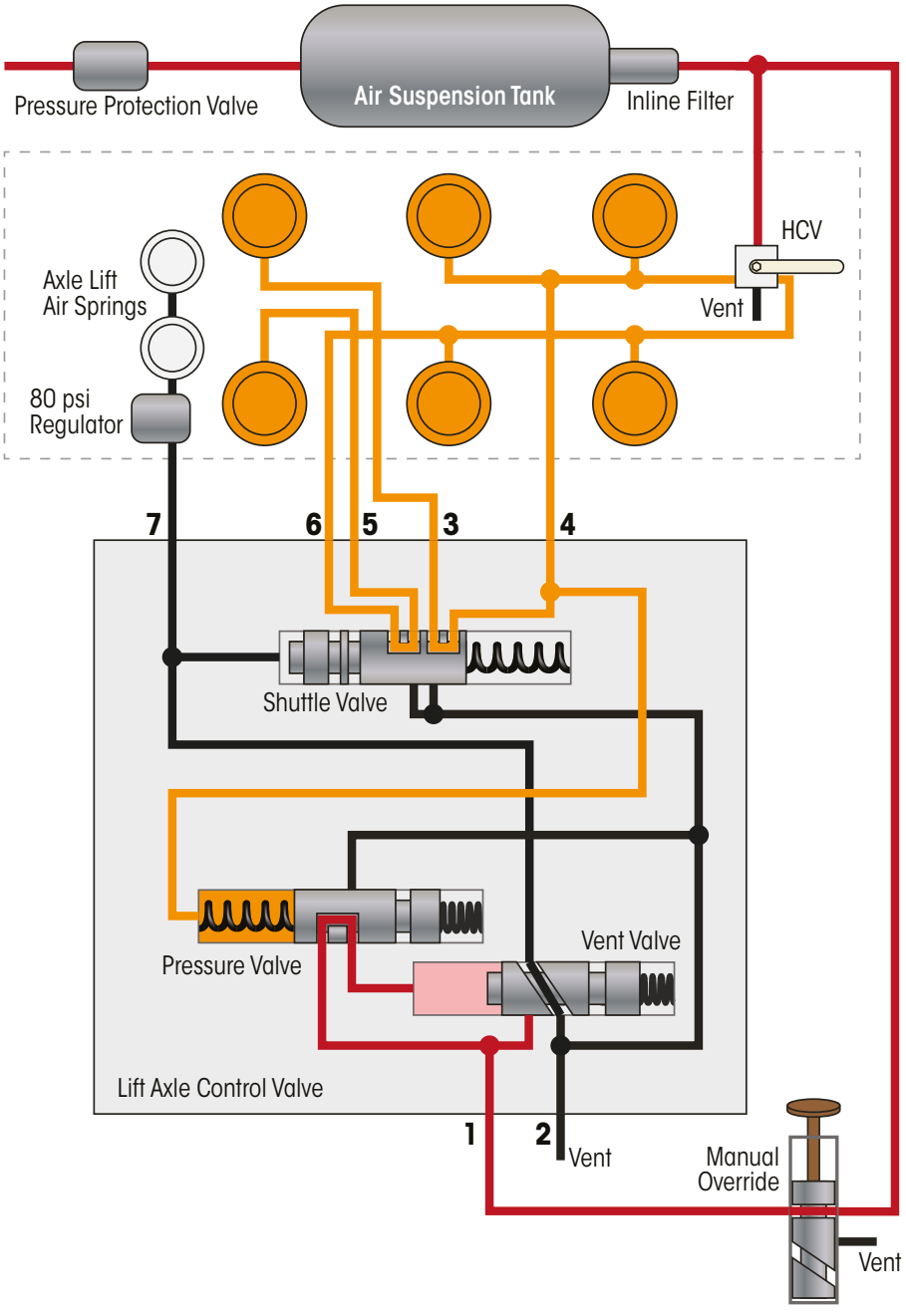


Figure 12: Auto/Auto Operation at Transition Weight

Manual Override

When the manual override is engaged, it vents pressure from the vent valve shuttle valve and axle lift air springs. This forces the shuttle valve to supply air spring pressure to all the air springs. Figure 13 and Figure 14 show that the result is the same regardless of the pressure or position of the pressure valve. The axle comes down because there is pressure in the axle air spring and no pressure in the axle lift air springs.

Gross Load Operation

In Figure 13 at gross load, air spring pressure pushes on the automatic drop valve. With the automatic drop valve moved over, any pressure on the operating valve is released through the automatic drop valve passage. This allows the pressure from the axle lift air springs and from behind the air suspension valve to vent via port 2, which lowers the lift axle.

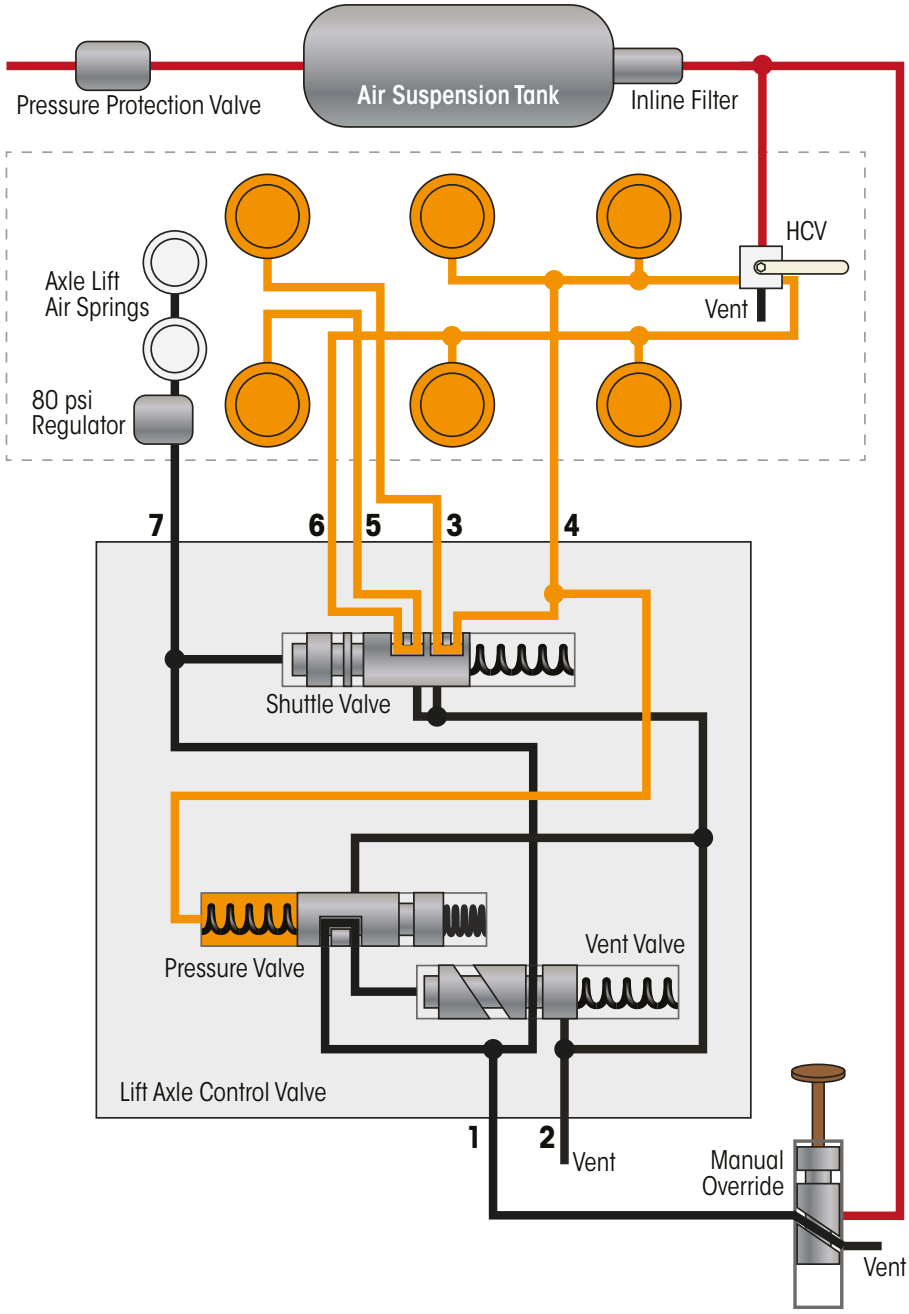


Figure 13: Auto/Auto Manual Override Operation at Gross Load

Tare Load Operation

In Figure 14 at tare load, the automatic drop valve is in the inactive position. Any pressure on the operating valve is released by the automatic drop valve. This allows the pressure from the axle lift air springs and from behind the air suspension valve to vent via port 2, which lowers the lift axle.

NOTICE: The LACV operational diagrams shown in this section only show one height control valve. However, operation of the LACV with two height control valves is the same.

