TECHNICAL MANUAL

TRAILER SUSPENSION MAINTENANCE MANUAL

LIT NO: 97117-161
DATE: August 2024 **REVISION:** F

HENDRICKSON
The World Rides On Us™

TABLE OF CONTENTS

CONVENTIONS APPLIED IN THIS DOCUMENT

This section explains the techniques used in this document to convey important information, safety issues and how to contact Hendrickson Asia Pacific.

Explanation of Signal Words

Hazard signal words (such as WARNING or CAUTION) appear in various locations throughout this publication. Information accented by one of these signal words must be observed at all times. Additional notes are utilised to emphasise areas of procedural importance and provide suggestions for ease of repair.

The following definitions indicate the use of safety signal words as they appear throughout the publication.

⚠ **WARNING**: Indicates hazards or unsafe practices which could result in severe personal injury or death.

⚠ **CAUTION**: Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE: Indicates hazards or unsafe practices which could result in damage to machine or equipment.

IMPORTANT: An operating procedure, practice or condition that is essential to emphasise.

⚠ Safety alert symbol used to indicate a condition exists that may result in personal injury or harm to individuals. It will be applied to WARNING and CAUTION statements, which emphasise severity.

Document Links

This document includes links that can be utilised when viewed electronically. Links within the document are identified by black underlined text, whereas links to external websites are identified by blue underlined text.

GENERAL SERVICE NOTES

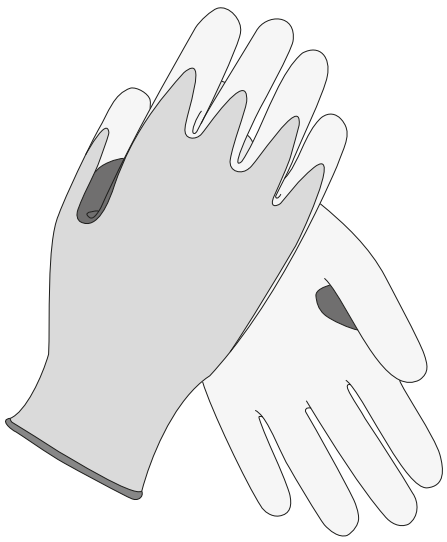
Before commencing work, you must read, understand and comply with:

- All instructions and procedures.
- All signal word (CAUTION and WARNING) statements to help avoid personal injury or property damage.
- Company's maintenance, service, installation and diagnostic practices.
- Vehicle manufacturer's safety instructions when working on the vehicle.
- Vehicle manufacturer's instructions for recommended practices not described in this manual.
- Local precautionary and Work Health and Safety (OH&S) regulations.

During Service

- Work must be conducted by trained personnel.
- Sudden release of tensioned springs (e.g. the spring brake part of the brake chamber, brake return spring or air spring) may cause injury.
- Use recommended tools only.
- Before releasing trailer back into service, perform operational checks and test the trailer to make sure systems and components are working correctly.

Hendrickson reserves the right to make changes and improvements to its products and publications at any time. Consult the Hendrickson website for the latest version of this manual at www.hendrickson.com.au.



Protective gloves are essential

IMPORTANT SAFETY NOTICES

NOTICE: The following safety notices are in general nature only. Please refer to the recommendations of the workplace safety authority in your country, state, territory or municipality for recommendations that are more thorough and advice on regulations that may also apply.

Proper maintenance, service and repair is important to the reliable operation of the suspension system and components. The procedures recommended by Hendrickson and described in this publication are methods of performing inspection, maintenance, service and repair.

The warnings and cautions should be read carefully to help prevent personal injury and to assure that proper methods are used. Improper maintenance, service or repair can cause damage to the vehicle and other property, personal injury, an unsafe operating condition or void the manufacturer's warranty.

Carefully read, understand and follow all safety related information within this publication.

⚠ **WARNING**: Do not modify or rework parts. Use only Hendrickson authorised replacement parts. Use of substitute, modified or replacement parts not authorised by Hendrickson may not meet Hendrickson specifications and will void warranty. It can also result in failure of the part, loss of vehicle control and possible personal injury or property damage. Do not modify parts without written authorisation from Hendrickson.

⚠ **WARNING**: Always wear proper eye protection and other required PPE (personal protective equipment) when performing vehicle maintenance, repair or service.

⚠ **WARNING**: Solvent cleaners can be flammable, poisonous and can cause burns. To help avoid serious personal injury, carefully follow the manufacturer's product instructions and guidelines and the following procedures:

- Wear proper eye protection.
- Wear clothing that protects your skin.
- Work in a well-ventilated area.
- Do not use petrol or any other highly flammable solvents to clean parts.

⚠ **WARNING**: Hot solution tanks or alkaline solutions must be used correctly. Follow the manufacturer's recommended instructions and guidelines carefully to help prevent personal accident or injury.

⚠ **CAUTION**: A mechanic using a service procedure or tool which has not been recommended by Hendrickson must first satisfy himself that neither his safety nor the vehicle's safety will be jeopardised by the method or tool selected. Individuals deviating in any manner from the provided instructions assume all risks of consequential personal injury or damage to equipment.

NOTICE: When welding to or on the axle, take every caution to prevent bearing damage. When grounding welding equipment to the axle, take precautions to stop current from passing through the wheel bearings. A connection that places a wheel bearing between the ground cable connection and the weld area can damage the bearing by electric arcing.

Brake Linings

⚠ **CAUTION**: Brake linings contain non-asbestos fibres. Wear approved eye protection and respirator when working on or near the brakes to prevent a possible health hazard.

⚠ **WARNING**: Avoid creating dust. Dust from brake pads and/or parts may be hazardous to the respiratory system.

The following precautions and considerations should be applied when handling these materials:

- Compressed air or dry brushing should never be used for cleaning brake assemblies or work area.
- Hendrickson recommends that workers doing brake work should take steps to minimise exposure to airborne brake lining particles. Proper procedures to reduce exposure include working in well ventilated area, segregation of areas where brake work is done, use of local filtered ventilation systems or use of enclosed cells with filtered vacuums.
- Workers should wash before eating, drinking or smoking; shower after working and should not wear work clothes home. Work clothes should be vacuumed and laundered separately without shaking.
- While Hendrickson does not offer asbestos brake linings, brake linings supplied by others may contain asbestos. Follow workshop, local, state and national safe practices as appropriate.

DOCUMENT PURPOSE

The purpose of this document is to provide detailed Preventative Maintenance guidelines for Hendrickson trailer suspensions. These guidelines must be used in conjunction with other relevant documents, such as the trailer manufacturer's recommendations and the National Heavy Vehicle Inspection Manual, available from the Australian National Heavy Vehicle Regulator (www.nhvr.gov.au).

Scheduled maintenance offers a key element for the safe operation of your vehicle, and with a comprehensive maintenance program supports the reduction of unexpected downtime and provides a warranty safeguard.

The trailer manufacturer is responsible for the correct installation and alignment of the suspension system in line with Hendrickson specifications, and all daily post and pre-trip inspections and maintenance requirements should be conducted as outlined by the trailer manufacturer.

The information contained in this document provides the scheduled intervals for the Hendrickson trailer suspensions based upon either time or kilometres travelled (whichever comes first) for trailers sold and operating in Australia.

The maintenance schedule requirements are broken down and described in the following areas:

1. Daily Based Service and Inspections (Driver)
2. Distance-Time Based Service (Qualified Technician)

Additional literature is available on the Hendrickson Australia website, www.hendrickson.com.au, which details system and component specific service information, parts list and technical publications and manuals. These must be used as reference material in conjunction with this preventative maintenance document.

Descriptions and specifications in this document were in effect at the time of publishing. Hendrickson reserves the right to make changes to the information without notice.

IMPORTANT: This document includes minimum inspection requirements for normal on-highway applications. For trailers subjected to off-road, abnormally rough or extreme conditions, inspection and lubrication should be adjusted to ensure maximum suspension performance and integrity.

NOTE: The frequency at which inspections are recommended is based on an average trailer usage of 180,000 km per year. Higher usage or service operating conditions require more frequent inspections.

REFERENCE DOCUMENTS

The following Hendrickson documents provide important service information and are referred to at various points in this manual. Available Trailer Suspension Literature may be accessed in bulletin 97117-311. Alternatively, you can use the following links.

97117-250 – Wheel End Maintenance

97117-251 – Trailer Suspension Torque Specifications

97117-273 – CONNEX™ ST Drum Steerable Maintenance

97117-296 – Disc Brake Steerable Maintenance

L427 – TFB™ Pivot Bush Replacement Procedure

L459 – Setting Trailer Ride Height

L579 – Trailer Suspension Alignment Procedures

T72009 – MAXX22T™ ADB Installation & Procedures

L1009 – Loose Axle S-Cam & Air Chamber Bracket Repair

97117-101 – Hanger Repair Procedure

97117-187 – Lift Axle Control Valve Procedures

T51002 – TIREMAAX™ PRO Service Procedures

97117-129 – TIREMAAX PRO-LB Installation & Service

Another useful document is the Australian National Heavy Vehicle Inspection Manual from the Australian National Heavy Vehicle Regulator.

MAINTENANCE INTRODUCTION

The basic concept behind maintenance is to prevent vehicle breakdown and to minimise overall costs. Many Australian fleets are adopting servicing models to comply with the Maintenance Management module of the National Heavy Vehicle Accreditation Scheme (NHVAS). The main purpose businesses in Australia have of joining this scheme is usually increased mass limits (concessional mass limits) along with removing the need for a certificate of inspection for annual registration renewal. However, when correctly implemented, it will also reduce costs, minimise vehicle down time and improve safety.

While the NHVAS is usually seen as the standard that businesses should meet, smart operators will do more and implement Condition-Based Maintenance (CBM). CBM predicts the wear rate, life cycle of vehicles systems along with a risk factor to determine when and how to service components. The basic principle of CBM is already being used to a limited degree in many fleets. Most operators will be able to tell you how long some components, such as tyres or brake shoes, will last in a specific vocation. So, they will plan ahead to replace or service that component once a trailer gets to that mileage. Just as component damage and breakdowns are a waste of money, so is over-servicing.

Expected component life varies significantly depending on a number of variables. Driver competence, mileage, manufacturer, equipment level and vocation all play a role in maintenance requirements. For example, Hendrickson HXL7 trailer wheels ends will travel 1.2 million kilometres with only simple regular inspections, while some other wheel ends require rebuilding every 12 months.

If you have only a few vehicles or trailers, it may be possible to set up a spreadsheet with your chosen factors. However, computer programs and web-based software can add automation, functionality and details that are not possible with more basic methods, as well as the ability to deal with larger fleet numbers. The primary objective should be to keep maintenance to the minimum required to ensure your equipment performs at peak efficiency to suit your business, vocation, and application. This will keep costs to a minimum and reduce downtime, both for maintenance and for breakdowns.

Hendrickson INTRAAX® axles are another important part of a fleet operators' goal of reducing maintenance costs. This is due to several key factors:

- Simple, functional design with fewer parts that results in fewer parts to wear out
- QUIK-ALIGN® suspension alignment fasteners allow for fast and easy axle realignment without welding or special tools
- TRI-FUNCTIONAL™ Bushes that improve ride and handling, and are proven technology for extended periods of trouble-free service
- No U-bolts that could fail or require regular torquing
- Brakes can be fully serviced without removal of hubs
- Hendrickson Extended Life wheel bearing systems

NOTICE: Steerable, HT, TOUGHLIFT™ suspensions and TRLAXLE® employ axle U-bolts that need to be checked for correct torque at regular intervals.

AVOIDING PENCIL INSPECTIONS

Pencil inspection is a term sometimes used to describe when a technician uses a pencil to tick off a maintenance checklist, without correctly conducting the required maintenance inspection. Pencil inspections are a common cause of component failure and breakdowns. Everybody involved in maintenance of vehicles needs to understand the importance of spending suitable time and effort maintaining vehicles. It is not just the technicians that need to understand this. Enough time needs to be allocated by workshop management to conduct the needed work. If this is not considered, people will cut corners and eventually there will be a disastrous failure.

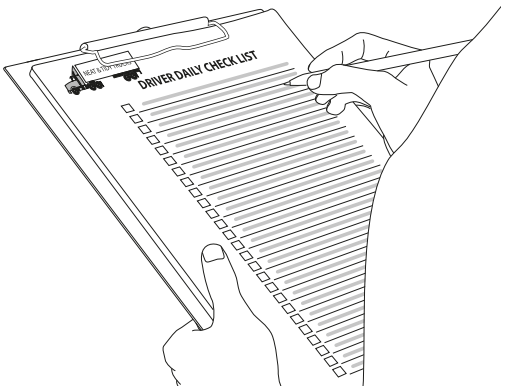


Figure 1: **Checklists Must Be More Than Tick the Box**

PREVENTIVE MAINTENANCE GUIDE

Refer to the "Suspension Maintenance Schedule Matrix" on page 10 for the complete service schedule. Refer to 97117-169 for an expanded service matrix with separate service schedules.

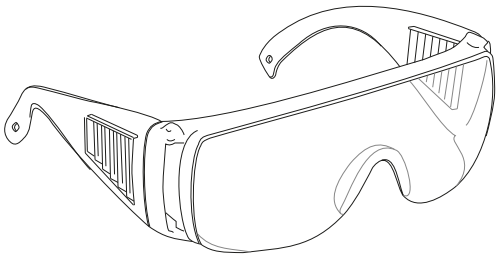
IMPORTANT: This document includes minimum inspection requirements for normal on-highway applications. For trailers subjected to some off-road, abnormally rough or extreme conditions, inspection and lubrication should be adjusted to ensure maximum suspension performance and integrity.

IMPORTANT: Workshops, transport businesses and drivers need to check or service more items than are listed in this suspension service schedule. This includes things like lights, reflectors, couplings, load doors and mudflaps.

Items that need inspection will vary depending on application, such as reefer, grain tipper or live bottom. Therefore, each business is responsible to create its own suitable service and driver checklists.

NOTICE: Torque specifications are available in Hendrickson Manual 97117-251.

⚠ **WARNING**: Always wear proper eye protection and other required PPE (personal protective equipment) when performing vehicle maintenance, repair or service.



LUBRICATION POINTS AND FREQUENCY

There are few areas requiring lubrication for Hendrickson suspensions and axles. These areas include tie rod ends, kingpins (steer axle), brake adjusters, S-cam spider bushes and support bearing journal or cam tube. Each requires NLGI #2 EP chassis lubricant and should be replenished regularly.

Apply grease when components are unloaded; brakes must be released, and steer axles must be off the ground. Always apply grease until fresh lubricant appears at purge point.

INSPECTION

Recommended inspections should be conducted at periodic intervals and must also be carried out any time the suspension is damaged or otherwise functioning improperly.

This schedule is based on normal on-highway average annual trailer distance of 180,000 km. Inspection intervals will need to be adapted to suit trailer distance and operating conditions. Inspections should be carried out at the time or mileage intervals specified, whichever occurs first.

Areas to Inspect

A general inspection should include any point on the suspension where suspected wear or damage may occur.

Inspection/Lubrication Intervals

Periodic intervals listed in "Suspension Maintenance Schedule Matrix" on page 10 and noted in this document for inspection and lubrication should be modified according to trailer use. Inspection and lubrication may be required more often if:

- Required by OEM
- Required by component vendor
- Trailer type and application demands are high
- Impact or other evidence of suspension damage

Inspection Depth

There are only four inspection and service levels mentioned in this schedule, but inspection depth will vary depending on who and when the inspection is conducted.

For example, the daily driver inspection requires briefly checking that there are no noticeable air leaks, no components are damaged or loose and the trailer appropriate for its next trip. At a monthly service inspection, the technician will need to have a closer look at the trailer systems and components to ensure that it can safely operate until the next service. Likewise, the three-monthly and 12-monthly services each require deeper and more though inspections to ensure trouble free and safe trailer operation.

Pre-Delivery

Pre-Delivery Inspections (PDI) are typically required by the trailer OE to be conducted prior to new trailer delivery to the customer. It includes testing suspension and vehicle for proper operation. This should also be performed by a repair facility after replacing a suspension or axle/beam weldment.

Daily

This pre-operation inspection can detect worn, broken or loose parts before any serious problems occur. During a walk-around, check for any obvious problems or abnormalities.

First Service (before 15,000km)

This inspection is to be carried out after the trailer has been in service, but no later than 15,000km.

15,000km (Monthly)

This inspection is more comprehensive than the daily inspection and covers more areas. Seals, hubcap and hubcap gaskets should be checked for condition and potential leaks. This is to be carried out at 15,000km or monthly intervals, whichever occurs first.

Brake adjusters should be checked for free stroke and applied stroke. Do not manually adjust auto brake adjusters.

Steer axle tie rod ends and should be lubricated monthly, as should kingpins for disc brake steerable suspensions.

45,000km (Quarterly)

Perform quarterly inspections listed. This is to be conducted at 45,000km or quarterly intervals, whichever occurs first. Along with other checks, hubs must be inspected for smooth rotation. If the bearings feel rough, sound noisy or do not rotate freely, do not place the suspension back into service.

Tie rods, kingpins, S-cam spider bush and support bearing journal or cam tubes should be greased at this time, and also during any other service when grease points are easily accessible.

180,000km (Yearly)

Perform yearly inspection as listed. This is to be carried out at 180,000km or yearly intervals, whichever occurs first.

The yearly service is similar to the 45,000km, but increases depth of service. It includes service of conventional bearings, lubricating brake adjusters, along with other checks such as thorough TIREMAAX, brake and suspension systems inspection.

PREPARING TRAILER FOR SERVICE

IMPORTANT: Do not repair a suspension or any component that is under warranty without first contacting Hendrickson Customer Service.

⚠ **WARNING**: To prevent serious eye injury, always wear safety glasses when performing trailer maintenance and service.

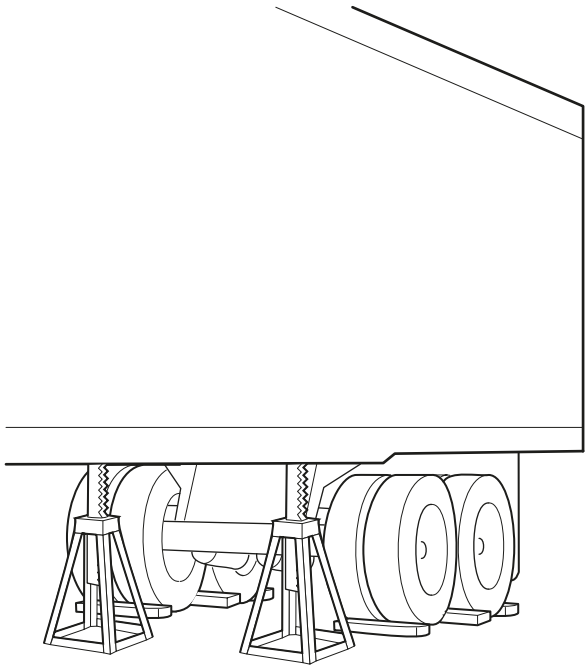


Figure 2: **Trailer Preparation**

Before beginning any work on a trailer suspension system, the following steps help to ensure conditions are safe. Refer to "General Service Notes" on page 4.

1. Park the trailer on a level, debris-free surface.
2. Set the trailer parking brakes.
3. To prevent the trailer from moving, chock the wheels of an axle not being raised.
4. Exhaust the air from the trailer suspension.
5. Release the trailer parking brakes.
6. Raise trailer with a jack until un-chocked wheels clear the work surface.
7. Support the raised trailer with suitable load-rated safety stands. Refer Figure 2.

⚠ **WARNING**: Do not work under a trailer supported only by jacks. Jacks can slip or fall over, resulting in serious personal injury.

SUSPENSION MAINTENANCE SCHEDULE MATRIX

System			Technician					Driver
Time/mileage, whichever occurs first.			Pre-Delivery Inspection	15,000km First Inspection	15,000km (Monthly) Inspection	45,000km (3 Monthly) Inspection	180,000km (12 Monthly) Inspection	Daily Visual Inspection
Tyre Pressure Control Refer to page 93	Tyre Pressures		🔧	👁	👁	🔧	🔧	👁
	TIREMAAX™ PRO System Pressures						🔧	
	TIREMAAX PRO Hoses & Connections		🔧	👁	👁	👁	🔧	👁
	TIREMAAX PRO System & Warning Lamp		👁	👁	👁	👁	🔧	👁
Wheel End Refer to page 20	Wheel Studs & Nuts		👁	🔧	👁	👁	👁	👁
	Inner Hub Seal Lubricant Leak Check			👁	👁	👁	👁	👁
	Hubcap Integrity & Leaks		👁	👁	👁	👁	👁	👁
	Hub Smooth Rotation			🔧		🔧	🔧	
	Hub Temperature – Post Operation			🔧	🔧	🔧	🔧	👁
	Lubricant Level – Oil Filled Hubs		👁	👁	👁	👁	👁	👁
	Conventional Hubs – Clean, Inspect, Lubricate & Set End Play						🔧	
	Wheel End Sensor/Monitor (where fitted)			👁	👁	👁	👁	👁
	Hubodometer (where fitted)		👁	👁	👁	👁	👁	👁
Fixture to Trailer	**Pivot Connection** Refer page 68	QUIK-ALIGN® Pivot Bolt	👁	👁	👁	🔧	🔧	👁
		TFB™ Pivot Bush				👁	🔧	
		Wear Washers				👁	👁	
	Hangers – refer page 77		👁	👁		👁	👁	👁
Suspension System	Fasteners & U-Bolts – refer 97117-251		👁	👁	👁	🔧	🔧	
	Trailing Arms		👁	👁			👁	
	Axle, Connections & Welds		👁	👁		👁	👁	👁
	Axle Breather Vent – refer page 96			👁		👁	👁	
	Air Springs – refer page 78		👁	👁	👁	👁	🔧	👁
	Shock Absorbers – refer page 72		👁	👁	👁	👁	👁	👁
	Shock Absorber Mounting & Fasteners		🔧	🔧	👁	🔧	🔧	👁
	Aux. Rebound Limiter/Straps – page 76		👁	👁		👁	👁	👁
	UBL Lift Kit (where fitted) Refer page 90	Fasteners	🔧	👁	👁	🔧	🔧	
		Welds	👁	👁		👁	👁	
		Lift Bag/Leaks	👁	👁		🔧	🔧	
		LACV & Pressure Regulator	👁	👁		👁	🔧	

LEGEND

👁 Visual Inspection	Lubrication Point	🔧 Physical Check / Adjustment / Torque / Operation / Leak Check

NOTE: For further details refer to "Preventive Maintenance Guide" on page 8 & trailer torque manual 97117-251. Refer to 97117-169 for an expanded matrix with separate service schedules.

Suspension Maintenance Schedule Matrix continued...

System			Technician					Driver
Time/mileage, whichever occurs first.			Pre-Delivery Inspection	15,000km First Inspection	15,000km (Monthly) Inspection	45,000km (3 Monthly) Inspection	180,000km (12 Monthly) Inspection	Daily Visual Inspection
Brakes	**Brakes General**	Dust Shield – page 52	👁	👁	👁	👁	👁	👁
		Air Line Routing & Leaks	👁	👁	👁	🔧	🔧	👁
		ABS Sensor – page 52	👁	👁	👁	👁	👁	
	Brake Chambers Refer to page 47 and page 61	Security & Fasteners	🔧	👁	👁	👁	🔧	👁
		Surface Damage		👁	👁	👁	👁	👁
		Clamp Ring Security	👁	👁	👁	👁	👁	👁
		Clevis Assembly	👁	👁	👁	👁	👁	
	Drum Brake System Refer to page 22	Drums			👁	👁	👁	
		S-Cam	👁	👁	👁	👁	👁	
		S-Cam Bushes & Tube	👁 💧	👁	👁	👁 💧	👁 💧	
		S-Cam Radial/End Play					🔧	
		Brake Adjuster	🔧 💧	👁	🔧	🔧	🔧 💧	
		Brake Shoe Lining			👁	👁	🔧	
		Anchor Pin Bushes					👁	
		Brake Shoe Springs					👁	
	Disc Brake System Refer to page 58	Rotor		👁	👁	🔧	🔧	
		Calliper & Fasteners	👁	👁	👁	👁	👁	
		Brake Pads			👁	🔧	🔧	
		Pad Retaining Springs		👁	👁	👁	👁	
		Running Clearances	👁	👁	👁	👁	👁	
		Guide Pin Cap/Adjuster Boot		👁	👁	👁	👁	
		Guide Pins & Piston Boots			👁	👁	🔧	
Air System Refer to page 80	Ride Height Check – refer page 86		🔧	🔧		🔧	🔧	
	Height Control Valve – refer page 82		👁	👁	👁	👁	🔧	👁
	All Air Line Fittings		👁	👁	👁	👁	🔧	👁
	Dump Valve (Where fitted)						🔧	
Self-Steer Axles Refer to Drum brake 97117-273 Disc brake 97117-296	Tie Rod Ends & Clamps		👁 💧	👁	🔧 💧	🔧 💧	🔧 💧	
	Drum Brake Kingpin Bushes & Arm Pivots		👁 💧	👁	👁	🔧 💧	🔧 💧	
	Disc Brake Kingpin Bushes		👁 💧	👁	👁 💧	🔧 💧	🔧 💧	
	Lock Straight Assembly or Dampers		👁	👁	👁	👁	👁	
	Lock Straight Air Spring & Chamber		👁	👁		👁	🔧	
Suspension	Overall Axle & Suspension Condition		👁	👁			👁	

👁 Visual Inspection	💧 Lubrication Point	🔧 Physical Check / Adjustment / Torque / Operation / Leak Check

AFTER IDLE TIME OR POST-FLOOD SERVICE

If there is any doubt about the serviceability of any components, then it is best to disassemble, analyse and inspect to avoid costly breakdowns or component failure. Refer to Table 1 on page 13.

Idle Time

Trailer suspensions not operated (idle) for prolonged periods of time must be inspected prior to renewed operation or production installation (e.g. Manufacturing outside storage, trailer used for storage at dock or in parking areas, etc.).

Normally, machined surfaces (bearing races, bearings, etc.) are protected by lubricant flowing onto, over and around during use. Lack of trailer motion causes lubricants to flow downward and away from these surfaces until it reaches a level pool in the hub. Metal surfaces are eventually unprotected and exposed to the environment. Seals and gaskets not exposed to lubricant can degrade in performance. Check and replace as needed.

Surface cracks on rubber components do not normally affect performance.

Flood

Oil and water do not mix. Lubricants continue to seek a level state, even while under water. All metal surfaces, wires and materials that are directly exposed to moisture, pollutants and other contaminants can lead to rust and corrosion.

⚠ **CAUTION**: Flood waters are often contaminated with bacteria or other organisms that may be harmful to human health. Wear gloves and other necessary safety equipment when working on trucks or trailers that have been affected by floods. Any waste such as water, tainted grease or sludge must also be managed and disposed of appropriately.

Figure 3: **Flood Waters Cause Out of Sight Component Damage**

Recommended Checks	Idle Time	After Flood [2]	Comments
Air springs [2]	👁	👁	Inspect while aired up at ride height.
Drum Brakes [1] [2]	🔧	🔧	
Air Disc Brakes [1] [2]	🔧	🔧	If submerged, replace calliper assemblies, otherwise inspect for contamination and check function.
Brakes, Brake chamber actuator [2]	🔧	🔧	If submerged, replace brake chamber actuator.
Bush tubes	👁		
Bush tube spacers	👁		
Air line hoses, tubing, fittings, valves, etc... [2]	🔧	🔧	Pests and insects will enter and nest in any small opening. Seals and gaskets can dry and become non-functional.
Obvious signs of damage or wear	👁	👁	
Shock absorbers	👁	👁	Refer to "Shock Absorbers" on page 72.
Wires, electrical connections and connectors		🔧	If submerged, disassemble, clean and apply dielectric grease during assembly.
Contamination [3]		👁	Where critical, remove all contaminants.
Lubrication Points [3]	🔧 💧	🔧 💧	Ensure lubricant is fresh and moisture free at all grease fittings.
S-cam and cam tubes	🔧 💧	🔧 💧	
Smooth wheel bearing rotation	🔧		If submerged, bearings will need to be disassembled for inspection and replacement of lubricant, seals & gaskets.
Clean, inspect & repack wheel bearings. Replace hub seals, gaskets and lubricant.		🔧 💧	Mandatory after flood, as needed after idle. Inspect axle interior and remove any existing moisture. If any moisture present, replace spindle filter and plugs with new.

Table 1: **After Idle Time & Post Flood Service Recommendations**

NOTES:

[1] If drum or ADB rotor contact surface is corroded following flood and being submersed for any length of time, they must be replaced.

[2] All systems should be operationally checked and tested.

[3] Replacing lubricant purges any collected moisture and/or degraded lubricant.

LEGEND

👁 Visual Inspection	💧 Lubrication Point	🔧 Physical Check / Adjustment / Torque / Operation / Leak Check

SUSPENSION IDENTIFICATION

Suspension identification should begin with the easiest and most obvious features first. Beginning with hubcaps, suspension design type and then collecting details from the identification and build tags. After the base suspension is established, further details may be gained from the applicable individual parts list, which are available on the hendrickson.com.au website.

Checking Hubcaps & Pivot Connection

The first identifying item that you will notice when looking at a trailer will be the hubcaps.

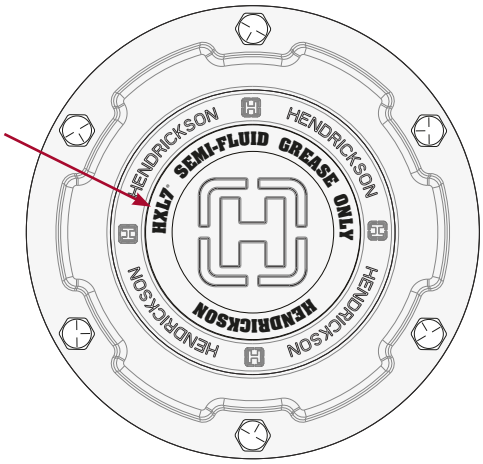


Figure 4: **Identifying Hendrickson Wheel End by Hubcap**

Hubcaps on Hendrickson axles will usually be marked with the [H] logo coupled with an identifying label. The label will specify what type of wheel end is fitted to the axle, such as HXL5® or HXL7®. (Refer Figure 4.) If it is not a Hendrickson hubcap, then it is probably not a Hendrickson axle, but it may still have a Hendrickson suspension.

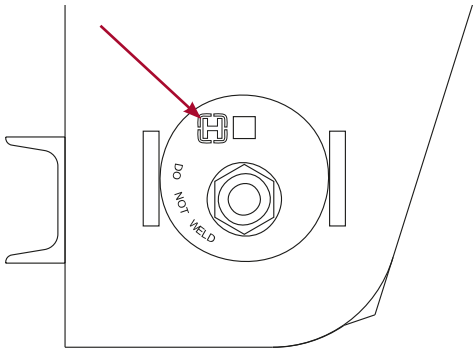


Figure 5: **QUIK-ALIGN® Pivot Connection**

Look at the front of the suspension, where it joins the hanger, and you should be able to identify the exclusive Hendrickson QUIK-ALIGN® pivot connection system. This system allows for quick and reliable wheel alignment and repair of suspension systems without welding. It will have an embossed Hendrickson [H] logo. Refer Figure 5.

INTRAAX® Identification

INTRAAX® axles have unique properties due to the integration of the axle and suspension, along with the benefits of the distinctive TRI-FUNCTIONAL™ Bush (TFB™). INTRAAX can be recognised by the axle passing through the suspension beams, while the Hendrickson HT suspension uses U-bolts and is welded to the axle.

Keep in mind that a Hendrickson loose axle may be fitted to another manufacturer's suspension, on the other hand, an HT suspension may be fitted with any type of loose axle. If it is not a Hendrickson INTRAAX integrated suspension, then there could be a mixture of components.

A Hendrickson loose axle can be identified by the hubcap (refer Figure 4) and when matched with a HT suspension will also have a QUIK-ALIGN pivot connection with the [H] logo on the locating washers (refer Figure 5).

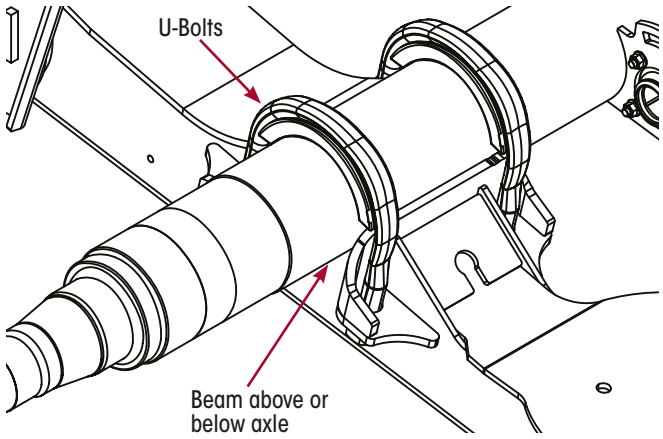


Figure 6: **Hendrickson HT Suspension**

On an HT suspension the beams are welded to the axle and have U-bolts securing the connection. (Refer Figure 6.) The beams will have Hendrickson identification tags and [H] branded QUIK-ALIGN hardware. (Refer Figure 5). The HT suspension will often, but not always, be mated with a Hendrickson loose axle. This is not an integrated INTRAAX suspension.