Auto/Auto with Manual Override Operation at Tare Load

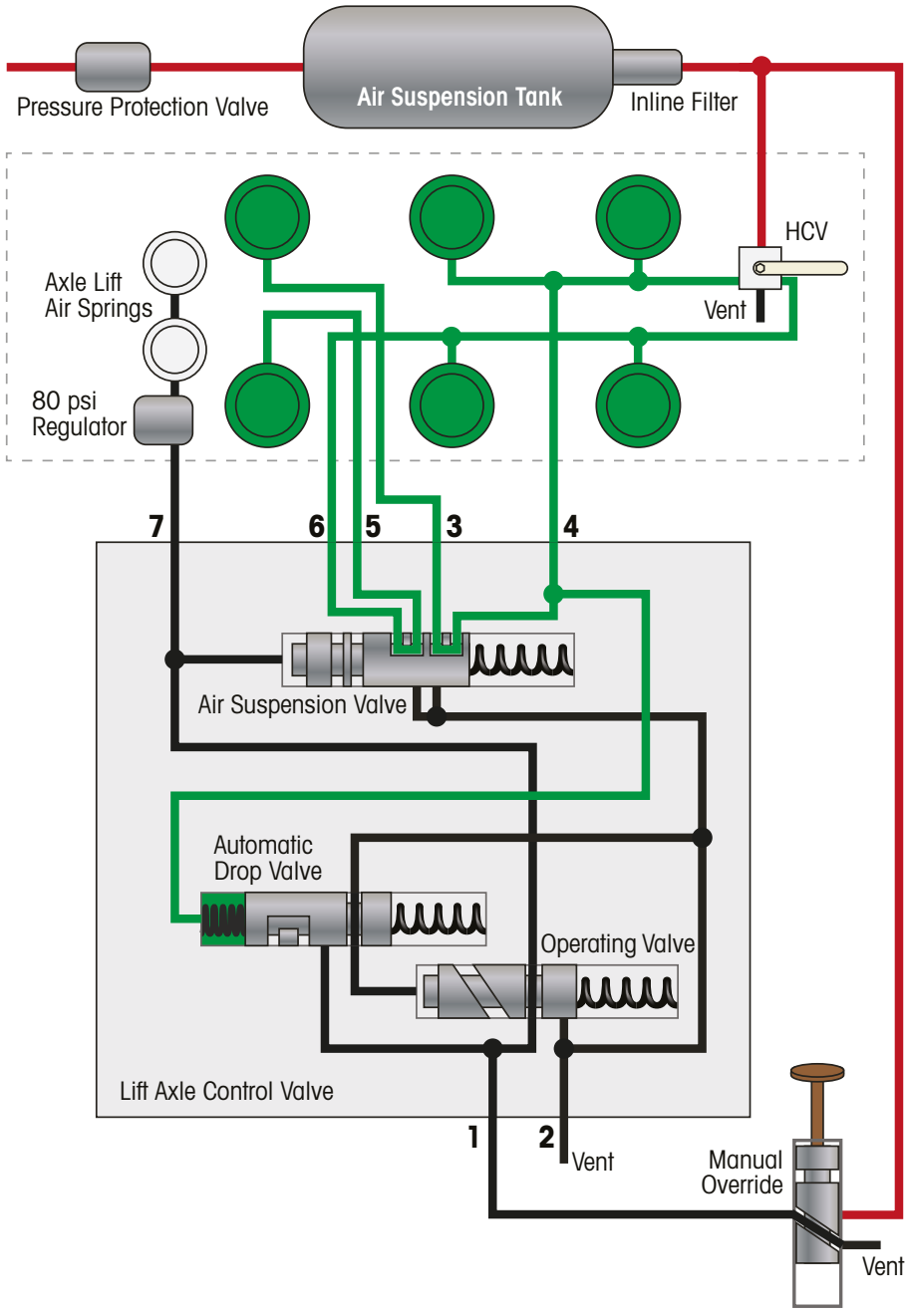


Figure 14: Auto/Auto Manual Override at Tare Load

SINGLE LIFT TRIAXLE LAYOUT

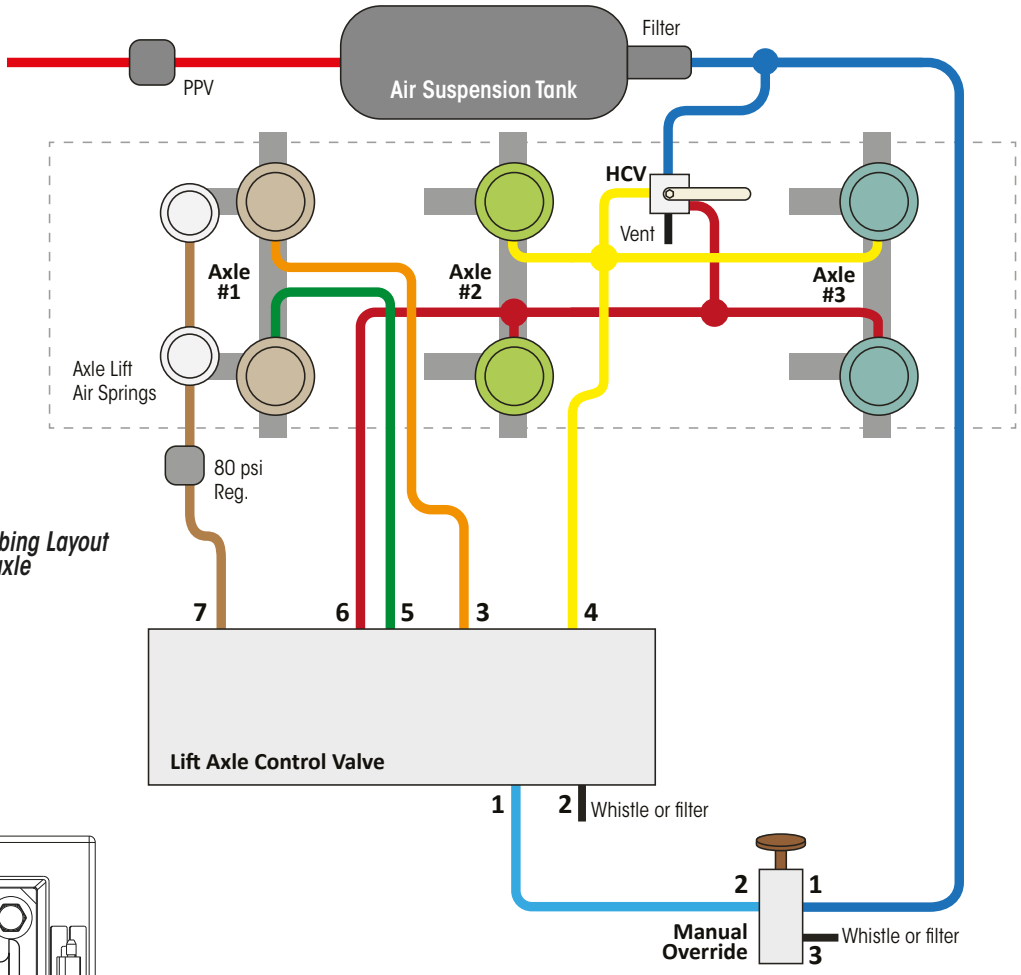


Figure 15: LACV Plumbing Layout Single Lift Triaxle

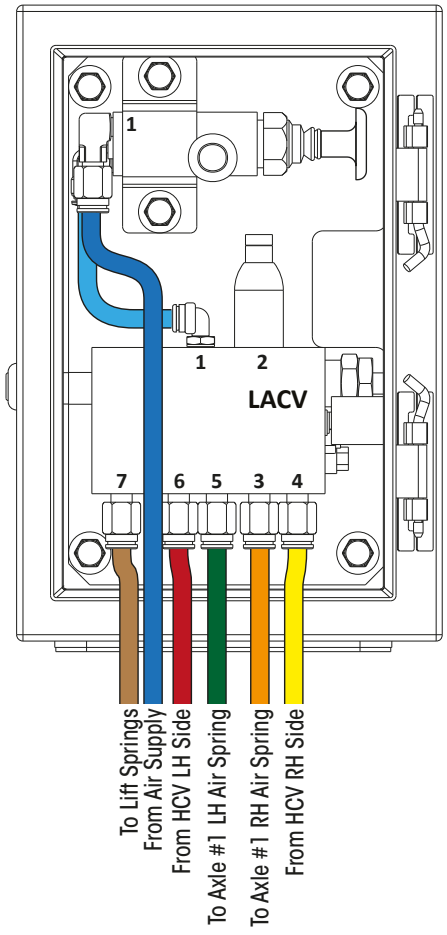


Figure 16: LACV Hose Connections Single Lift Triaxle

The plumbing supply for the LACV system goes through the brake pressure protection valve to the air suspension supply tank. It passes through a filter to the height control valve and the manual override valve. Refer Figure 15 and Figure 16.

The height control valve supplies air to the left and right air springs. The left and right air circuits are kept separate in the LACV. Therefore, it is important that the right air springs (port 4) are connected to the right air spring on the lift axle (port 3). Likewise, the left air springs must be attached to port 6 and the left air spring of the lift axle is attached to port 5.