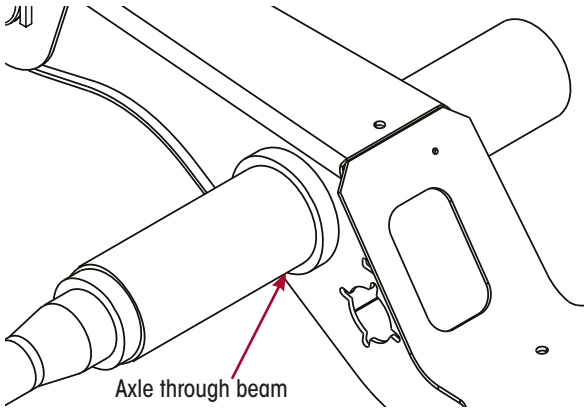


Figure 7: **Hendrickson INTRAAX® Integrated Suspension**

On an INTRAAX suspension the axle passes through the beams and is integrated into the suspension. It has no U-Bolts. This design ensures all suspension components are of greatest reliability, including having no U-bolts that need regularly checking. Refer Figure 7.

Pivot Bush Identification

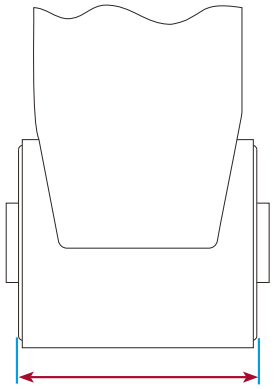


Figure 8: **Wide 6" (150 mm) bush for AAT, AAL, EDT, EDL & HT**

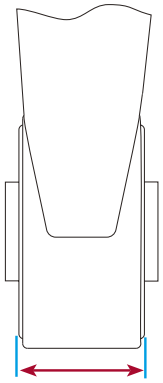


Figure 9: **Narrow 3" (75 mm) bush for AANT & AANL**

The final major INTRAAX identification feature is the width of the TRI-FUNCTIONAL bush.

- The standard (wide) bush is 6 inches (150 mm) wide, refer Figure 8.
- The narrow bush is 3 inches (75 mm) wide, refer Figure 9.

Top Mount or Underslung HT Identification

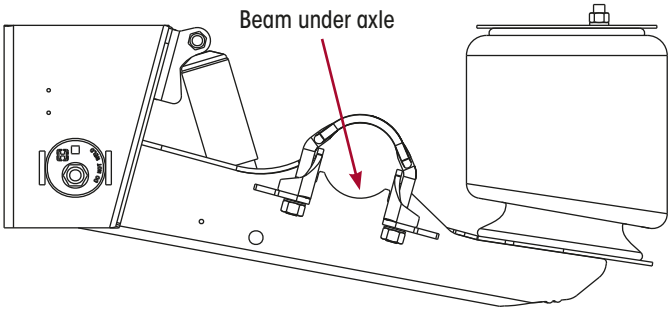


Figure 10: **Underslung HT Suspension (HT250U Shown)**

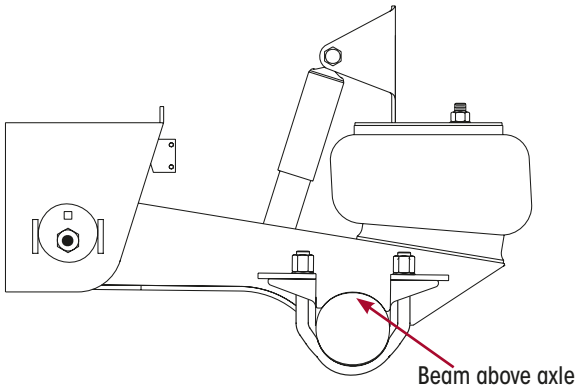


Figure 11: **Top Mount HT Suspension (HT230T Shown)**

Hendrickson HT suspensions will be either top mount (overslung) or underslung. Top mount places the beam over the axle; Underslung positions the beam under the axle. They are attached to the axle by means of U-bolts along with welding. Refer to Figure 10 and Figure 11.

Top Mount or Low Ride INTRAAX Identification

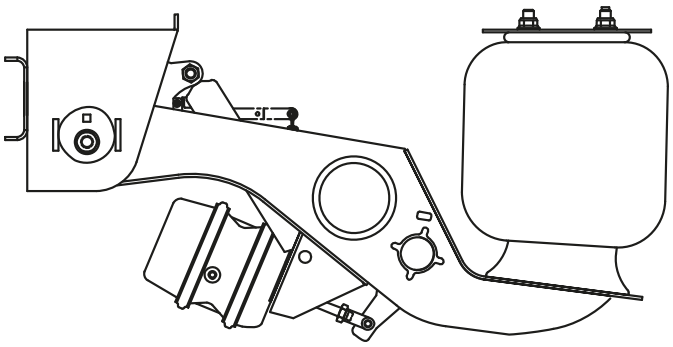


Figure 12: **Low Ride INTRAAX Suspension (AAL Shown)**

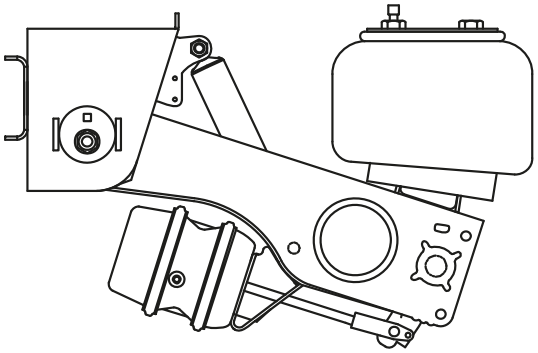


Figure 13: **Top Mount INTRAAX Suspension (AAT Shown)**

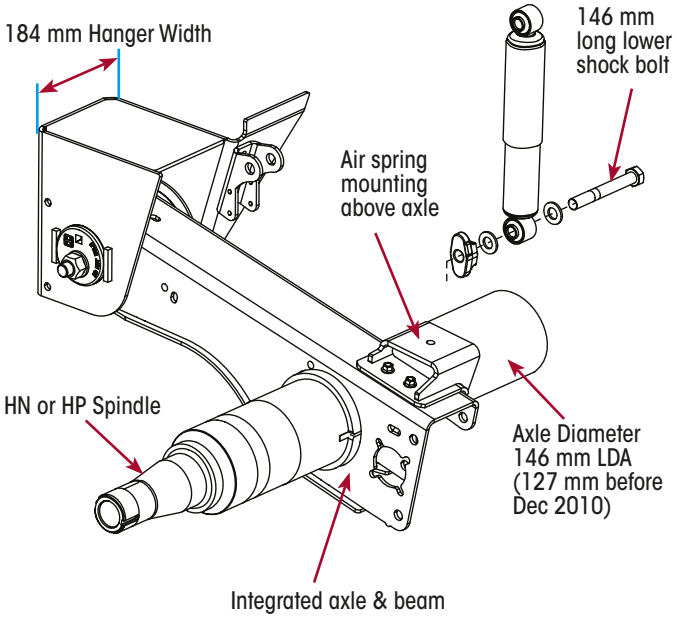
An INTRAAX suspension will be either top mount or low ride, depending on where the air spring mounts to the suspension. Top mount INTRAAX resemble an overslung suspension, whereas low ride INTRAAX are comparable to underslung. However, INTRAAX axles are unique because axles pass through the beams, rather than over or under, so they are not called overslung or underslung. Refer to Figure 12 and Figure 13.

Identifying INTRAAX® Model

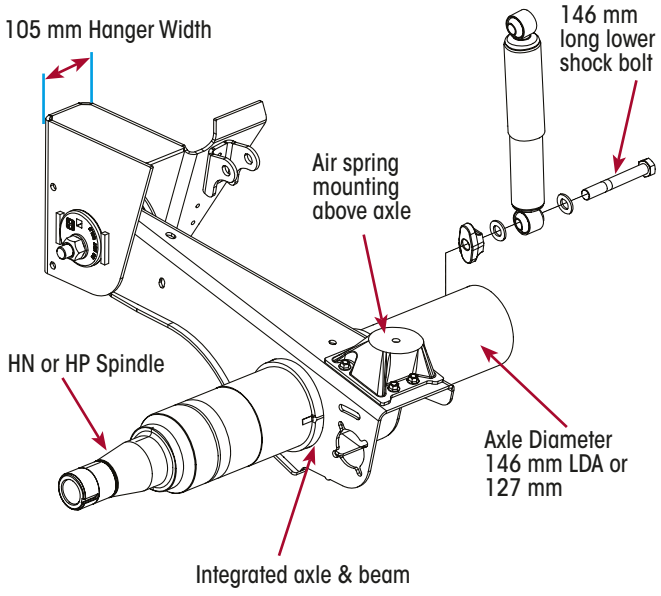
Other axle differences include axle diameter, track width, parallel (HP) or tapered (HN) spindles, shock or ZMD damping, load rating capacity and whether it is disc or drum brake. Types of brakes, hubs, bearings, slack adjusters and other variables may also be necessary, depending on the service work required. Australian Road Friendly suspension may include additional brackets for the lower shock absorber mount. Compare the suspension with the following illustrations to verify to suspension type.

INTRAAX Top-Mount Identification

AAT INTRAAX Top-Mount
AAT230, AAT250



AANT INTRAAX Top-Mount
AANT230



Identifying Axle Diameter

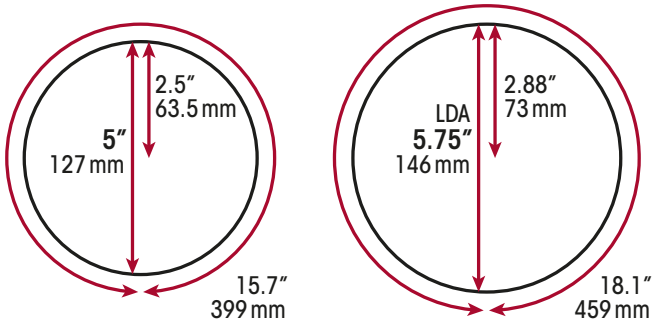


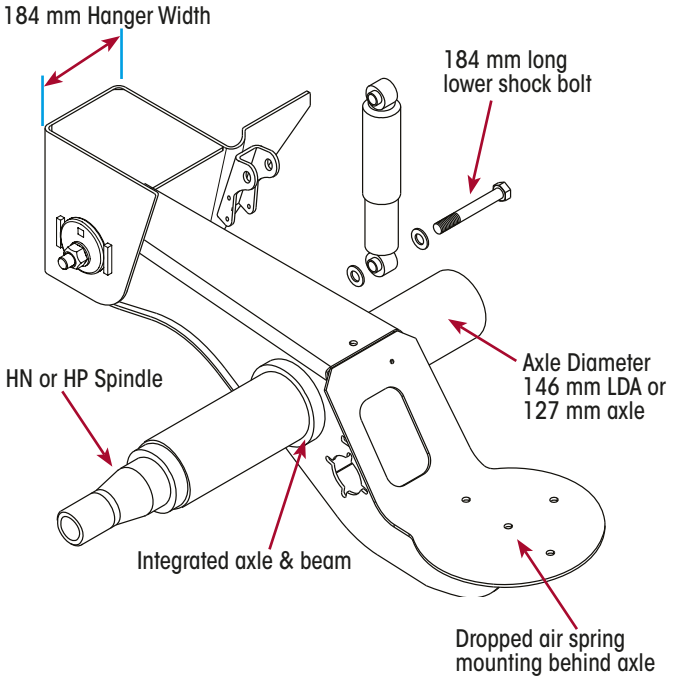
Figure 14: **Identifying Axle Diameter**

If unsure, it is easy to confirm axle diameter by measuring axle circumference with a tape measure. Refer Figure 14.

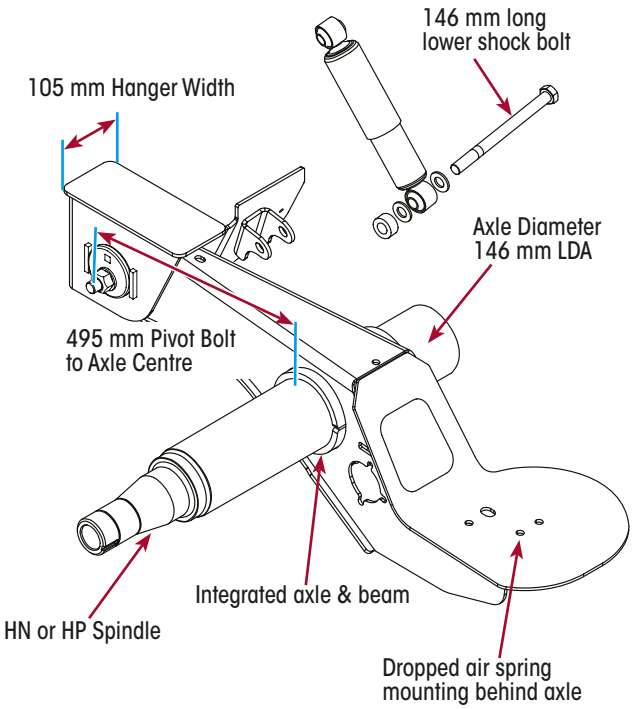
- 5″ (127 mm) axle has a circumference of 399 mm (15.7″) and a radius of 63.5 mm (15.7″).
- 5.75″ (146 mm) LDA axle has a circumference of 459 mm (18.1″) and a radius of 73 mm (2.88″).

INTRAAX Low-Ride Identification

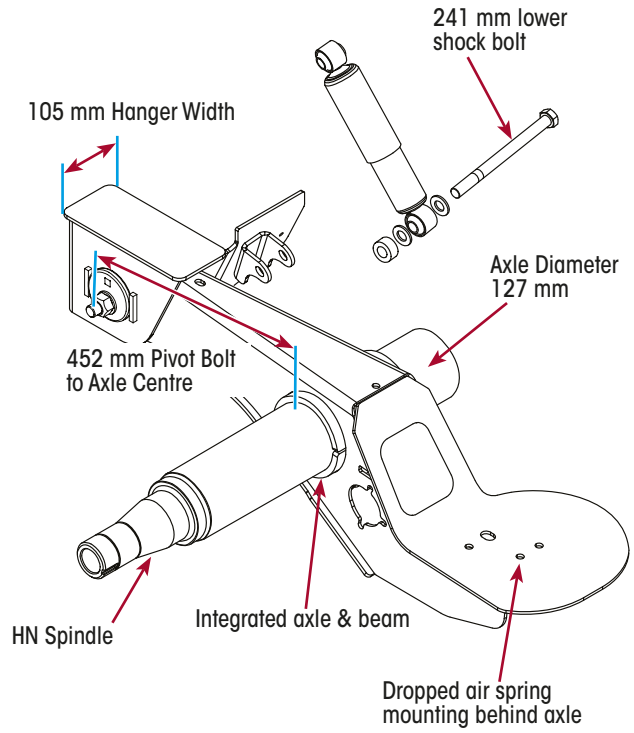
AAL INTRAAX Low-Ride
AAL230, AAL250



AANL INTRAAX Low-Ride
AANL230

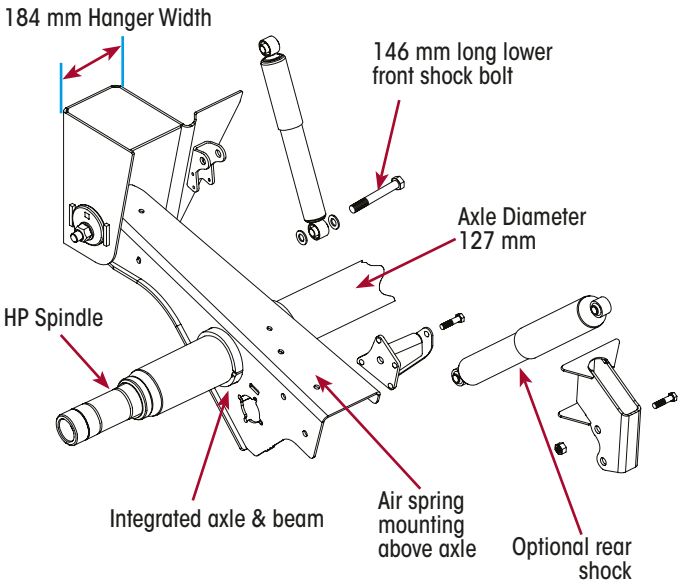


AANLS INTRAAX Short Beam Low-Ride (New Zealand)
AANLS200

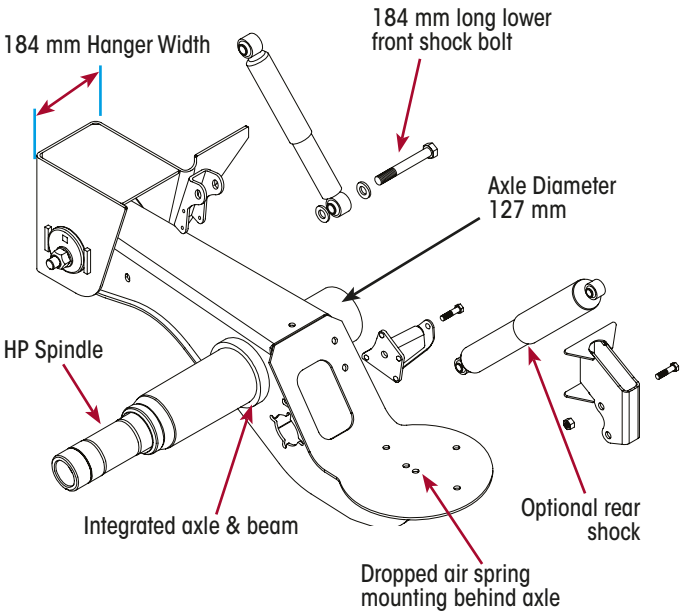


INTRAAX Extreme Duty Identification

EDT INTRAAX Extreme Duty Top-Mount
EDT300



EDL INTRAAX Extreme Duty Low-Ride
EDL300



IDENTIFICATION PLATES

To confirm identification or if more detailed information is required, refer to the identification plates that are attached to the suspension beams.

HT suspension: Both beams will have an ID plate.

INTRAAX suspension: The left-hand beam will have the identification numbers from the HALFTRAAX™ (bare axle). The right-hand beam will have the assembly number which will provide further details, such as suspension ride height and the assembly number which can be used to track finer details or variations if necessary.

SUSPENSION IDENTIFICATION PLATE

Figure 15: **Axle Identification Number Plate**

The suspension ID plate is usually located on the inboard side of the left-hand trailing arm and provides the following:

- Model
- Description
- Customer Part Number (if applicable)
- Axle Serial Number
- Axle Capacity

The serial number (e.g. SK1607220262) provides the following details:

Manufacturing Plant Identifier

The first two digits of the axle serial number identify the manufacturing plant that originally manufactured the suspension assembly. For example:

- SK – Somerset Kentucky
- LI – Lebanon Indiana
- CO – Canton Ohio

Date of Manufacture

The third to eighth digits of the serial number identify the date the suspension assembly was manufactured in date format: Year - Month - Date. For example, the code 160722 shows that it was manufactured on 22 July 2016.

Manufacturing Sequence Number

The final four digits (e.g. 0262) of the serial number provide the manufacturing sequence number.

SUSPENSION ASSEMBLY NUMBER PLATE

Figure 16: **Axle Assembly Number Plate**

The suspension assembly number plate is usually located on the inboard side of the right-hand trailing arm. It indicates that the suspension has been assembled in Australia and provides the following:

- Ride Height
- Assembly Part Number
- Date of Assembly

Assembly Number

The first six digits of the assembly part number identify the suspension system base model, while the remaining digits identify specific options such as wheel end and brake system configuration.

Refer to the following table for a five-level breakdown of the assembly number for INTRAAX and Steerable suspensions. For further details refer to the specific parts list for that suspension or axle.

Base Model Identification

Manufacturer (Digit 1)	TRI-FUNCTIONAL™ Bush Width (Digit 2)	Load Capacity (Digit 3 & 4)	Model (Digit 5)
H= Hendrickson	• N = Narrow – 3 Inch TFB (76.2 mm) • W = Wide – 6 Inch TFB (152.4 mm) • S = Steerable with Wide 6 Inch TFB (152.4 mm)	• 20 = 20,000 lbs (9,070 kg) • 23 = 23,000 lbs (10,430 kg) • 25 = 25,000 lbs (11,300 kg) • 30 = 30,000 lbs (13,600 kg)	• L = Low Ride • T = Top Mount

Table 2: **Base Model Identification**

RIDE HEIGHT PLATE

The ride height plate is usually attached to the trailer frame by the trailer manufacturer. It provides an additional means of identifying a Hendrickson suspension system, along with giving information about system ride height and road friendly certification number. Refer Figure 17.

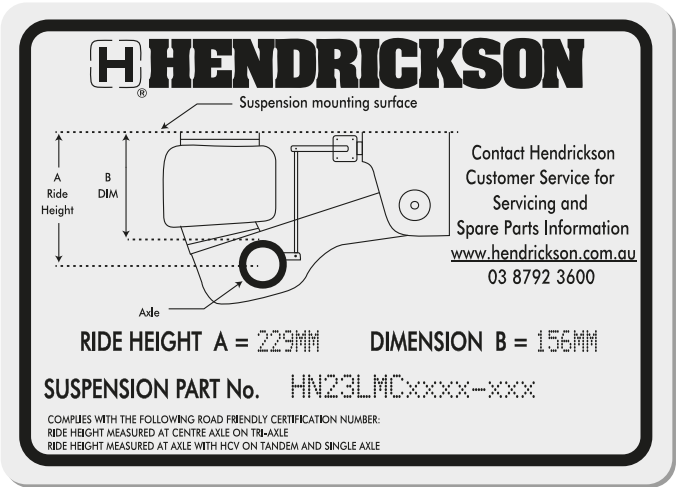
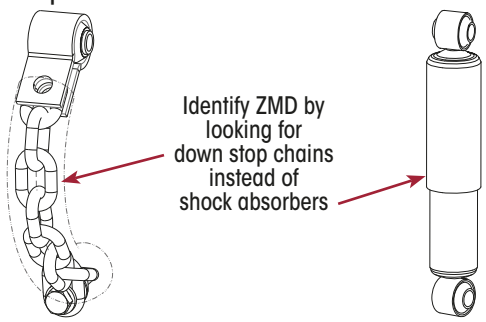


Figure 17: **Suspension Ride Height Plate**

ZMD™ Suspension Identification



Zero Maintenance Damping™ (ZMD™) suspensions use down stop chains and internally damped air springs to replace the function of standard shock absorbers. These suspensions can easily be identified by the installation of down stop chains instead of shock absorbers.

NOTE: There are other component changes and internal differences within the air springs. These cannot simply be interchanged with standard components. Refer also to "ZMD™ Suspension System" on page 79.

Spindle Identification

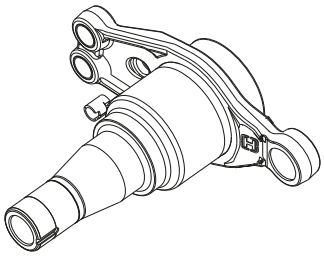


Figure 18: **HN Tapered Spindle**

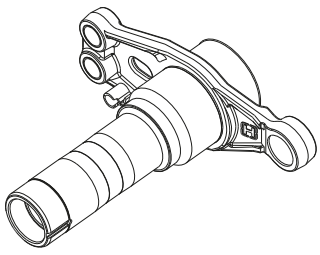


Figure 19: **HP Parallel Spindle**

Depending on specifications, Hendrickson suspensions and axles may be available with either HN (Tapered) or HP (Parallel) spindles. Refer Figure 18 and Figure 19.

WHEEL ENDS

Wheel end inspection and maintenance is described in Hendrickson technical publication 97117-250. Please refer to this document for further details regarding maintenance, service and inspection.

Keep in mind that trailer use and operating conditions vary greatly depending on vocation (type of work performed). Therefore, trailer wheel-end inspection and routine maintenance must be tailored for each vocational use. Off-road use, dirt, dust, grain, corrosive substances, temperature and humidity extremes will all have an impact on maintenance and inspection interval requirements.

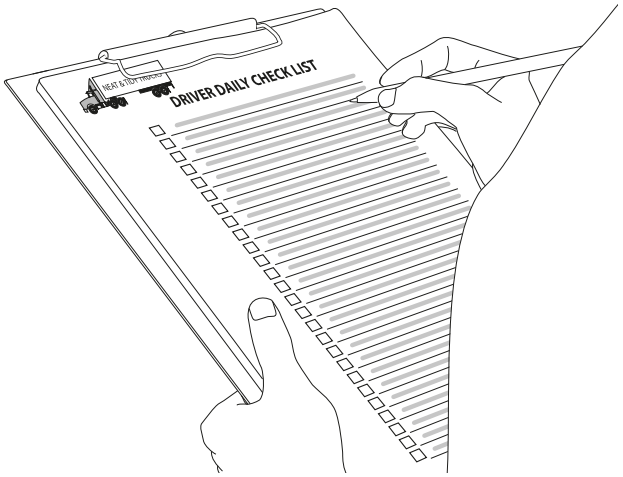


Figure 20: **Pre and Post Trip Check Lists Are Essential**

Operator/Driver Inspection

Hendrickson Asia Pacific recommended that the vehicle operator perform daily pre-trip and post-trip inspections of the wheel ends as an essential part of the routine preventative maintenance schedule. Refer Figure 20.

Pre-Trip Inspection

With the vehicle parked on level ground and with the park brake applied, walk around the vehicle and visually inspect each wheel-end assembly for any evidence of the following defects:

1. The presence of lubricant around the brake components, hubcap or on the inside of the wheel.
2. Loose, damaged or missing hubcaps.
3. Loose, damaged or missing fasteners.
4. If hubs are oil filled, check for adequate oil level.
5. Check wheel end sensors/monitors for fault status (if fitted).

If any of the above conditions are found, take the trailer out of service until the item can be repaired.

Post-Trip Inspection

Post trip inspection should be performed immediately after parking the vehicle (i.e. with the vehicle on level ground and with the park brake applied), walk around the vehicle and visually inspect each wheel-end assembly for the following items:

1. The presence of lubricant around the brake components, hubcap or on the inside of the wheel.
2. Loose, damaged or missing hubcaps.
3. Loose, damaged or missing fasteners.
4. Excessive hub temperature. (Refer Notice below.)
5. If hubs are oil filled, check for adequate oil level.
6. If fitted, check wheel end monitor status.

NOTICE: The most effective and safest way to check hub temperatures is with an infrared thermometer. Exact temperatures will vary depending on conditions but should be consistent across all the axles. However, the relative temperatures can also be checked simply by carefully placing the back of the hand against each hubcap. Do not touch hub if significant radiant heat indicates that the temperature is likely to burn. Refer Figure 21.

Temperatures should be reasonably consistent across all wheel ends. If an individual hub exhibits a significantly higher temperature in comparison to others on the trailer, a detailed inspection of the affected hub is required.

If any of the above conditions are found, the vehicle should be placed out of service until the item can be repaired.

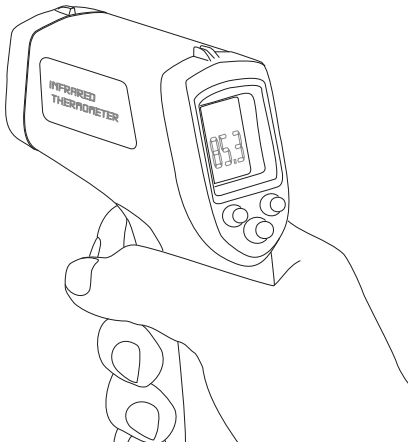


Figure 21: **If Possible, Use an Infrared Thermometer**

Maintenance Inspection

At regular intervals, the hub assemblies should be checked for seal leaks and smooth rotation. In addition to the intervals listed below, thorough inspections should be done at each brake reline, since the wheel end will be dismantled enough to easily make these inspections. Inspect wheel studs, clean hub/wheel mating surfaces and drum/wheel pilots whenever brake drums are removed. In addition to the inspection at brake service, always maintain current shop preventative maintenance as well as pre- and post-trip inspection practices.

Every Month

Visually inspect the back of hub and hubcap for hub seal and gasket leakage.

Every Three Months

Visually inspect the back of hub and hubcap for hub seal and gasket leakage. Check the hub for smooth rotation.

Every Twelve Months

Some wheel ends, notably those with standard lithium grease or those used in dusty off-road conditions, require regular rebuilding every year. If required by product or application, remove and disassemble the hub assemblies. Clean and inspect all components, replace as required. Replace seal and repack bearings with fresh lubricant.

NOTICE: This is a brief overview of the wheel end inspection and maintenance, which is described in detail in Hendrickson Wheel End Maintenance technical manual 97117-250. Please refer to this document for further details regarding maintenance, service and inspection.

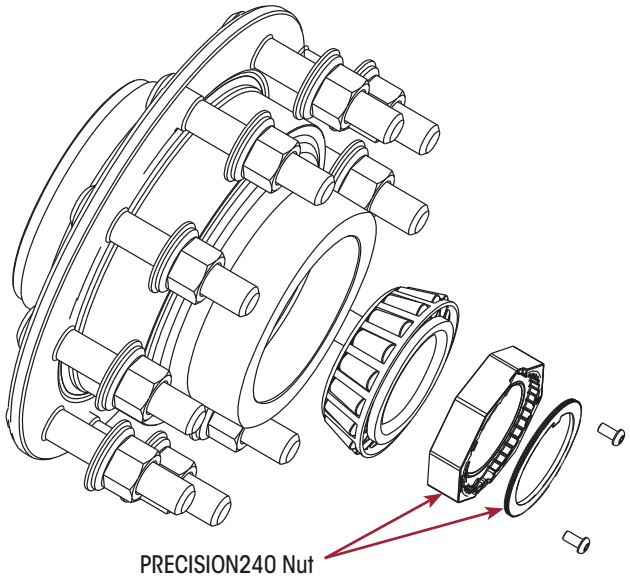


Figure 22: **Typical Wheel End Components**

DRUM BRAKES

Drum brakes are not as good at heat dissipation compared with disc due to their enclosed design. This allows more heat to build-up with repeated high-speed braking. However, drum brakes are better protected from dirt, dust and contamination from dirty environments, poor road conditions and off-road use.

NOTICE: Hendrickson outboard drum brakes are very quick and easy to service because there is no need to remove the hubs for brake service.

IMPORTANT: Brake hardware (such as brake shoe rollers, roller retaining clips and brake return springs) experiences fatigue during its normal use and may not have the same performance characteristics as new components. When conducting any major brake overhaul work, such as a brake reline, it is recommended that these components be discarded and not reused.

NOTICE: For details regarding loose trailer axle s-cam and brake chamber bracket replacement refer to Hendrickson service manual L1009.

Brake Wear & Temperature

Vehicles operating under extreme loads, such as trailers in mountainous regions or refuse vehicles in stop/start applications, can experience extreme spikes in brake temperatures of up to 370 degrees Celsius.

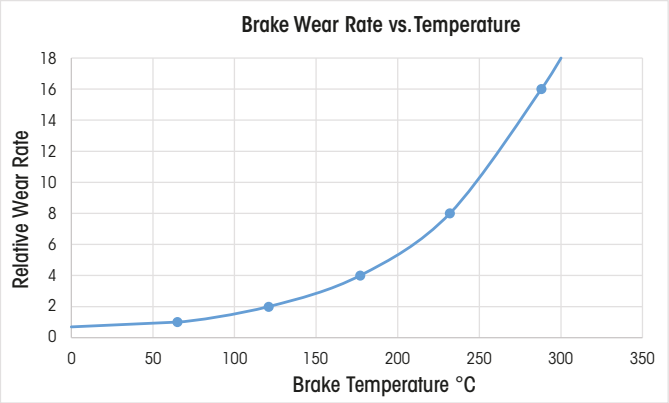


Figure 23: **Brake Wear vs. Temperature**

Application	Temperature °C
LOW DUTY – Prime mover-trailer in line-haul.	40 - 95
MEDIUM DUTY – Truck in inter-city area.	95 - 200
HEAVY DUTY – Prime mover-trailer in mountainous regions and refuse/ agitator trucks.	200 - 315
EXTREME – Temporary temperature spikes in refuse trucks or trailer in mountainous regions.	315 - 450

Table 3: **Typical Brake Temperature for Application**

Brake wear increases exponential to its operating temperature. For every 56 degrees Celsius increase in temperature lining wear doubles and brake life is cut in half. Refer to Figure 23 and Table 3.

Tools and Equipment

IMPORTANT: A calibrated torque wrench must be used to tighten fasteners to specified values.

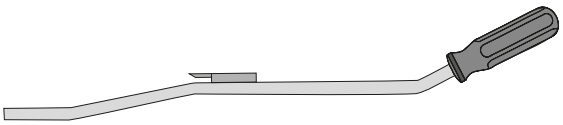


Figure 24: **Brake Spring Tool**

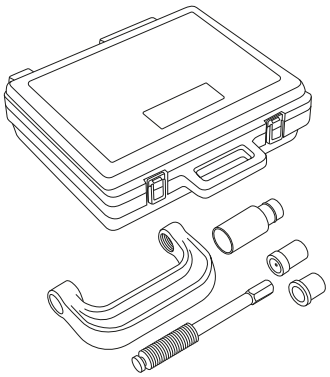


Figure 25: **Anchor Pin & Bush Tool**

A Brake Spring Tool (Figure 24) and Anchor Pin & Bush Tool (Figure 25) may be required during when carrying out some brake maintenance procedures. For more details refer to "Special Tools" on page 104.

INITIAL INSPECTION

1. With the parking brake applied, check each of the wheel hubs for signs of damage or lubricant leakage.
2. Check the brake chambers with brakes applied to see if any pushrod over-stroke indicators are showing. Refer Figure 97.
3. Remove both inspection grommets from backing plates and inspect brake lining depth thickness.