The lift springs connect to port 7. The manual override valve connects to port 1. Port 2 of the LACV is a vent and will hold either a whistle or filter.

The manual override valve should have system air pressure at port 1. Port 2 supplies air pressure to the LACV. This air pressure is vented when the lift axle needs to be manually dropped, such as for maintenance. Port 3 of the override valve vents pressure through either a whistle or filter.

DUAL LIFT TRIAXLE LAYOUT

When twin lift axle control valves are used, it is important that they are plumbed and calibrated to prevent simultaneous operation. The recommended plumbing arrangement for twin LACV is shown in Figure 17 and the suggested hose layout is shown in Figure 18.

Using this layout, the valves are configured to drop axle #3 before dropping axle #1 as load increases. The manual override valves are connected in series. Manual override #1 operates both axles and override #2 only operates axle #3. This is designed to prevent axle #1 dropping on its own.

Each LACV must be calculated and calibrated individually depending on needs. For example, if axle #3 is required to drop at 6.5 tonnes and axle #1 needs to drop at 13 tonnes, then the drop pressures will be similar for both LACV because the distributed load per axle is alike.

However, the lift pressure for axle #1 should be set lower than that for axle #3 to prevent the fluctuating operation. For example, the pressure could be set 0.55 bar (8 psi) lower. Therefore, if the lift pressure of axle #3 is set at 2.27 bar (33 psi), then set the lift pressure of axle #1 at 1.72 bar (25 psi).

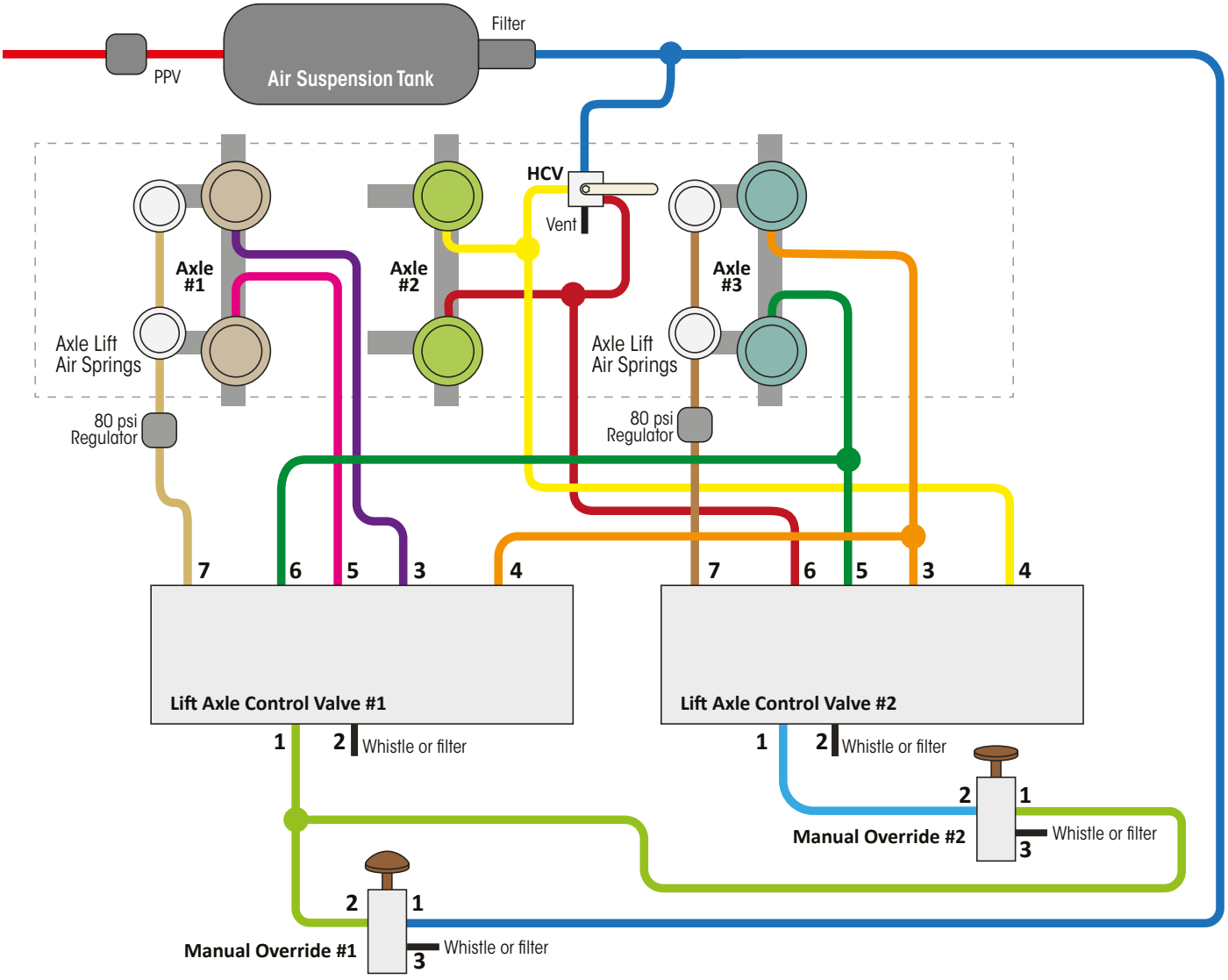


Figure 17: LACV Plumbing Layout Dual Lift Triaxle

Plumbing

The plumbing supply for the LACV system goes through the brake pressure protection valve to the air suspension supply tank. It passes through a filter to the height control valve and LACV #1 manual override valve.

The height control valve supplies air directly to the centre axle left and right air springs. Pressure from the HCV left and right is fed to ports 4 and 6 of LACV #2. Pressure out of LACV #2 goes to axle #3 air springs and ports 4 and 6 of LACV #1. Axle #3 lift springs connect to port 7 of LACV #2.

LACV #1 gets left and right air pressure, to ports 4 and 6, from LACV #2 (ports 3 and 5). When needed, LACV #1 supplies left and right pressure, from ports 3 and 5, to axle #1 air springs. Axle #1 lift springs are operated via port 7 of LACV #1.

The manual override valves are connected in series. Manual override #1 supplies air pressure to drop axle #1 and to manual override #2. In this way manual override #1 simultaneously vents pressure from both LACV. Manual override valve #2 only acts on axle #3 and prevents improper axle operation. Manual override #1 should have direct system air pressure at port 1.

NOTE: The plumbing layout shown here is a suggested pattern for installing twin LACV. Layouts may need to be tailored to suit application. However, caution must be used as variations to the operating principles in this layout may cause the lift axles to operate erratically.