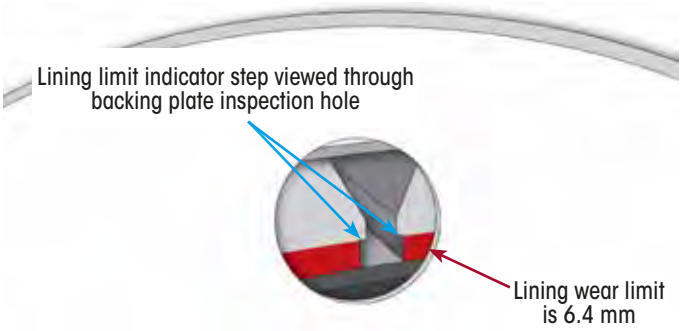


Figure 26: **Brake Inspection Through Dust Shield**

4. Hendrickson brake linings have an indicator step to show when the linings are due for replacement. Refer Figure 26.
5. Check each slack adjuster for free stroke and applied stroke as detailed under "Checking Free & Applied Stroke" on page 48. If there is excessive free stroke with an auto brake adjuster, do not simply adjust it out. Inspect and repair any issues with anchor stud, adjuster or foundation brake.

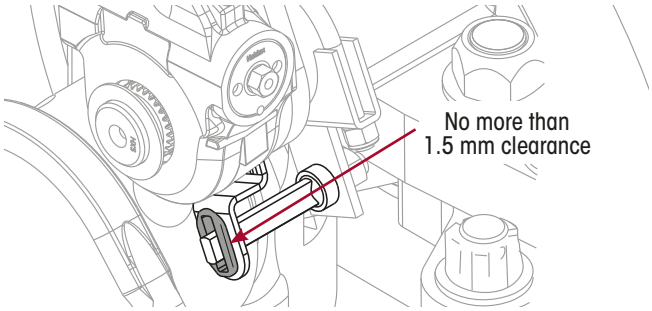


Figure 27: **Check Anchor Stud Clearance**

6. The anchor stud must be in close contact with the brake adjuster control arm for the self-adjustment mechanism to work properly and are designed to have no clearance when new. If the measured clearance is greater than 1.5 mm, the stud grommet needs to be replaced. Refer Figure 27.

Brake Inspection Criteria

NOTE: Brake inspection criteria Table 6 must be used in conjunction with the assessment information detailed in this manual.

Description	Specification
Brake Drum Oversize Diameter	3.05 mm[1] Maximum
Brake Lining Thickness	6.4 mm Minimum
S-Cam Axial (End) Play	0.1 to 1.6 mm
S-Cam Radial (Side) Play	1.5 mm Maximum
Slack Adjuster Anchor Stud Bush Play	1.5 mm Maximum
Anchor Pin Bush Radial Play	0.25 mm Maximum

[1] Refer to the maximum service diameter that is cast into the outside of all Hendrickson brake drums.

Table 4: **Brake Inspection Criteria**

BRAKE INSPECTION WITH DRUM REMOVED

1. Check lining wear and estimate remaining service life, depending on operating conditions and service intervals. Replace with new shoes or reline when thickness of lining is 6.4 mm at thinnest point, or 1.6 mm above rivet head. Replace any cracked, broken or oil-soaked linings immediately.
2. Check brake shoes for wear, corrosion, expanded rivet holes and friction material deterioration.
3. Remove brake shoes to complete thorough inspection.
4. Check anchor pins for wear and brake spider for cracks and excessive wear at anchor pin bushes.
5. Check S-cam brackets for damage, cracks or broken welds.
6. Check for brinelling, corrosion and wear of S-cam head surface and for wear at shoulder adjacent to S-cam washer.
7. Check the brake shoe springs and hardware are in good condition.
8. Inspect drums for scoring, cracks, heat spotting and wear. Measure inside diameter in several locations to check for oversize, bell-mouthing and out of round. Refer "Brake Drum Inspection" on page 24 for details.
9. Drums usually have a maximum machining tolerance of 2.3 mm (0.090") and a maximum oversize service diameter of 3.05 mm (0.120"). Refer to maximum service diameter that is cast or engraved onto all Hendrickson brake drums.

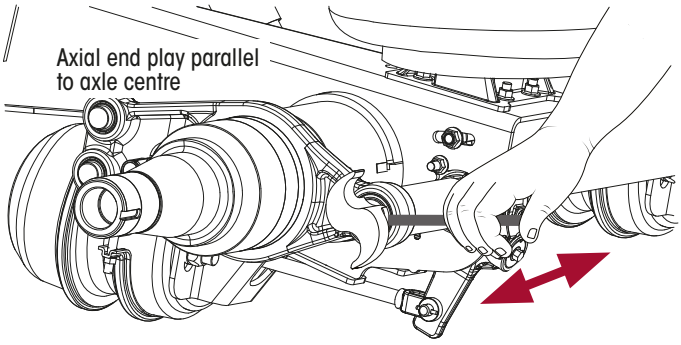


Figure 28: **Axial (End) Play 1.5 mm Maximum**

10. Check S-cam axial (end) play. Check S-cam axial (end) play. End play should be between 0.1 and 1.6 mm (0.005 to 0.060"). If end play is out of specification, correct it by removing the slack adjuster retaining ring (circlip). Add or subtract washers, as necessary. Refer Figure 28.
    Excessive axial end play reduces S-cam bush service life. Accordingly, it is good practice to adjust end play to minimum clearance without making it tight.

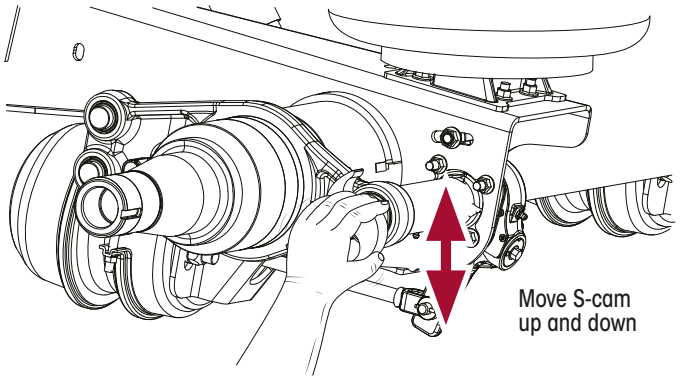


Figure 29: **Radial (Side) Play 1.5 mm Maximum**

11. Check S-cam radial play. Replace the bushes and seals it is more than 1.5 mm (0.060"). Check condition of S-cam bearing journal and replace if necessary. Refer Figure 28.

NOTE: Hendrickson INTRAAX S-cam tubes are quick and easy to service because they can be replaced without removing the hubs.

12. Check the dust shields for correct fitment, corrosion and damage.

BRAKE DRUM INSPECTION

Brake drums need to be in good condition for the trailer brakes to operate efficiently and safely. Therefore, inspection of the drums should be carried out at regular intervals, along with the remainder of the braking system.

Here are the most common conditions found when inspecting brake drums along with likely causes.

Excessive Wear

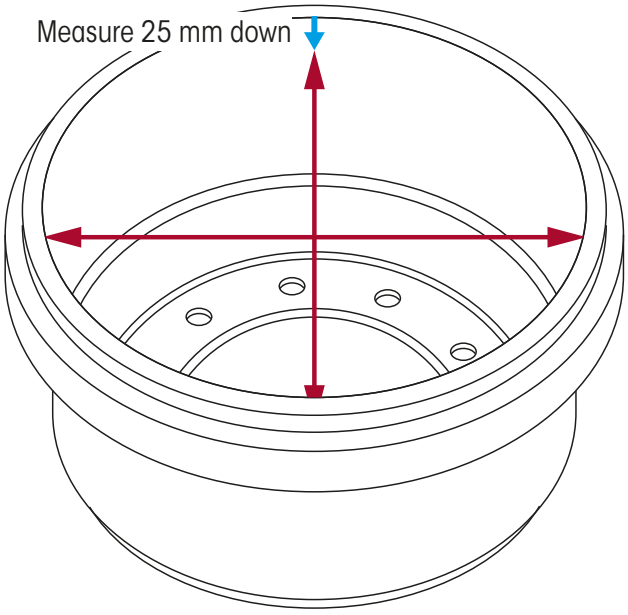


Figure 30: **Measuring Drum Wear**

Brake drums should be measured for diameter in two positions, 90 degrees apart, approximately 25 mm down from drum edge. Maximum allowed service diameter is usually marked on the outside of the drum. As a guide, this measurement is 3.02 mm larger than new diameter. Refer Figure 30.

If there are excessive brake vibrations or noise, drum can also be checked for runout. Mount drum onto hub without the backing plate. Install a lever style dial indicator to measure approximately 6 mm in from drum edge. Runout should not exceed 0.5 mm. If it does, it may be possible to resurface the drum, provided that after machining the drum does not exceed 1.1 mm less than maximum diameter. This is to ensure the drum does not exceed maximum diameter when in service.

Polished Drums

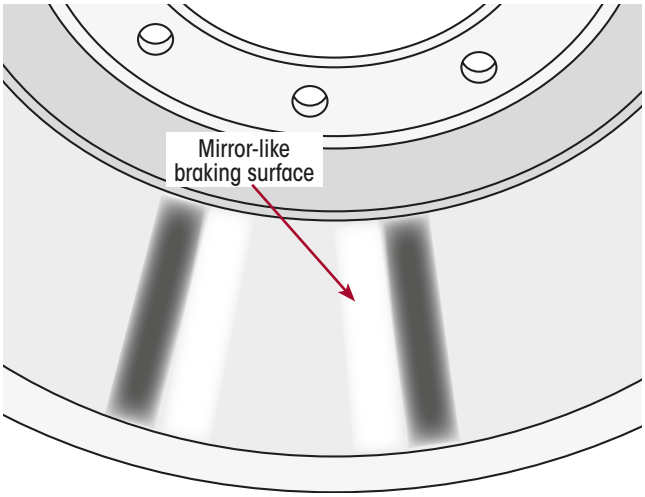


Figure 31: **Inspect for Polished Finish**

Braking surfaces with a polished mirror-like finish can prevent brakes from operating at maximum efficiency. Sand braking surface with an 80-grit emery cloth. Refer Figure 31.

Polishing can be caused by using improper brake linings or from lightly dragging brakes. Check and correct any of these conditions before placing trailer back into service.

Scored Drums

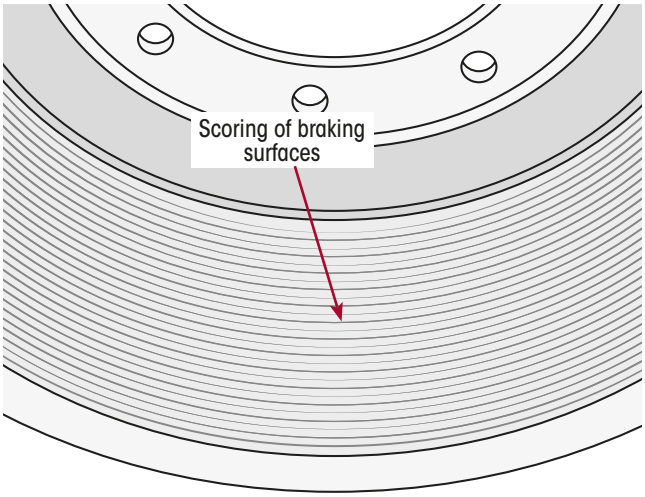


Figure 32: **Inspect for Scoring**

Scoring is identified by marked grooves across the braking surfaces. It is often accompanied by excessive wear to linings and drum. The drum should be replaced if drum exceeds maximum recommended diameter. Refer Figure 32.

Scoring can be caused by dirt or dust entering the braking system and becoming embedded into the brake linings. Depending on severity, linings can be cleaned with 80-grit emery cloth or replaced. Ensure dust shields are installed correctly, in good condition and the inspection grommets are fitted. It can also be caused by linings worn down to the rivets.

If new brake linings are being fitted to a scored brake drum, it may be possible to resurface the drum, provided that after machining the drum does not exceed 1.1 mm less than maximum diameter. This is to ensure the drum does not exceed maximum diameter when in service.

Grease-Stained Drums

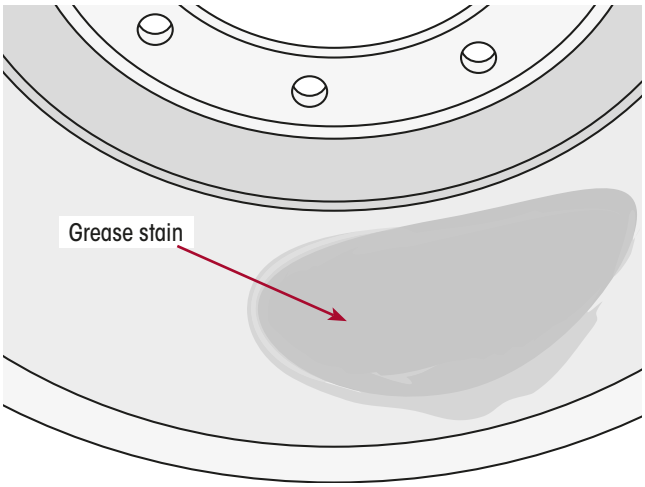


Figure 33: **Inspect for Grease or Oil Stains**

Grease or oil on the drum braking surface can be presented as a sticky film or dark carbon build-up. The drums may be cleaned with a suitable solvent. However, the drum will need replacing if unable to thoroughly clean up all residue. Any contaminated brake linings will need to be replaced. Refer Figure 33.

Grease or oil staining may be caused by leaking hub seals, over-greasing of S-cams or driving through contamination.

Heat-Checking

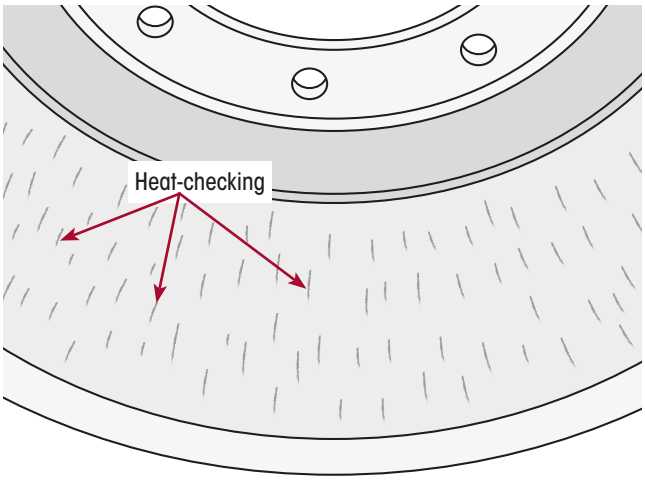


Figure 34: **Inspect for Excessive Heat-Checking**

Inspect for heat-checking, which is the development of fine hairline cracks on the braking surface. These normal cracks should be monitored to ensure that they do not exceed 1.5 mm in width or 3 mm in depth. Refer Figure 34.

These cracks are caused by the normal heating and cooling of the brakes.

Blue Drums

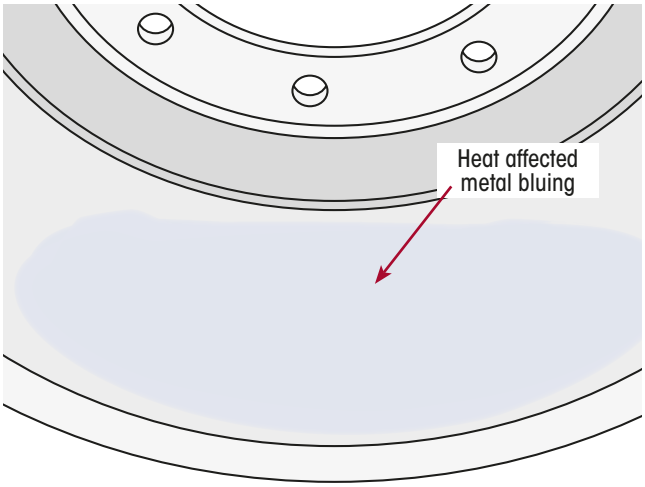


Figure 35: **Inspect for Metal Bluing**

Bluing of the drum is caused by excessive heat. The drum can continue to be used if there are no signs of martensite or cracking and is has not exceeded the drum maximum wear limit. Refer Figure 35.

This may be caused by brake system imbalance, continued quick stops, or a dragging brake. The cause of the overheating should be corrected before placing trailer back into service or it will progress to martensite or cracking. Other brake components should also be checked for possible heat damage.

Martensite Spotted Drums

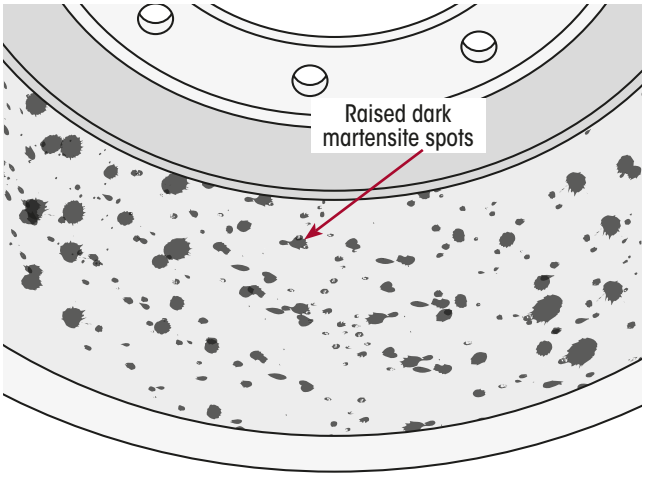


Figure 36: **Inspect for Martensite Markings**

Martensite is evident from hard, slightly raised dark coloured spots in the braking surface. It will present an uneven braking surface and cause brake pulsations and noise. Brake drums with martensite should be replaced. Refer Figure 36.

Martensite is caused by extremely high temperatures. Therefore, it may be due to improper braking techniques, a dragging brake or poor brake balance. These conditions should be checked and rectified before returning trailer to service.

Cracked Drums

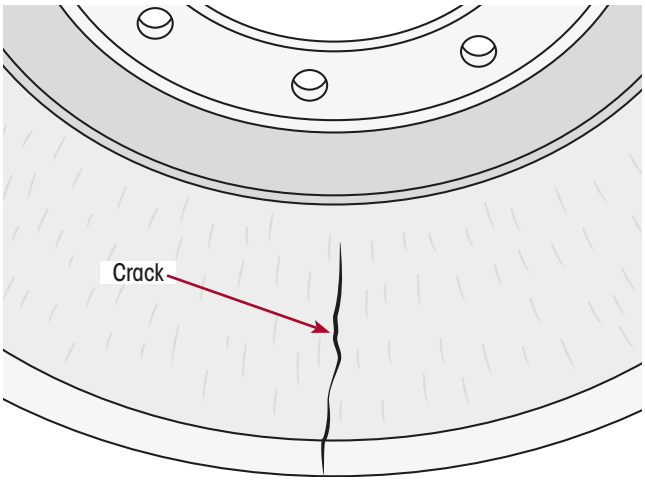


Figure 37: **Inspect for Cracks**

Inspect for cracks through the drum and around the flange and mounting holes. Replace drum if any are found. Refer Figure 37.

Cracks in the drum braking surface are usually caused by excessive heating and subsequent cooling of the drums and is often due to poor driver control. It can also occur if the parking brake is set on an excessively hot brake. Rough handling of new drums can cause similar cracking.

Cracking around mounting holes can be caused by improper drum mounting, loose wheel nuts, poor, uneven or dirty mounting surfaces or from heat stress. Refer to "Installing Brake Drum and Tyre/ Wheel" on page 54.

BRAKE SHOE & LINING INSPECTION

Brake shoes must have no cracks or broken welds. There must be no noticeable wear or elongation at anchor pin or roller seats. Shoes must not be stretched or twisted.

Brake shoe linings must be inspected for any faults, such as wear and cracks, which could be detrimental to the service life of the trailer. The following check items should be used a guide to inspection.

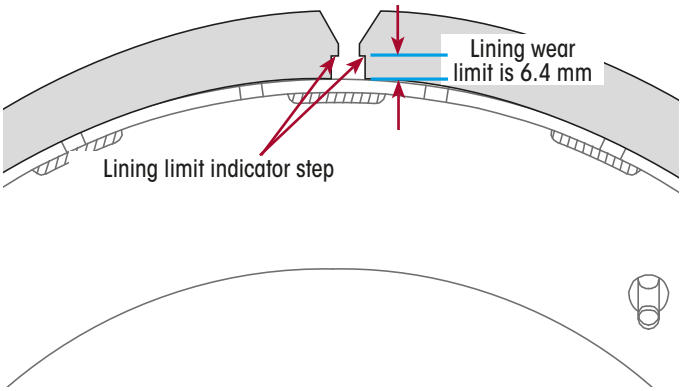


Figure 38: **Check for Lining Wear**

Lining thickness must be at least 6.4 mm in thickness and not worn down to the lining wear indicator step. Refer Figure 38.

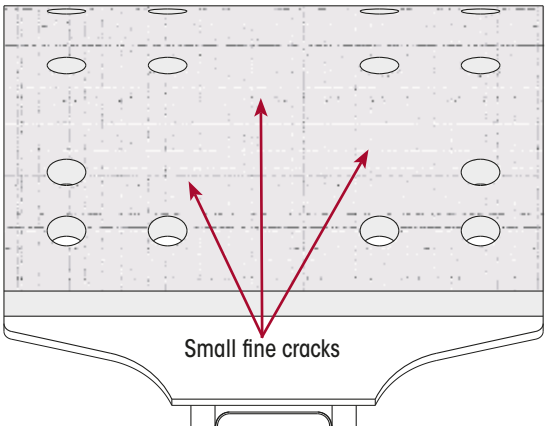


Figure 39: **Check for Acceptable Fine Cracks**

Small fine surface cracks are acceptable if they of minimal depth that could easily be removed with 80-grit emery cloth. Refer Figure 39.

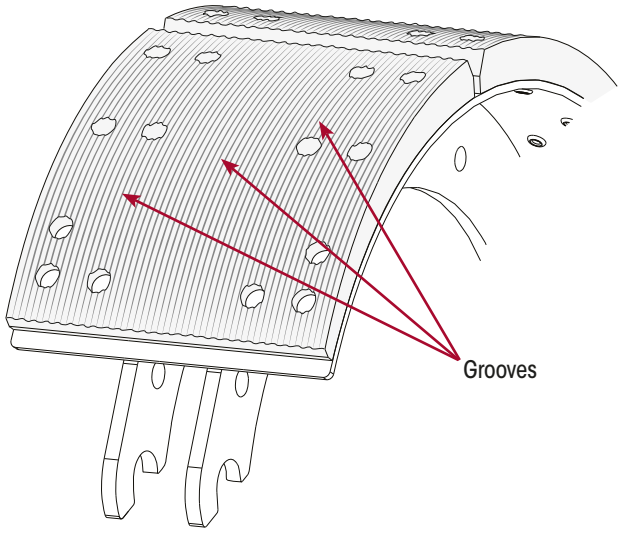


Figure 40: **Check for Grooving**

Grooves are generally caused by embedded dirt or dust in the lining. If there is still plenty of lining material left, they may be cleaned up with some 80-grit emery cloth. However, if there is little lining left before requiring replacement it may be better to replace the linings. The drums should also be checked for grooves. Refer Figure 40.

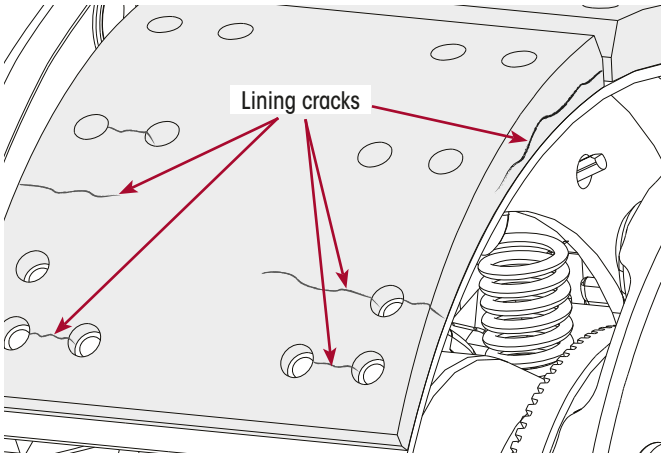


Figure 41: **Check for Unacceptable Cracks**

Linings should be checked for anything other than fine surface cracks. Replace the linings if there are cracks on the edge of the lining that exceed 1.6 mm in width or if there is a crack that exceeds 38 mm in length. Refer Figure 41.

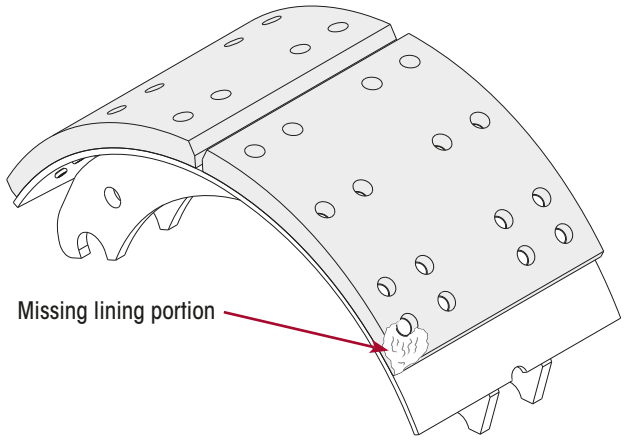


Figure 42: **Check for Missing Lining Portions**

Check for missing brake lining portions. Replace linings if a lining segment is missing that exposes a rivet when viewing the lining from the edge. Refer Figure 42.

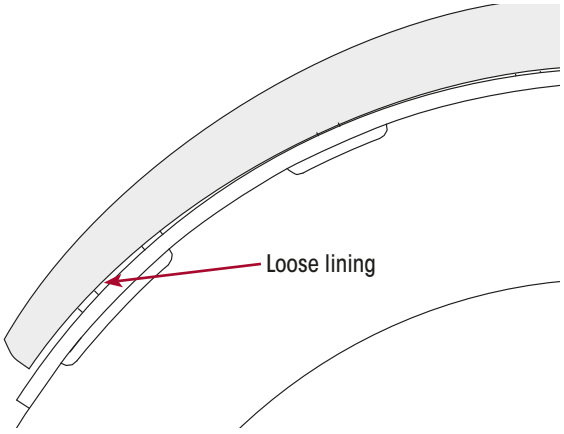


Figure 43: **Check Linings for Security**

Check to ensure the linings are tight against the brake shoes. Replace linings if a segment has 1.6 mm or more movement. Refer Figure 43.

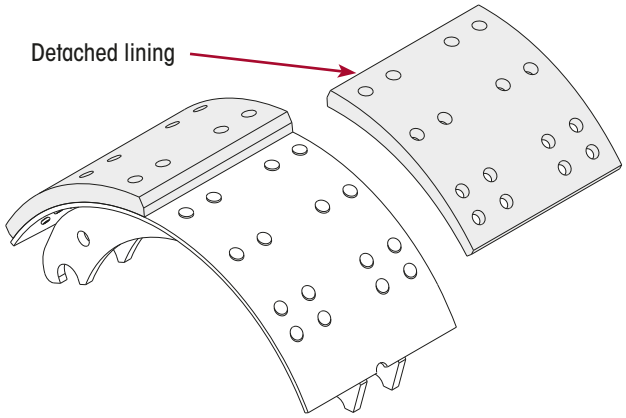


Figure 44: **Check for Detached Lining Segments**

A complete lining segment detached from the cam side of the shoe is usually due to repeated extreme brake applications. Replace linings and retrain driver. Refer Figure 44.

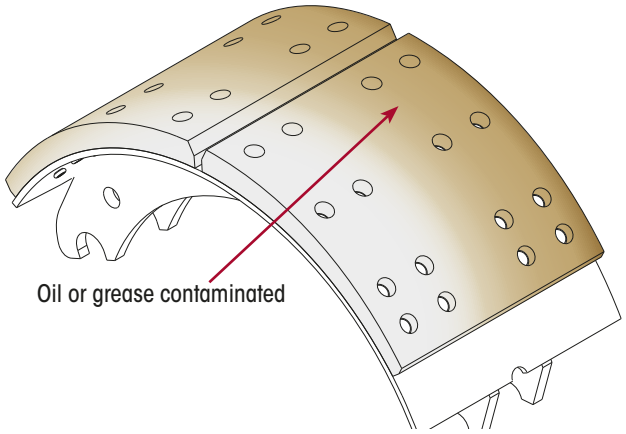


Figure 45: **Check for Oil or Grease Contamination**

Inspect for oil or grease contamination of the linings. The linings must be replaced if there is any sign of contamination. Brake drum should also be either cleaned or replaced, depending on the severity of the contamination. Refer Figure 45.

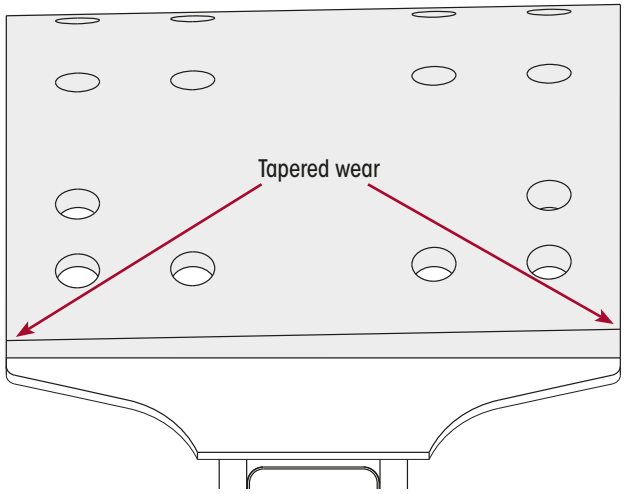


Figure 46: **Check for Uneven or Tapered Lining Wear**

Brake lining should be checked for uneven or tapered wear. Tapered wear usually indicates a bent brake spider or worn camshaft bushes. The cause of the tapered wear must be determined and rectified before replacing the linings. Refer Figure 46.

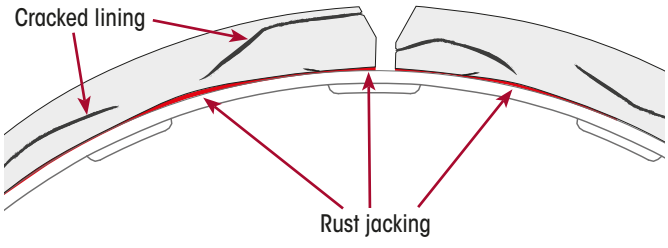


Figure 47: **Check for Rust Jacking**

Inspect for rust jacking, which is the formation of iron oxide that can push the lining away from the shoe. This

causes the lining to crack and break away. Rust jacking can be brought about by improper shoe preparation before installing new linings. It can also be due to operating in a harsh or corrosive environment. Both the lining and shoe should be replaced as an assembly to minimise re-occurrence. Refer Figure 47.

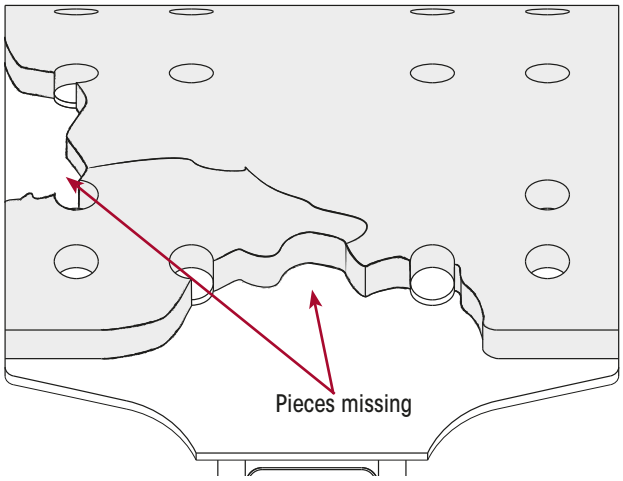


Figure 48: **Check for Missing Pieces (Chunking)**

Inspect for chunking, which is when large pieces of brake friction material break away from the lining. It is usually caused by thermal overloading of the brakes, which degrades the lining resin and allows the lining to break apart. Replace the linings, inspect the drums for heat damage, determine cause of excessive heat and, if necessary, retrain the driver. Refer Figure 48.

BRAKE SHOE PROCEDURES

Brake Shoe Removal

To gain access to the brake shoes:

1. Remove the tyre/wheel assembly.
2. Remove the brake drum.

NOTICE: In some instances, it may be necessary to slightly retract the brake shoes, so the drum can clear the brake shoe/lining assembly.

⚠ **WARNING**: It is critical that any brake drum reaching maximum wear diameter be considered unsafe and immediately replaced. To avoid severe injury or death, any brake drum exceeding this dimension is considered a safety hazard.

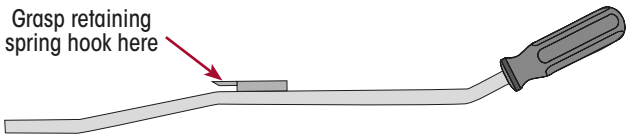


Figure 49: **Brake Spring Tool**

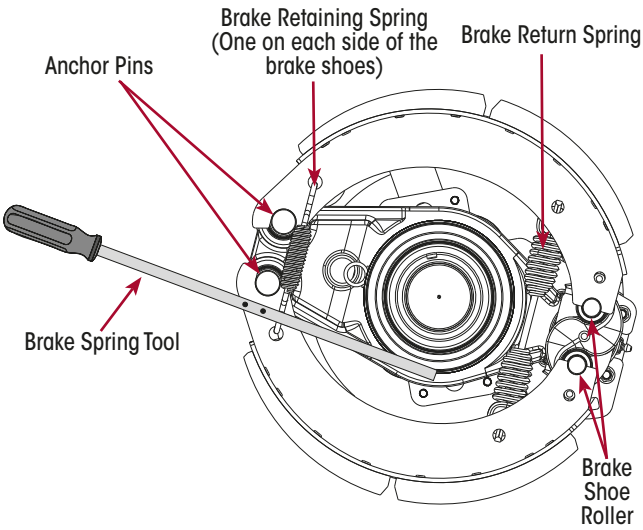


Figure 50: **Removing Brake Retaining Spring**

1. While manually supporting the lower brake shoe, use Brake Spring Tool (Figure 49) to unhook both brake retaining springs from the brake shoes. Take care not to damage the hub seal, spindle bearing or sealing surfaces. Refer Figure 50.
2. Pull the upper and lower brake shoes off the anchor pins. When free of the anchor pins, carefully pull the brake shoes away from the spider.