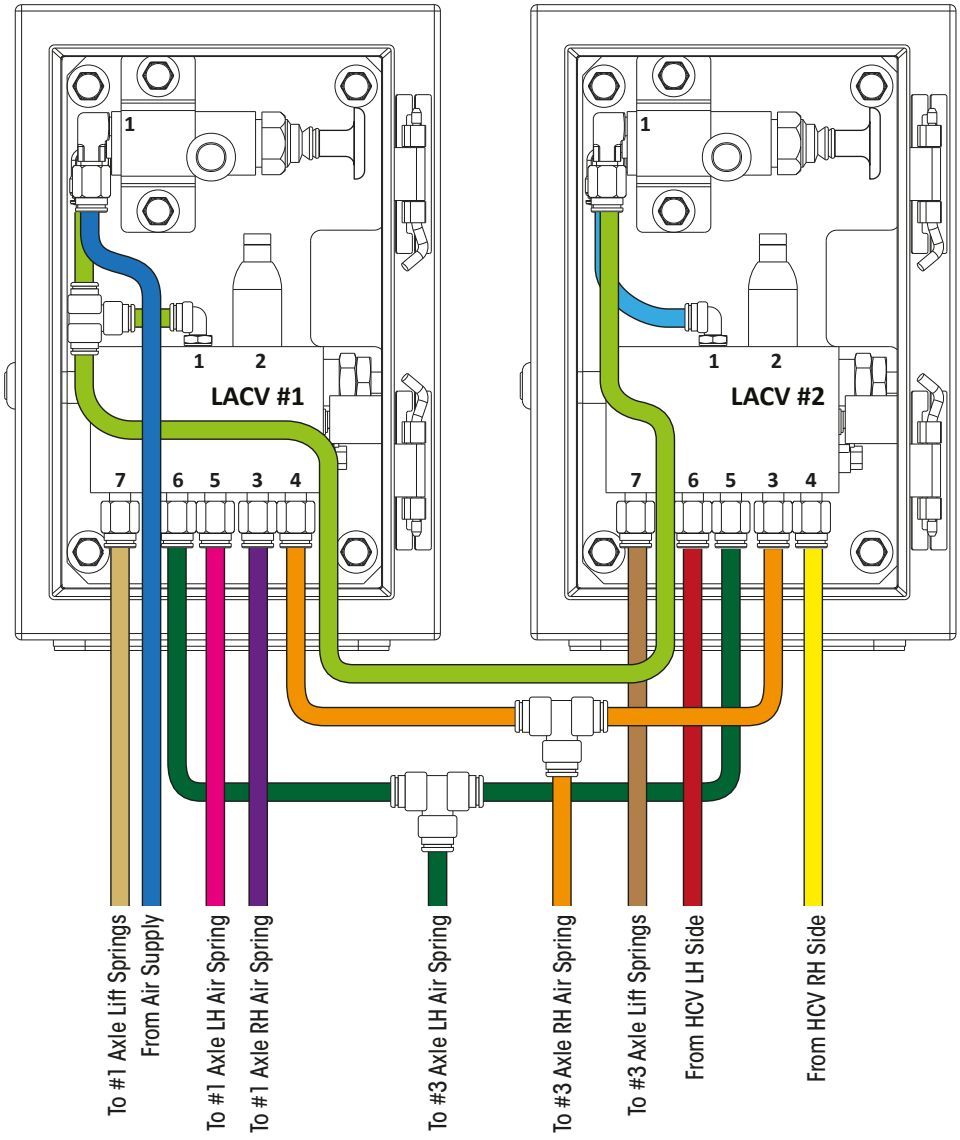


Figure 18: LACV Hose Connections Dual Lift Triaxle

LACV ADJUSTMENT

IMPORTANT: Hendrickson lift axle control valves should be calibrated at installation and do not normally require recalibration. Do not attempt to adjust the valves if they are simply not operating correctly. If there are operational issues, always diagnose and repair any faults. Refer to "LACV Inspection" on page 6 and "LACV Troubleshooting Guide" on page 21.

CAUTION: Warning whistles attached to Hendrickson lift axle control valves operate when lifting and dropping axles. Wear appropriate hearing protection when adjusting the LACV and/or muffle the whistles.

IMPORTANT: In Australia, do not adjust LACV to function beyond ADR 43/04 2006, which states that the liftable axle on a Triaxle group, with dual wheels, "must come down no later than when the load imposed on the ground reaches 13.0 tonnes." Similarly, on a Tandem axle the liftable axle must come down no later than 6.5 tonnes.

Automatic drop and lift (raise) pressures must be set and adjusted to suit the properties of the suspension. If necessary, valves can be calibrated either on the vehicle or on a test bench, with pressures to simulate in-vehicle conditions, so that they meet each application, vehicle configuration and applicable law. Using a pressure regulator to simulate air spring pressure greatly simplifies adjustment. Refer to Figure 19 to see how to set up your LACV calibration equipment.

NOTICE: Pressure ranges and adjustment screw alterations shown in the following instructions are estimated only. Precise adjustment settings can only be made by using a calibrated weighbridge, an accurate pressure gauge and allowing time, a minute or two, for the valve to respond to any changes.

PROPER OPERATING PRESSURES

In ADR 43/04 'Vehicle Configuration and Dimensions', under section nine it states that retractable axles must lower and remain down when the prescribed transition mass is reached or exceeded. Refer to the ADR for more details. However, in most cases, the lift axles must come down before there is 6.5 tonnes per axle. On a triaxle, this would be 13 tonnes for the two fixed axles. It is recommended that the LACV is adjusted to drop the axles before the transition mass is reached. This will ensure the lift axle drops down before the maximum legally allowed load.

Use "Air Spring Load-Pressure Charts" on page 22 to determine the appropriate target operating pressure for the suspension design and application. You will need to determine two pressures from these charts, air spring pressures at transition mass with axle lifted and again with axle lowered.

Once the lift axle drops, the load is distributed across all axles and the air spring pressure drops accordingly. Therefore, on a tandem axle the 6.5 tonnes are spread across the two axles, leaving 3.25 tonnes per axle. A Triaxle has the 13 tonnes distributed across the three axles placing 4.33 tonnes on each axle.

To prevent the axle cycling up and down the axle lift pressure must be set at least 3.4 bar (5 psi) lower than the pressure/load per axle with axle dropped.

Two pressure values are required:

- **Drop Pressure**: Air spring pressure when the suspension has reached transition mass and the axle needs to drop. This is used to set LACV drop pressure. This proposed pressure should be confirmed on a calibrated weighbridge for each unique suspension design.
- **Lift Pressure**: Air spring pressure after the axle has dropped and the transition mass is shared across all axles. This pressure, minus 0.34 bar (5 psi), is the pressure when the axle should lift. The 0.34 bar (5 psi) allowance will ensure the suspension does not oscillate up and down over road undulations.

EQUIPMENT REQUIRED

- Air supply capable of maintaining a steady pressure in the range 6 to 8 bar (90 to 120 psi)
- 1 x Adjustable pressure regulator (with gauge), 0-100 psi
- 1 x Calibrated pressure gauge, 0-8 bar (0-100 psi), with accuracy of least 5 kPa (0.5 psi)
- 2 x Pressure gauges, 0-8 bar (0-100 psi) simply required to detect pressure/no pressure only
- 3/8" tube and fittings as required
- Common workshop hand tools
- Calibrated weighbridge is recommended for initial installations to confirm calculations

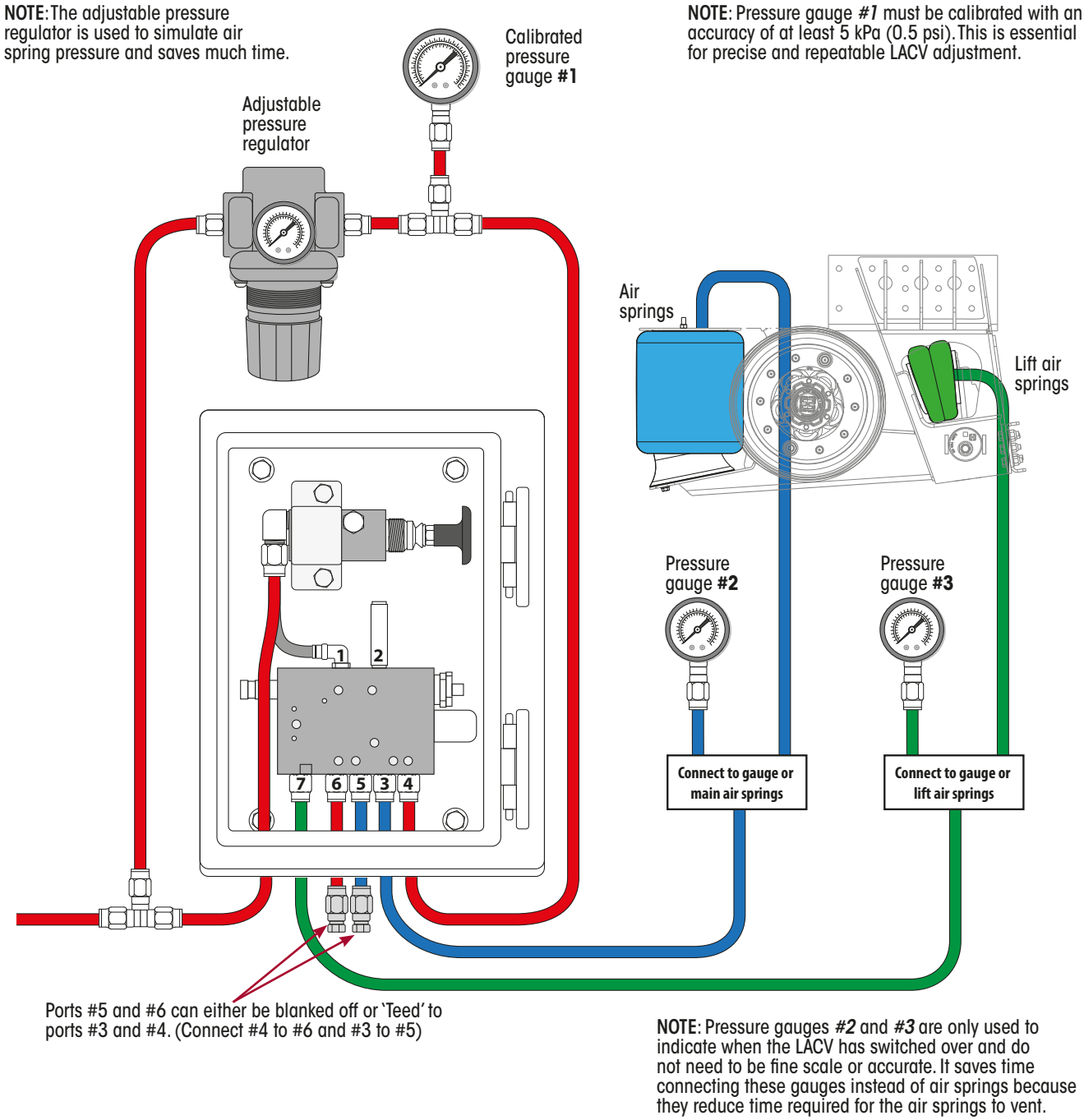


Figure 19: LACV Calibration & Adjustment Setup

AUTOMATIC DROP PRESSURE

The first calculation and adjustment to be made is the pressure drop setting. This pressure setting is dependent on the required axle drop transition mass and is a function of the vehicle configuration, number of axles, suspension geometry and applicable legislation. This setting applies to both Manual/Auto and Auto/Auto LACV.