IMPORTANT: The brake return spring, brake shoe rollers and roller retaining clips will remain on the brake shoes during this procedure.

3. Discard the used brake hardware.
4. With the brake shoes off, inspect the S-cam and S-cam bushes for wear.

Brake Shoe Installation

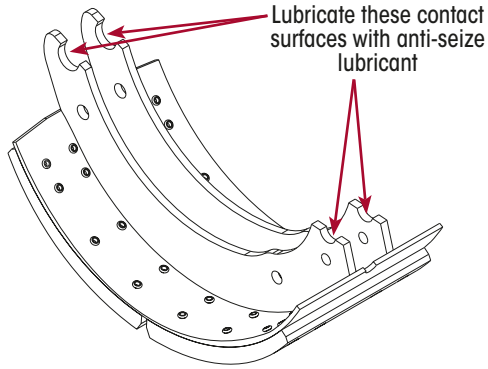


Figure 51: **Brake Shoe Contact Surface Lubricant Points**

1. Pre-lubricate brake shoe points as indicated in Figure 51.

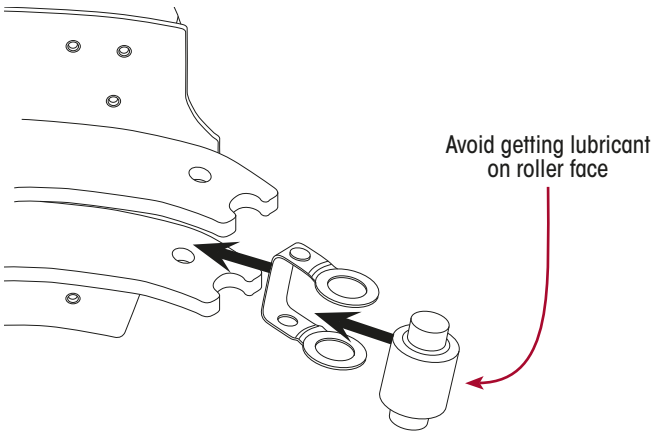


Figure 52: **Brake Shoe Roller & Clip Installation**

2. Lubricate roller ends with anti-seize compound, insert roller onto spring clip and install roller assembly into brake shoe. Refer Figure 52.

IMPORTANT: Lubricant is only desired on the ends of the brake shoe rollers. Avoid getting any lubricant on the middle of the rollers where they contact the S-cam or onto the brake linings.

3. Put the upper brake shoe in position, resting the brake shoe webs on the anchor pin.
4. Hook the brake return spring to the return spring pin in the upper brake shoe.
5. Attach the return spring to the lower brake shoe.

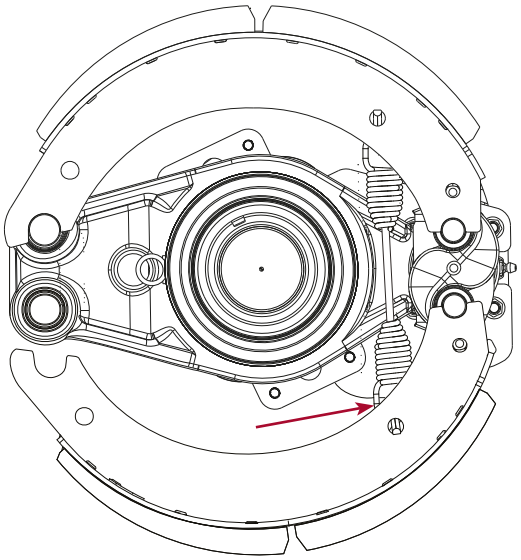


Figure 53: **Return Spring Installed onto Lower Brake Shoe**

6. With the lower brake shoe roller on the S-cam, swing the lower brake shoe into position over the anchor pins. Refer Figure 53.

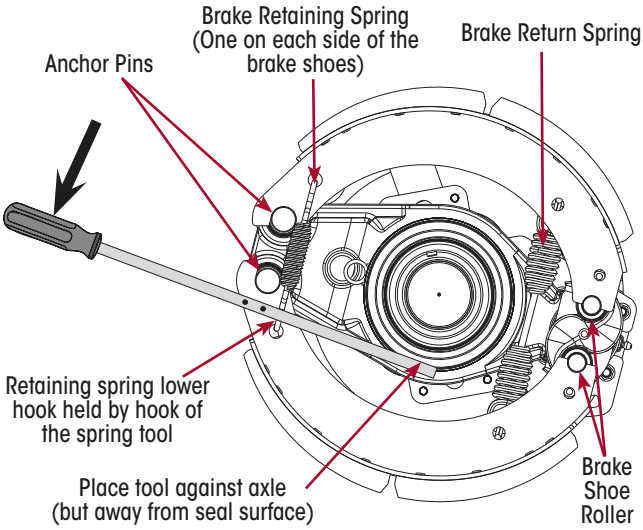


Figure 54: **Brake Retaining Spring Installation**

7. While manually supporting the lower brake shoe, use Brake Spring Tool to hook inner brake retaining spring onto the anchor end of the brake shoes. Take care not to damage the hub seal, spindle bearing or sealing surfaces. Refer Figure 54.
8. Repeat with outer brake retaining spring.
9. Give the retaining springs a gentle tap and visually check all three springs to ensure they are installed securely.
10. Install the brake drum and the tyre/wheel assembly. Refer to "Installing Brake Drum and Tyre/ Wheel" on page 54.

11. Set initial slack adjuster position by turning adjusting hex clockwise until the linings contact the brake drum.

12. Use slow steady force to turn adjusting hex back half a turn (180°) anticlockwise.

NOTICE: In normal brake operation there is no need to turn adjusting hex. Doing so more than is necessary could cause the self-adjusting clutch to fail prematurely.

NOTICE: If new brake linings and/or brake drum have been installed, they will need to settle in before a consistent stroke measurement is reached.

13. Rotate wheels to ensure the brakes do not drag.

NOTE: Raise wheels off the ground when adjusting brakes to ensure that they do not drag. New brake linings expand on first use, so it is especially important that they are checked for adequate clearance.

14. Check operation of brake chamber and slack adjuster.

BRAKE LINING RIVET PROCEDURES

NOTICE: It is highly recommended that brake shoes be replaced with complete Hendrickson assemblies due to convenience, cost and reliability concerns. Hendrickson processes ensure highly reliable components that resist loose attachment, rust jacking and chunking.

Lining Removal

1. Remove brake shoe rollers and clean any superficial dirt, dust and grease from brake shoe assembly.

2. Remove rivets holding lining to the shoe. Punching or drilling out the rivet centres is preferable to shearing, which may cause rivet holes to become distorted or oversize. Ensure drill or punch size is appropriate for rivet without enlarging or damaging the rivet hole.

3. Clean brake shoe of all grease, scale and rust.

Inspection

1. Inspect cleaned brake shoe for wear and distortion.

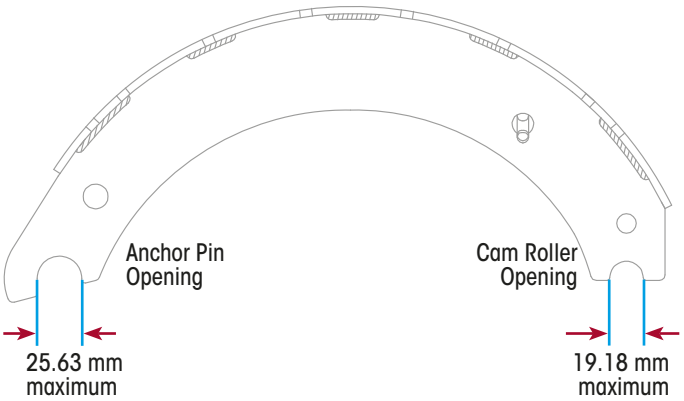


Figure 55: **Checking Brake Shoe Openings**

2. Check anchor pin and camshaft roller openings for wear, out-of-round or flaring. The anchor opening must not exceed 25.63 mm and the camshaft roller opening must not exceed 19.18 mm in diameter. Refer to Figure 55. Replace shoe if wear is above these limits.

Brake Size	Nominal Spread	Tolerance
16.5"	323.85 mm	±0.75 mm
15"	296.06 mm	±0.75 mm

Table 5: **Brake Shoe Spread Specification**

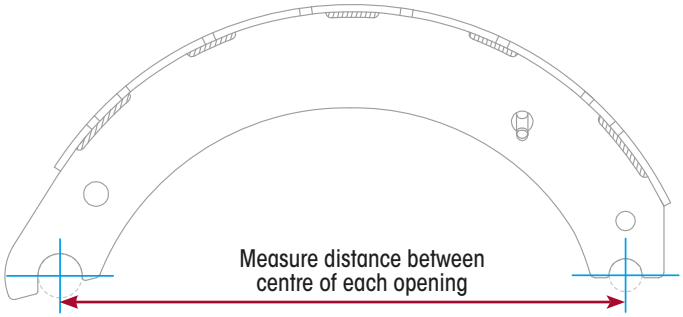


Figure 56: **Checking Brake Shoe Spread**

3. Check brake shoe for spread. Measure centres between anchor and roller hole centres. Replace shoes if the measurement is greater than specification. Refer Table 5 and Figure 56.

4. Check lining support and shoe web for distortion.

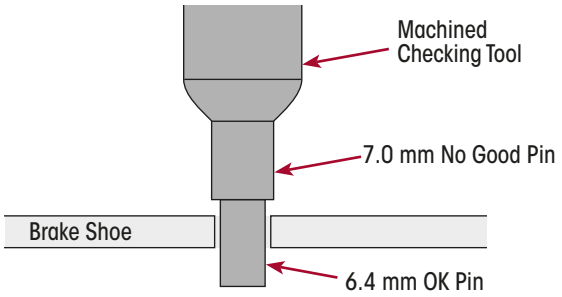


Figure 57: **Shoe Rivet Hole Go-No-Go Gauge**

5. Check shoe rivet holes for size and distortion. Use a go-no-go gauge that is 6.4 mm and stepped at 7.0 mm to determine hole size suitability. Refer Figure 57.

6. Replace return spring pin by tapping out with a brass hammer. Install new pin in the same way.

7. Check remaining shoe areas for serviceable condition, including weld seam for cracks and corrosion.

Preparation

Cleaned and inspected brake shoes must have a suitable covering of corrosion coating before installing the brake linings. Hendrickson recommend using suitable cathodic electro-coating. Other suitable coatings may also be used but, depending on operating conditions, these may reduce the brake shoe service life.

Assembly

1. Inspect brake lining blocks for cracks and chipped edges and corners.

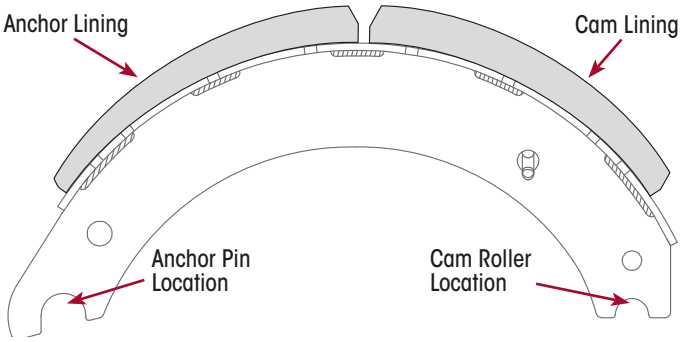


Figure 58: **Brake Lining Position**

2. Place both linings onto the shoe to check form and fitment. Ensure cam and anchor linings are placed in the correct position. Refer Figure 58.

3. Hold one of the linings in position and install all rivets.

4. Clamp shoe assembly in riveter.

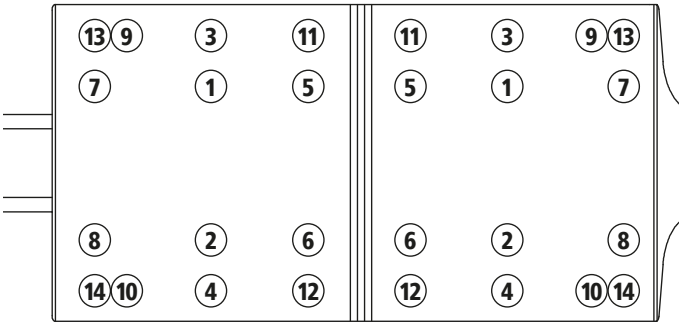


Figure 59: **Clinch Rivets Criss-Cross from Centre Outwards**

5. Clinch rivets using riveter following the order shown in the figure. Refer Figure 59.

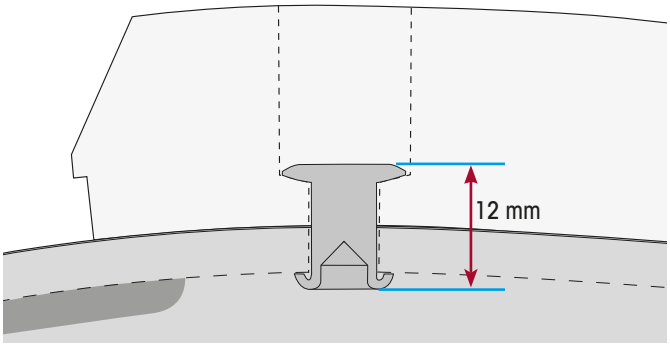


Figure 60: **Rivet Compression**

NOTICE: The rivets should be compressed to 12 mm ±0.25. Refer Figure 60.

6. Assemble second lining onto shoe with all rivets and complete riveting task by repeating steps 4 and 5.

Rivet Inspection

Check rivets for installation and integrity.

1. A single hairline crack that does not extend into the centre tube part of the rivet is acceptable. Open cracks, radial cracks and cracks that extend into the central tube of the rivet are not acceptable.
2. Visually check each rivet roll-over to ensure that they are equally clinched.
3. Attempt to turn each rivet. A rivet that is easy to turn indicates an improper riveting procedure. The minimum torque required to turn a rivet is ***0.2 Nm***.

Lining Inspection

1. Check that the lining is tight against the shoe. Use a 0.15 mm feeler gauge to ensure there are no voids between the lining and shoe.
2. Check that there are no cracks in the lining, especially around the rivets.

Roller assembly

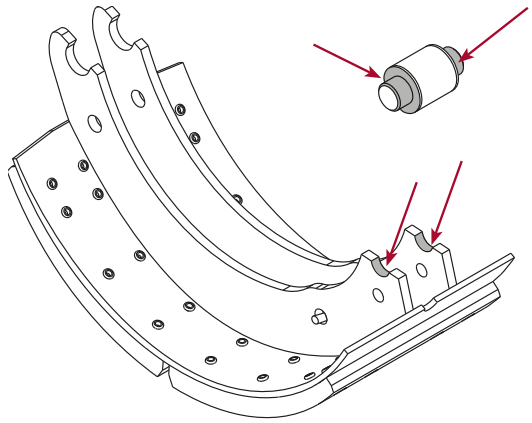


Figure 61: **Apply Lubricant to Roller Ends & Roller Slot**

1. Smear a small amount of suitable anti-seize compound grease to the roller ends and the corresponding roller slot in the shoe. Refer Figure 61.

NOTICE: Do not allow any grease onto the roller face. If necessary, clean any grease from the roller face using a solvent cleaner.

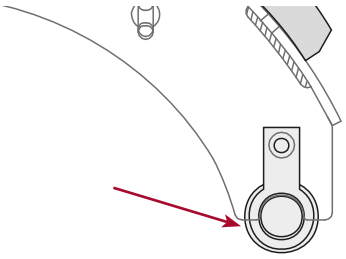


Figure 62: **Install Roller Assembly into Brake Shoe**

2. Fit clip onto roller and install into the brake shoe assembly. Refer Figure 62.

Brake Shoe Specifications

Description	Specifications
Brake Lining Rivet Nominal Diameter ø Refer SAE J663 #10 Brake Rivet Standard	6.3 mm ±0.1 mm
Shoe Rivet Hole Size ø	6.9 mm Maximum
Brake Shoe Anchor Opening ø	25.63 mm Maximum
Brake Shoe Cam Opening ø	19.18 mm Maximum
Brake Shoe Spread	324.6 mm Maximum

NOTE: Brake shoe specifications in Table 6 must be used in conjunction with the associated instructions.