1. Calculate the load and corresponding air spring pressure of the axles when the lift axle needs to drop. Refer to "Air Spring Load-Pressure Charts" on page 22 for a summary of lowering transition mass/ load pressure relationships for the most common Hendrickson suspensions. Refer to "Truck Suspensions" on page 19 for LACV installed to trucks.

   Divide the transition mass by the number of fixed axles to find load per axle. Look up the load per axle in the relevant load pressure chart to find the required drop pressure. This can be expressed mathematically:

   $$\frac{\text{Transition Mass}}{\text{Number of Fixed Axles}} = \text{Load per Axle}$$

   Use *Load per Axle* and the load/pressure charts to find the corresponding drop pressure.

Example: A triaxle trailer fitted with HT230 Top Mount with S-21208 air springs, a single lift axle and with a transition mass of 13 tonne. 13,000 kg divided by two axles equates to 6,500 kg per axle. Look the HT230 Top Mount suspension up in the load/pressure charts and you will see that at 6,500 kg it should have a drop pressure of around 4.14 bar (60 psi). This proposed pressure should be confirmed with a weighbridge on the first suspension with that configuration.

$$\frac{\textit{13,000 kg (Transition Mass)}}{\textit{2 (Number of Fixed Axles)}} = \textit{6,500 kg (Load per Axle)}$$

6,500 kg from the HT230 Top Mount chart gives a pressure of 4.14 bar (60 psi).

2. Connect the pressure regulator and calibrated pressure gauge to the LACV to be calibrated as shown in Figure 19. The air supply must be clean, dry and be a steady pressure of at least 6 bar (90 psi).

   Alternatively, if this is the first suspension for a particular configuration it is recommended that the vehicle be placed onto a calibrated weighbridge.

3. Slowly increase pressure with the pressure regulator to port #4 of the LACV (or add weight if on weighbridge) until the axle drops. If calibrating off-vehicle you will see pressure gauges #2 and #3 change as the LACV switches over. Refer Figure 19.

4. Record the pressure (and weight if on weighbridge) at this point.

IMPORTANT: Wait a minute or two between each change in pressure (weight) or adjustment to give the LACV time to respond. This is because the LACV has a built-in delay to prevent oscillating operation.

5. The adjustment for automatic drop pressure is located on the right-hand side of the LACV, usually underneath a black cap. The adjustment range begins at 2.5 bar (36 psi) all the way to 5.8 bar (84 psi). The adjustment screw has a 24 mm locknut, which needs to be loosened before attempting adjustment. Refer Figure 20.

6. Turn the screw clockwise to raise the drop pressure and anticlockwise to lower the drop pressure. As a rough guide, each turn of the adjustment screw equates to approximately 0.19 bar (2.75 psi).

7. Keep adjusting and checking the drop pressure until you are confident the setting is correct and compliant with any legislative requirements.

IMPORTANT: Do not move the smaller screw near the drop pressure adjustment screw. This screw is a stabiliser setting that is calibrated at the factory.

NOTICE: Ensure that the locknut is tightened after setting pressure drop.

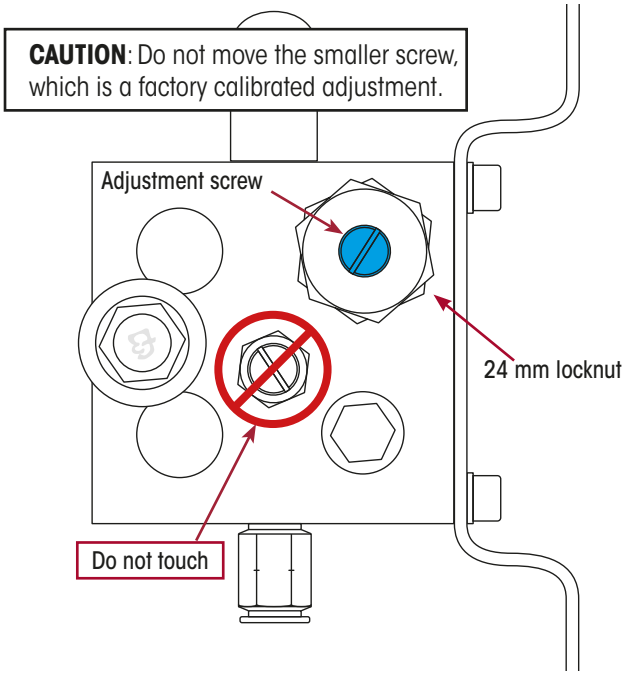


Figure 20: Pressure Drop Adjustment

LIFT PRESSURE

NOTE: The pressure setting for lifting (raising) the axle is a hysteresis or margin setting related to the drop pressure. To keep it simple for routine adjustments we can leave out calculating hysteresis. Refer to the box "Lift Hysteresis Pressure Detail" on page 20 if you want or need to know more. Lift pressure setting applies to Auto/Auto LACV only.

1. After calculating target drop load/pressure, divide the load by the number of axles when the axle has dropped. Find this pressure "Air Spring Load-Pressure Charts" on page 22. Subtract 0.34 bar (5 psi) from this pressure to find the target lift pressure. The extra 0.34 bar (5 psi) is to ensure the axles don't hunt (oscillate) up and down over road undulations. This is a similar calculation used to find the drop pressure, only with all axles on the ground and then subtract 0.34 bar (5 psi).

$$\frac{\text{Transition Mass}}{\text{Number of Lowered Axles}} = \text{Load per Axle}$$

   Use *Load per Axle* and the load/pressure charts to find the corresponding pressure, then subtract 0.34 bar (5 psi) to find the target lift pressure.

Example: Using our previous example of a triaxle trailer, with HT230 and a single lift axle, once the axle drops at transition mass, the 13 tonnes will be spread across 3 axles. So, 13,000 kg divided by 3 axles is 4,333 kg per axle. Look up 4,333 kg on the HT230T load/pressure charts you will see that the air spring pressure will drop to 2.62 bar (38 psi). Subtract 0.34 bar (5 psi) and we will find our target lift pressure, which is 2.28 bar (33 psi).

$$\frac{\textit{13,000 kg (Transition Mass)}}{\textit{3 (Number of Lowered Axles)}} = \textit{4,333 kg (Load per Axle)}$$

4,333 kg from the HT230 Top Mount chart gives a pressure of 2.62 bar (38 psi).

2.62 bar – 0.34 bar = 2.28 bar (33 psi)

   Alternatively, measure and record the air spring pressure as soon as the lift axle drops. Use this as the base figure and subtract 0.34 bar (5 psi) to arrive at the correct lift pressure.

2. Adjustment for the lift pressure is a 4 mm Allen key screw on the left-hand side of the valve. This may be located underneath a yellow plastic cap. If so, ensure the yellow cap is refitted after removal to minimise dust ingress. Refer Figure 21.

3. Slowly reduce pressure to Port #4 of the LACV (or remove load from the suspension) until the axle lifts. Remember to wait a minute or two for the LACV to settle before making further adjustments.

4. Record the pressure/load and adjust if necessary.

5. To lower the lift pressure, turn the screw clockwise; likewise, to raise the pressure turn it anticlockwise. Each turn will change the pressure approximately 0.17 bar (2.5 psi).

6. Keep adjusting and checking the lift pressure until you are confident the setting is correct and compliant with any legislative requirements.

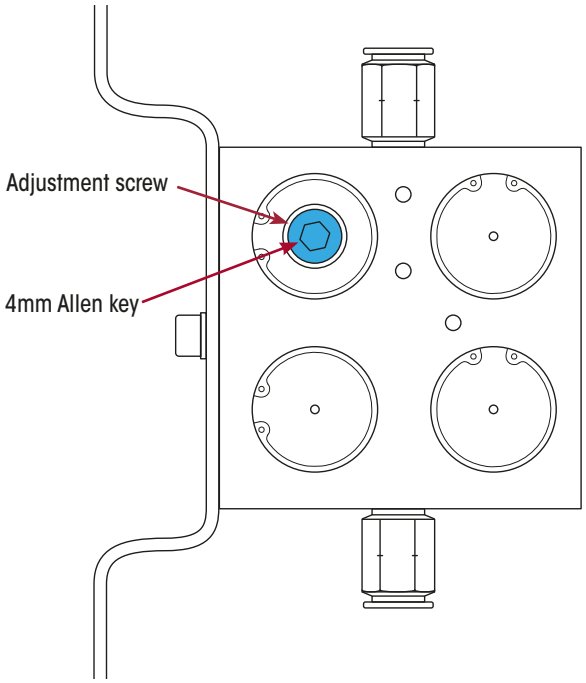


Figure 21: Lift Pressure Adjustment

TRUCK SUSPENSIONS

Unlike trailer suspensions, where suspension design and air springs usually match, truck suspensions use different lift axle suspension design to the drive axles. Therefore, lift axle air spring pressure charts can be used only as a guide in these applications. The complexity of various suspension designs means that LACV operating pressures are best determined on the vehicle. Refer "S-14249 Air Spring – TOUGHLIFT HLM-2" on page 25.

Refer to the adjustment recommendations detailed in this section of the bulletin, which include using a calibrated weighbridge and pressure gauge to determine suitable pressures for vehicle and suspension design. These pressures should then be recorded to aid future LACV calibration, which can be easily performed on a test bench.

LIFT HYSTERESIS PRESSURE DETAIL

This is a more detailed explanation describing calculation of the pressure needed to correctly set up the lifting of the axle. It is not needed for general adjustment and service of Hendrickson LACV. Use the "Lift Pressure" on page 19 unless this extra detail is required.

The LACV axle lift pressure is a margin of the drop pressure. The hysteresis pressure range is 1.2 to 2.6 bar (17 to 38 psi). That means that the axle will lift at a pressure that is 1.2 to 2.6 bar (17 to 38 psi) below the axle drop setting. Subtract this pressure from the axle drop pressure to find the lift pressure. The hysteresis is the difference between the drop and lift pressures and should only be set after the drop pressure is set.

1. Divide Transition Mass by the number of dropped axles to find Load per Axle.
2. Use Load per Axle and the load/pressure charts to find the corresponding pressure and subtract 0.34 bar (5 psi) to find the Target Lift Pressure.
3. Subtract the Target Lift Pressure from the Drop Pressure to find the Pressure Margin required.

This can be expressed mathematically:

tm/nfa → *dp*

tm/nla → *lwp*

lwp – 0.34 bar = *rp*

dp – *rp* = *mp*

Where: *tm* = transition mass
nfa = number of fixed axles
nla = number of lowered axles
dp = drop pressure
lwp = lowered pressure
lp = lift pressure
mp = margin pressure.

EXAMPLE: Using our previous example of a triaxle trailer, with HT230T and a single lift axle, once the axle drops at transition mass, the 13 tonnes (*tm*) will be spread across 3 axles (*nla*). Therefore, 13,000 kg divided by three is 4,333 kg per axle. Look up the load/pressure charts to find that the air spring lowered pressure (*lwp*) will be 2.62 bar (38 psi). We need to subtract 0.34 bar (5 psi) from that for our target lift pressure (*lp*), which give us 2.28 (33 psi). Because the lift pressure is a margin (hysteresis) from the drop pressure, the margin is the original drop pressure 4.14 bar (60 psi) minus 2.28 (33 psi), which equates to a target margin pressure (*mp*) of 1.86 bar (27 psi).

13,000 (*tm*) / 2 (*nfa*) = 6,500 → 4.14 bar (*dp*)

13,000 (*tm*) / 3 (*nla*) = 4,300 → 2.62 bar (*lwp*)

2.62 bar (*lwp*) – 0.34 bar = 2.28 bar (*lp*)

4.14 bar (*dp*) – 2.28 bar (*lp*) = 1.86 bar (*mp*)

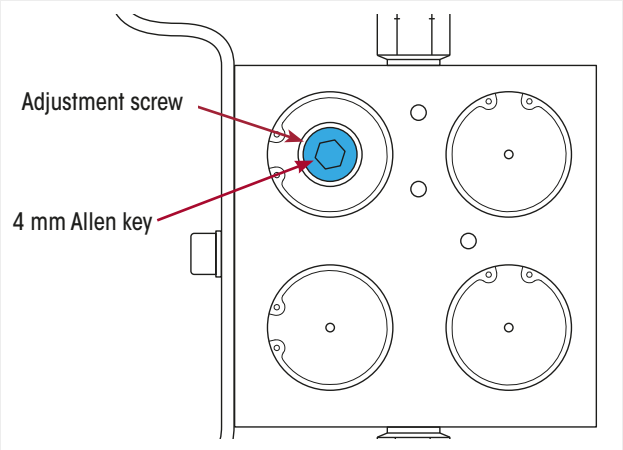


Figure 22: Lift Hysteresis Pressure Adjustment

The hysteresis margin pressure range is 1.2 to 2.6 bar (17 to 38 psi). That means that the axle will lift at a pressure that is 1.2 to 2.6 bar (17 to 38 psi) below the axle drop setting. Each turn of the hysteresis adjustment screw corresponds to approximately 0.17 bar (2.5 psi). Turning the 4 mm Allen adjustment screw clockwise will result increase the margin and anticlockwise will reduce it. Refer Figure 22.

NOTE: The two pressure setting adjustment screws adjust the tension of springs acting on the Automatic Drop Valve. Refer "LACV Operation" on page 9.

LACV TROUBLESHOOTING GUIDE

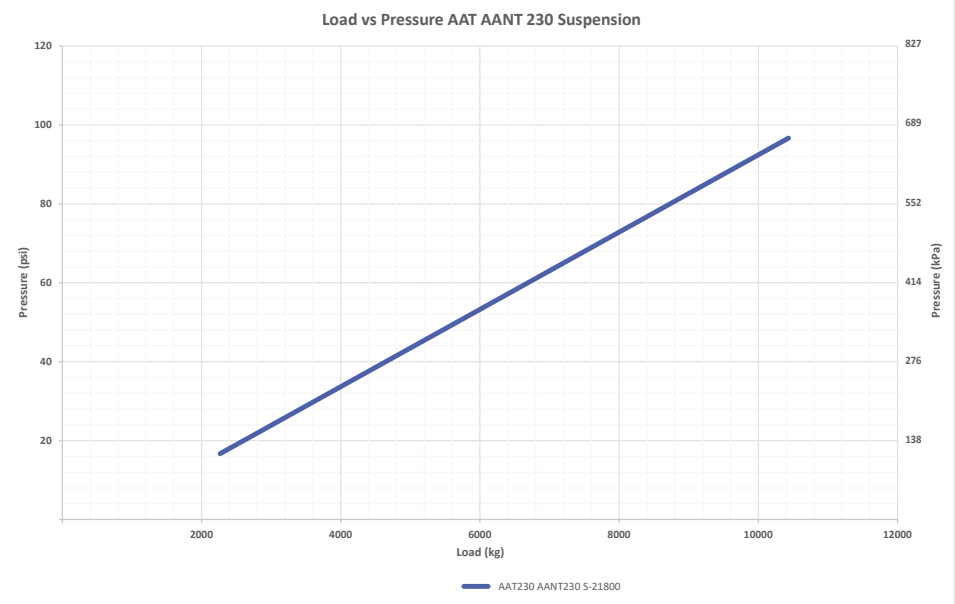
Problem	Possible Cause	Correction
Automatic lift or manual override does not function *	Lift axle control valve contaminated due to moisture in vehicle air supply or control box filled with dust or water.	Clean air supply system. Repair or fit air supply drier and/or filters. Replace lift axle control valve. Replace control box if cracked, damaged or seals have deteriorated. Refer "LACV Fault Diagnosis" on page 6.
	Kinked, pinched, or broken air line between LACV and lift air springs or between LACV and supply tank.	Inspect and replace pinched, kinked or broken air lines.
	Supply air pressure insufficient to operate lift mechanism.	Verify that there is a minimum of 690 kPa (100 psi) at the lift axle control valve. Use a calibrated gauge at port 1.
	Air kit control panel not properly plumbed.	Confirm that the air kit control panel is plumbed per the engineering installation diagram. Refer also diagrams on page 13 and page 14.
	Unladen weight exceeds suspension transition mass.	Check unladen vehicle mass using vehicle scales or weighbridge. Check for cause of extra weight. This may be due to additional body work, extra reinforcement attached, or a build-up of waste cement around the chassis on mixers.
Slow lift or lower times	Lift axle control valve contaminated due to moisture in vehicle air supply or control box filled with dust or water.	Clean air supply system. Repair or fit air supply drier and/or filters. Replace lift axle control valve. Replace control box if cracked, damaged or seals have deteriorated. Refer "LACV Fault Diagnosis" on page 6.
	Insufficient air flow or volume being delivered to lift axle control valve or air springs.	Find restriction and repair. This will usually be from an air line that is kinked or clamped between two components.
Air leaks	Leaking from an air line fitting.	Remove the air line and reinstall confirming the line is fully seated. If problem persists, cut off a short section of line and reinstall to confirm a clean cut that will interface properly with the fitting.
	Leaking from the lift axle control valve.	Control valve sealing surfaces may be damaged due to external contamination. Determine source of contamination, rectify source and replace valve assembly. Refer "LACV Fault Diagnosis" on page 6.
	Leaking from the override valve.	Valve sealing surfaces may be damaged due to external contamination. Determine source of contamination, rectify source and replace valve.
	Leaking from an air spring.	Air spring that are leaking from bellows or bead plate areas must be replaced to ensure continued operation.
Lift air springs damaged	Pressure limiting regulator set to incorrect pressure.	Check pressure setting to ensure it is no higher than 5.5 bar (80 psi).
	Pressure limiting regulator not installed.	Check for installation of pressure limiting regulator.
	LACV valves jammed or hoses routed incorrectly	Check hose routing. Check LACV operation and replace if necessary.

***** Lift axle control valve calibration does not change substantially with time. If the LACV is not operating correctly, then it is unlikely to be corrected with a simple adjustment. Refer "LACV Fault Diagnosis" on page 6 and "Calibration Check" on page 7.

AIR SPRING LOAD-PRESSURE CHARTS

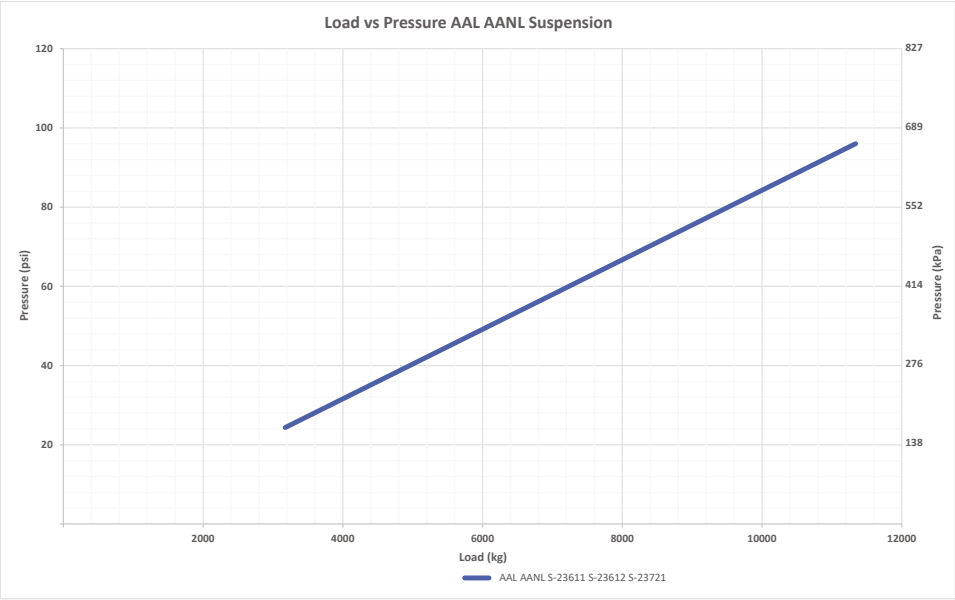
S-21800 & S-26773 AIR SPRINGS – AAT230 & AANT230

Load Per Axle		Pressure [1]	
lbs	kg	psi	kPa
5000	2268	16	110
7000	3175	25	172
7165	3250	27	187
9000	4082	34	234
9553	4333	37	257
11000	4990	43	296
13000	5897	52	359
14330	6500	58	402
15000	6804	61	421
17000	7711	71	490
19000	8618	80	552
21000	9525	88	607
23000	10433	95	655



S-23611, S-23612 & S-23721 AIR SPRINGS – AAL230/250 & AANL230

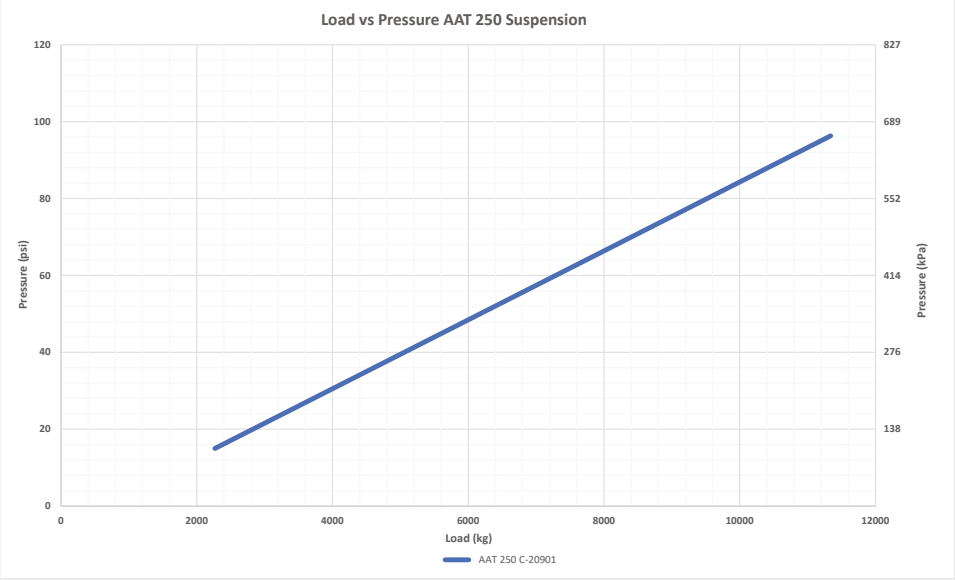
Load Per Axle		Pressure [1]	
lbs	kg	psi	kPa
7000	3175	24	165
7165	3250	25	176
9000	4082	32	221
9553	4333	35	240
11000	4990	40	276
13000	5897	48	331
14330	6500	53	369
15000	6804	56	386
17000	7711	65	448
19000	8618	72	496
21000	9525	80	552
23000	10433	88	607
25000	11340	96	662



[1] NOTICE: These load-pressure relationship charts assume a nominal unsprung mass, which may vary depending on axle and suspension options. Actual load and pressure should always be confirmed on a calibrated weighbridge for the first suspension of a specific arrangement.

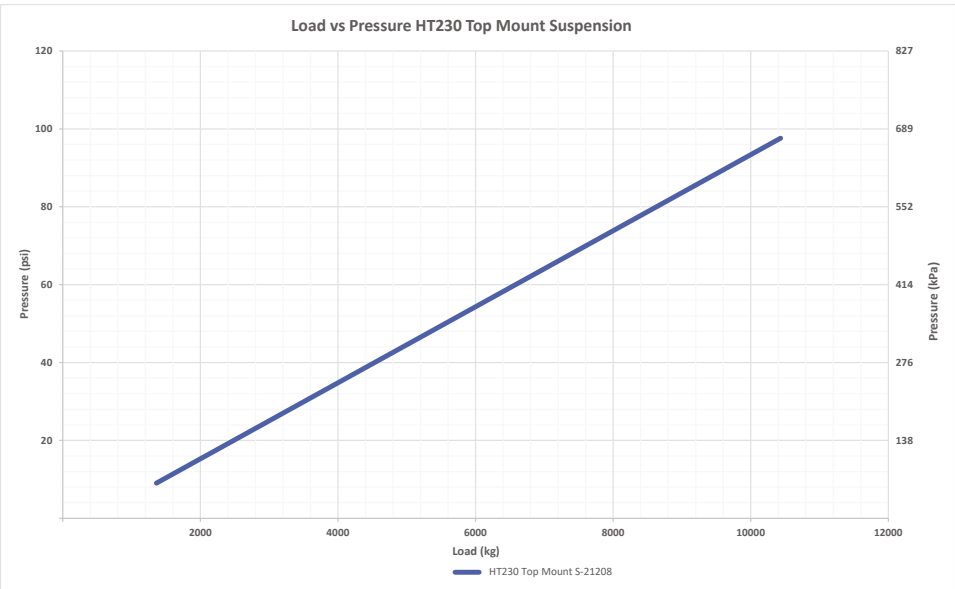
C-20901 AIR SPRING – AAT250

Load Per Axle		Pressure [1]	
lbs	kg	psi	kPa
5000	2268	14	97
7000	3175	23	159
7165	3250	25	170
9000	4082	31	214
9553	4333	34	234
11000	4990	39	269
13000	5897	47	324
14330	6500	53	362
15000	6804	55	379
17000	7711	65	448
19000	8618	73	503
21000	9525	82	565
23000	10433	87	600
25000	11340	95	655



S-21208 AIR SPRING – HT230 TOP MOUNT

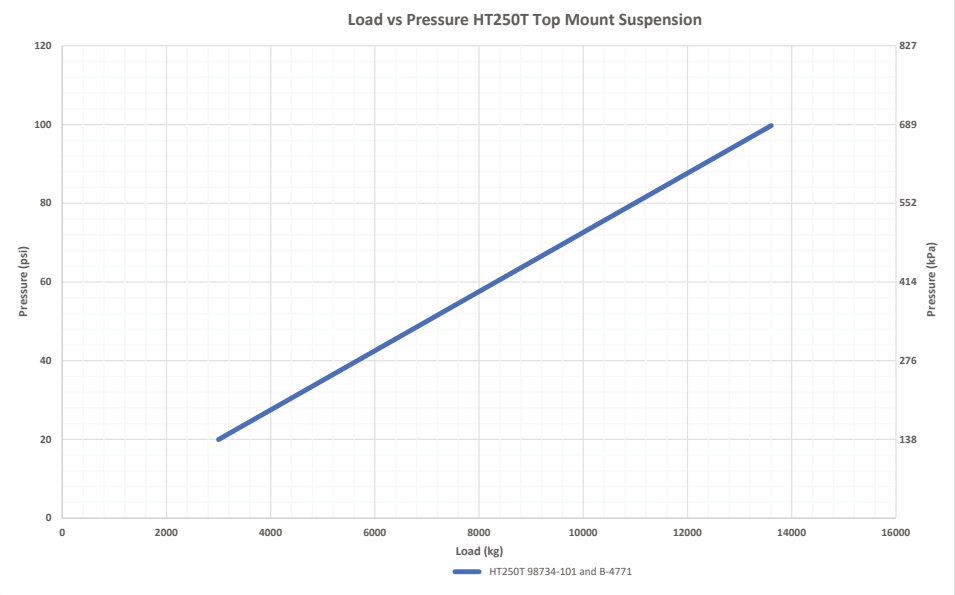
Load Per Axle		Pressure [1]	
lbs	kg	psi	kPa
3000	1361	10	69
5000	2268	18	124
7000	3175	26	179
7165	3250	28	192
9000	4082	35	241
9553	4333	38	262
11000	4990	44	303
13000	5897	53	365
14330	6500	60	414
15000	6804	62	427
17000	7711	71	490
19000	8618	80	552
21000	9525	89	614
23000	10433	98	676



[1] NOTICE: These load-pressure relationship charts assume a nominal unsprung mass, which may vary depending on axle and suspension options. Actual load and pressure should always be confirmed on a calibrated weighbridge for the first suspension of a specific arrangement.

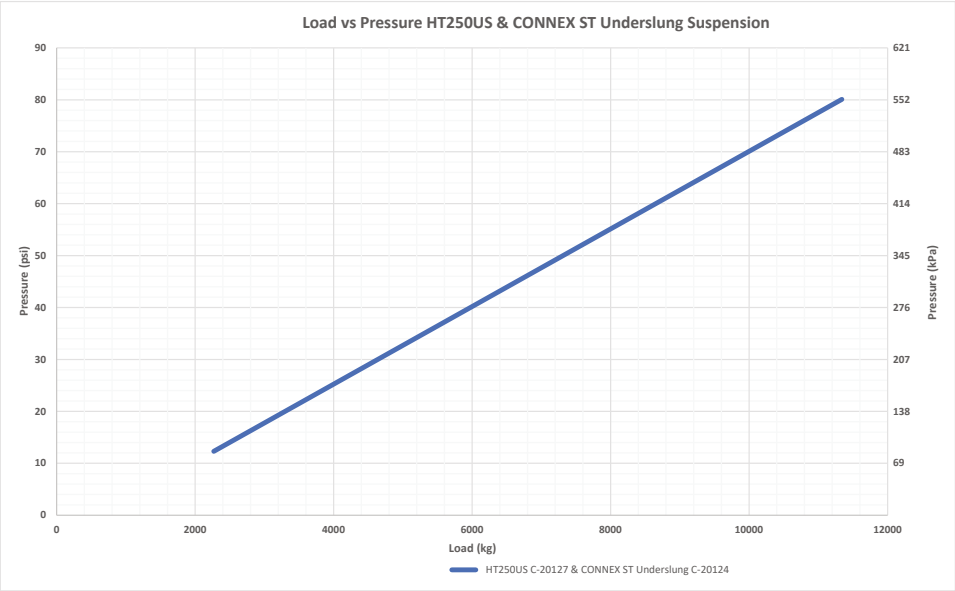
98734-101 & B-4771 AIR SPRINGS – HT250 TOP MOUNT

Load Per Axle		Pressure [1]	
lbs	kg	psi	kPa
7165	3250	22	153
9553	4333	30	204
10000	4536	31	214
12000	5443	38	262
14000	6350	45	310
14330	6500	46	317
16000	7257	52	359
18000	8165	59	407
20000	9072	66	455
22000	9979	72	496
24000	10886	79	545
26000	11793	86	593
28000	12701	93	641



C-20127 & C-20124 AIR SPRINGS – HT250US & CONNEX ST UNDERSLUNG

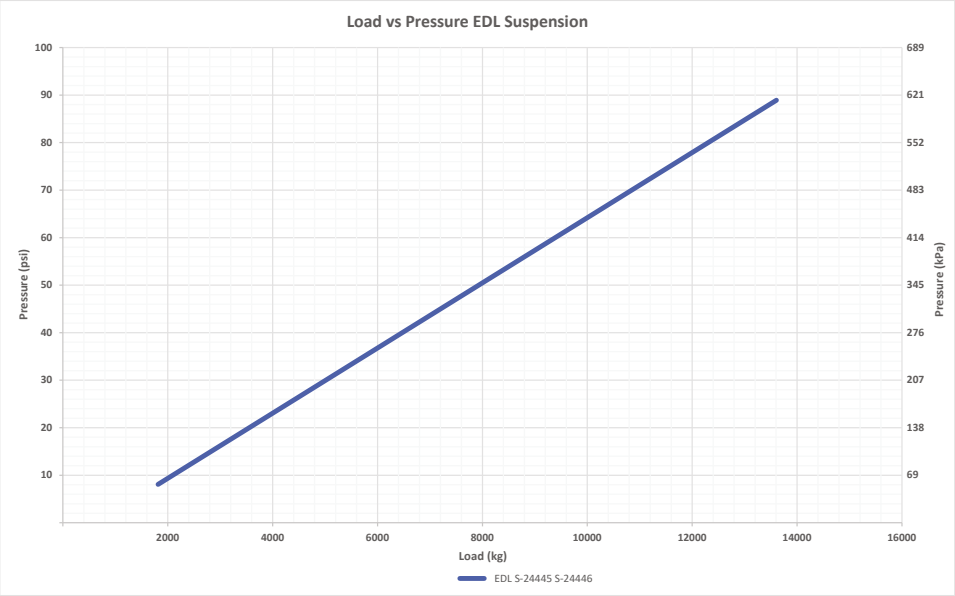
Load Per Axle		Pressure [1]	
lbs	kg	psi	kPa
5000	2268	12	83
7000	3175	19	131
7165	3250	21	143
9000	4082	26	179
9553	4333	28	192
11000	4990	32	221
13000	5897	39	269
14330	6500	44	303
15000	6804	46	317
17000	7711	53	365
19000	8618	60	414
21000	9525	66	455
23000	10433	74	510
25000	11340	80	552



[1] NOTICE: These load-pressure relationship charts assume a nominal unsprung mass, which may vary depending on axle and suspension options. Actual load and pressure should always be confirmed on a calibrated weighbridge for the first suspension of a specific arrangement.

S-24445 & S-24446 AIR SPRINGS – EDL300

Load Per Axle		Pressure [1]	
lbs	kg	psi	kPa
6000	2722	14	97
7165	3250	18	124
8000	3629	20	138
9553	4333	26	178
10000	4536	27	186
12000	5443	33	228
14000	6350	39	269
14330	6500	40	278
16000	7257	45	310
18000	8165	52	359
20000	9072	58	400
22000	9979	64	441
24000	10886	70	483
26000	11793	76	524
28000	12701	83	572
30000	13608	89	614



S-14249 AIR SPRING – TOUGHLIFT HLM-2[2]

Load Per Axle		Drum Brake		Disc Brake	
lbs	kg	psi	kPa	psi	kPa
7165	3250	22	155	24	167
9480	4300	34	231	36	250
9553	4333	34	233	37	252
10000	4536	35	244	38	264
12000	5443	42	293	46	317
14000	6350	50	342	56	383
14330	6500	52	361	57	392
16000	7257	59	404	63	438
18000	8165	67	462	73	501
20000	9072	74	513	81	558
22000	9979	81	558	89	614

[2] NOTE: Unlike trailer suspensions, where all designs and air springs usually match, truck suspensions will use different lift axle design to the drive axles. Therefore, the pressure/load relationship provided here may be used as a handy reference but should not be used as a specification.

Refer to recommendations detailed under "LACV Adjustment" on page 16, which includes using a calibrated weighbridge and pressure gauge to determine suitable pressures for vehicle and suspension design. These pressures should be recorded to aid future LACV calibration, which can then easily be performed on a test bench.

[1] NOTICE: These load-pressure relationship charts assume a nominal unsprung mass, which may vary depending on axle and suspension options. Actual load and pressure should always be confirmed on a calibrated weighbridge for the first suspension of a specific arrangement.

REVISIONS TABLE

DATE	REV	PAGE	DESCRIPTION
Jul-2021	B	All	Completely overhaul and expand document to replace bulletin 49441-167.
Jul-2022	C	19, 25	Add TOUGHLIFT pressure/load relationship chart and note.
Aug-2022	D	17	Correct diagram hose layout.
Nov-2023	E	6, 7, 21	Add extra details to LACV Fault Diagnosis pages.
Nov-2024	F	22	Add S-26773 air spring.

Actual product performance may vary depending upon vehicle configuration, operation, service and other factors.
All applications must comply with applicable Hendrickson specifications and must be approved by the respective vehicle manufacturer with the vehicle in its original, as-built configuration.
Contact Hendrickson for additional details regarding specifications, applications, capacities, and operation, service and maintenance instructions.

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