Table 6: **Brake Shoe Specifications**

ANCHOR PIN & BUSH PROCEDURES

⚠ **CAUTION**: To prevent a possible health hazard, wear approved eye protection and a respirator when working on or near the brakes.

Anchor pin and bushes should be checked for visible damage and wear. Replace bushes and pins at every brake reline or if radial clearance exceeds 0.25 mm (0.010").

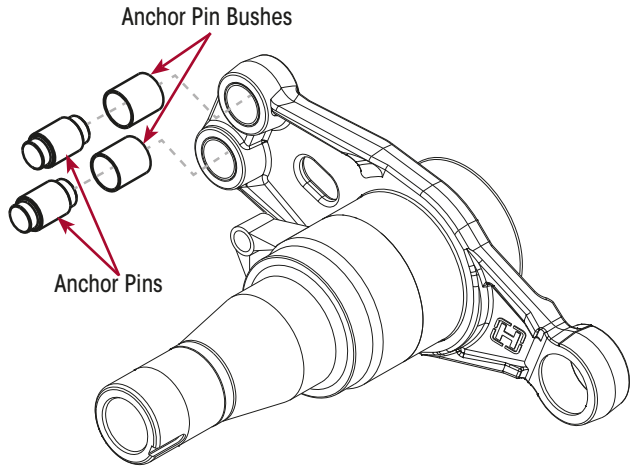


Figure 63: **Anchor Pin & Bush Installation**

1. Push out anchor pins. If necessary, spray pins with a penetrating lubricant. Tap out with a soft hammer or brass drift. Refer Figure 63.

NOTICE: Do not use excessive force when removing anchor pins to prevent damage to the brake spider. If necessary, use a suitable pin and bush removal tool. Refer to "Special Tools" on page 104.

2. Inspect the spider anchor pin bushes for wear or damage.

3. Replace bushes by removing with a specialised bush removal tool or by tapping out with a suitably sized drift. Install new bushes in the same manner until they are centred in the spider. Refer to "Special Tools" on page 104.

NOTICE: Excessive pounding on anchor pin bushes to remove or install can damage the bushes and cause misalignment of the brake spiders and brake shoes. If possible, use a suitable bush removal tool, which would prevent this damage.

4. Apply anti-seize compound to inside surface of anchor pin bushes. Refer to "Lubricants" on page 102.

5. Apply anti-seize compound to entire outer surface of anchor pins and install into brake spider.

DRUM BRAKE S-CAMS

Following the "S-Cam Quick Tips" and "Hendrickson HXS Brakes" explanation are sections describing repair procedures for various S-Cam options on Hendrickson axles. Refer to the appropriate section for relevant S-cam repair procedures. For more details regarding loose axle s-cam and brake chamber bracket refer to Hendrickson service manual L1009.

- "INTRAAX® With Cam Tube" on page 35
- "TRLAXLE® Cam Tube with Welded Mounting Plate" on page 38
- "S-Cam Without Cam Tube" on page 41

S-Cam Quick Tips

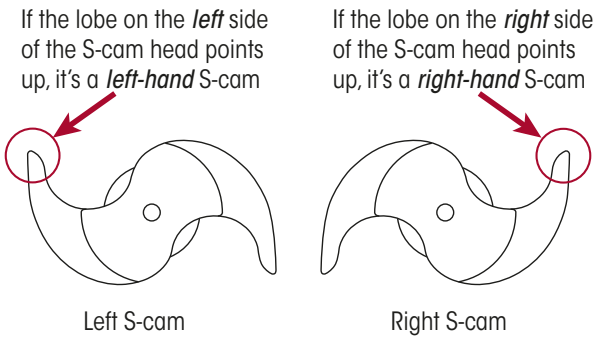


Figure 64: **Brake S-Cam Identification**

- Hold the camshaft horizontally with the splines facing away from you and look at the S-cam head.

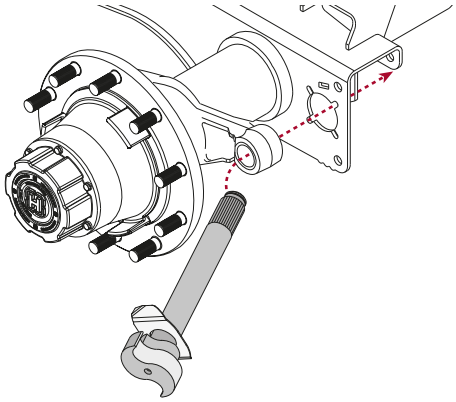


Figure 65: **INTRAAX S-Cam Replacement Without Hub Removal**

- INTRAAX® axle design enables complete brake service, including replacing S-cams without removing hubs from the axle.
- Coat the cam tube grease seals with fresh grease and pack some between seals and bushes to aid camshaft installation.
- Install the tapered outer cam washer onto the camshaft before installation.

Hendrickson HXS Brakes

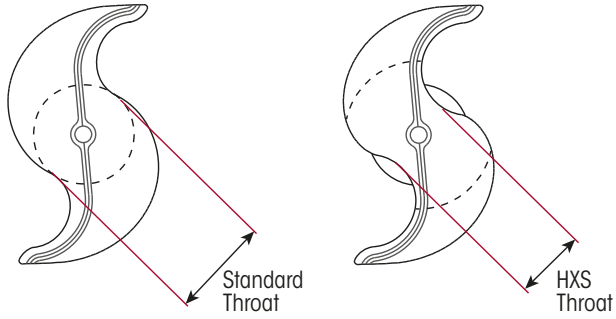


Figure 66: **Comparison of Standard and HXS S-Cams**

Hendrickson Extended Service™ (HXS™) brake shoes have a thicker lining, which gives much longer brake lining life. They can only be fitted to HXS S-cams because the throat is smaller to allow for the thicker linings. Refer Figure 66.

Figure 67: **HXS is Stamped into the End of the S-Cam**

HXS S-cams have been standard on all Hendrickson axles since 14 March 2000 and can be identified by the letters HXS stamped into the spine end of the S-cam. Refer Figure 67.

HXS brake shoes are also prominently stamped with the letters HXS. Standard brake shoes can be fitted to Hendrickson HXS S-cams.

INTRAAX® With Cam Tube

IMPORTANT: On INTRAAX cam tube suspensions, it is not necessary to remove the hub assembly to remove the S-cam. Once the cam tube assembly is removed, the S-cam can be slid past the hub.

If only the cam tube assembly is being removed (not the S-cam), start with Step 2. This can be done on the inboard side of the wheel without removing the hub, tyre/wheel assembly or the brake drum.

1. Remove the tyre/wheel assembly and the brake drum.
2. Using retaining ring pliers, remove the spline retaining ring.
3. Remove the spline inner washers.
4. Disconnect the brake chamber push rod from the slack adjuster by removing the split pin(s) and clevis pin(s) from the slack adjuster clevis. Do not adjust or remove the push rod jam nut at this time.
5. Retract the slack adjuster control arm(s) from the clevis. Refer to the section titled "Retracting Slack Adjuster Control Arm" on page 45 for complete slack retracting details.
6. With the slack adjuster control arm(s) retracted from the clevis, remove the slack adjuster from the S-cam.
7. Remove the S-cam journal washer.
8. Using retaining ring pliers, spread open the retaining ring and remove it from the groove in the S-cam.
9. Remove the second S-cam journal washer.
10. Discard and replace all worn parts with new.

INTRAAX Cam Tube Removal

The cam tube assembly must be removed to remove the S-cam without removing the hub.

1. Loosen and remove bolts that secure the cam tube brackets to the suspension beam.
2. Remove the cam tube brackets.

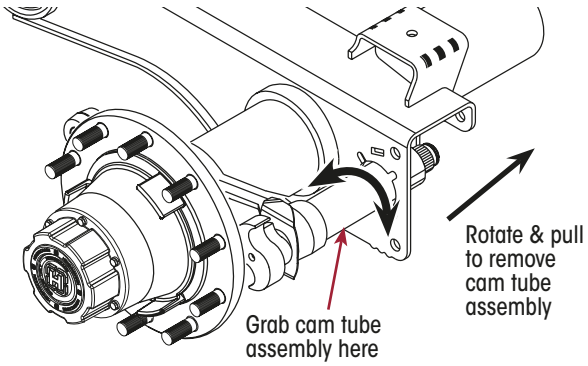


Figure 68: **INTRAAX Cam Tube Assembly Removal**

3. Pull the cam tube assembly free from the spider (use a back-and-forth rotating motion) and slide it out through the mounting hole in the suspension beam (Figure 68).

NOTE: Since the cam tube assembly is a modular (one-piece) component, all bushes and seals remain inside and will also be removed and replaced with new.

INTRAAX S-Cam Removal

If changing the cam tube only, skip this procedure and go to "INTRAAX Cam Tube Installation" on page 37.

NOTE: On INTRAAX cam tube suspensions, it is not necessary to remove the hub assembly to install the S-cam. If only the cam tube assembly is being installed (not the S-cam), it can be done on the inboard side of the wheel without removing the hub, tyre/wheel assembly or the brake drum. New hardware is supplied with a new cam tube assembly.

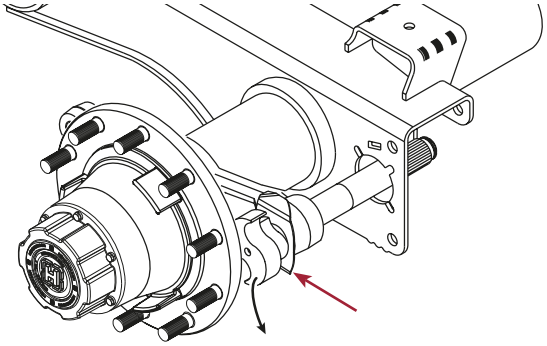


Figure 69: **INTRAAX S-Cam & Washer Removal**

1. Remove the S-cam and the Underhead cam washer from the outboard side of the spider (Figure 69).
2. Discard the worn S-cam, cam tube assembly and hardware.

INTRAAX S-Cam Installation

1. Thoroughly clean the spider assembly to remove heavy amounts of dirt or grease.

⚠ **WARNING**: Do not use petrol or other flammable cleaning solvents to clean the spider assembly. These solvents can cause a fire or disperse harmful vapours.

2. Thoroughly dry the spider immediately after cleaning to prevent rusting or pitting of the machined areas. Use rags, paper towels or low-pressure air to dry the parts.

⚠ **CAUTION**: Protect eyes and skin from particle penetration when using low pressure air.

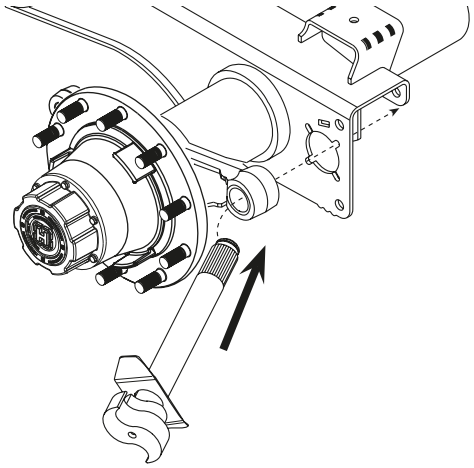


Figure 70: **INTRAAX Installing S-Cam**

3. Slide the Underhead cam washer onto the S-cam until it contacts the S-cam head as shown in Figure 70.

IMPORTANT: S-cams have left-hand and right-hand orientations. Ensure you install the S-cam the correct location so that the brake shoe rollers can properly engage the S-cam lobes.

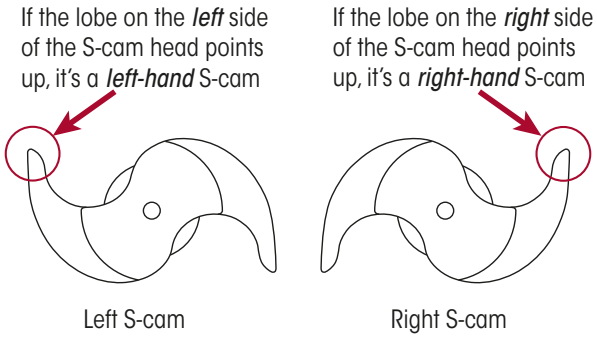


Figure 71: **Identifying S-Cam Orientation**

To differentiate, hold the S-cam horizontally with the splines facing away from you and look at the S-cam head. With the S-cam in this position (refer Figure 71), the S-cam lobe that points upward indicates orientation, left or right side.

4. Angle and slide this S-cam assembly through the spider and beam (Figure 70).

INTRAAX Cam Tube Installation

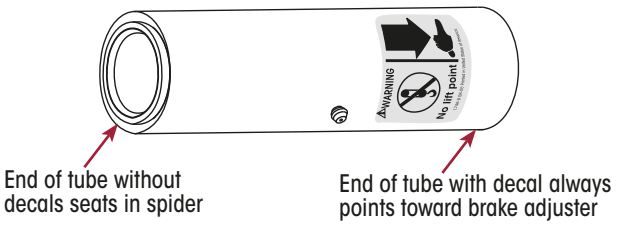


Figure 72: **INTRAAX Cam Tube Orientation**

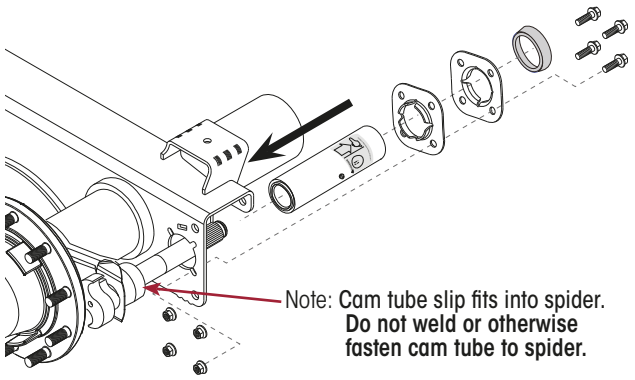


Figure 73: **INTRAAX Cam Tube Installation**

1. To aid assembly, lightly lubricate the internal seals and bushes on both ends of the new cam tube assembly with EP NLGI #2 grease.
2. Orient the end of the cam tube without the decal so that it goes onto the camshaft first (Figure 72). in other words, the end of the cam tube with the decal must be closest to the slack adjuster.
3. From the inboard side of the suspension beam, slide the new cam tube assembly onto the new S-cam, through the mounting hole in the suspension beam and into the spider as shown in Figure 73.

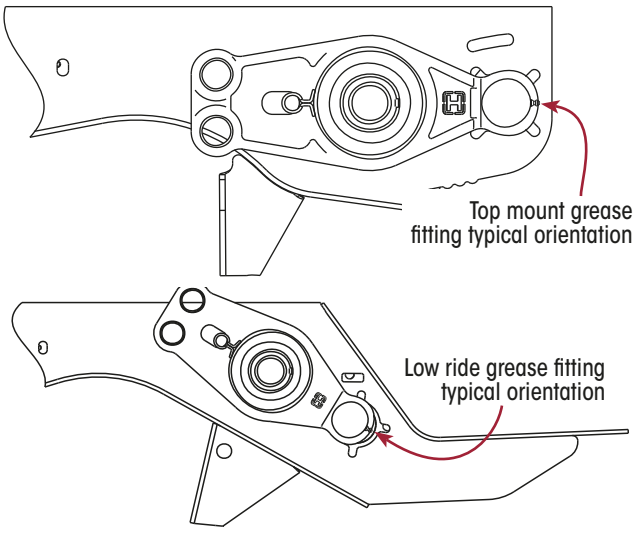


Figure 74: **INTRAAX Accessible Grease Fitting Orientation**

4. Rotate the cam tube so the grease fitting is accessible (either pointing downward or to the rear) when the drums are installed (refer to Figure 74).

IMPORTANT: Do not weld or otherwise fasten the cam tube assembly to the spider. The cam tube assembly 'slip fits' into the spider.

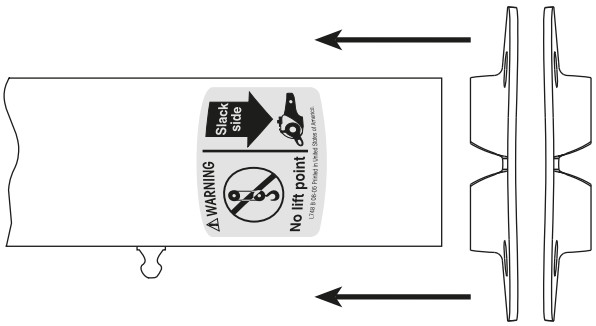


Figure 75: **INTRAAX Install Brackets Back-To-Back**

5. Arrange the two cam tube brackets back-to-back (Figure 75) and slide them onto the end of the cam tube assembly until they contact the suspension beam.
6. Rotate the cam tube brackets so their holes align with the holes (or slots) in the suspension beam. If necessary, rotate the cam tube so the grease fitting is accessible (either pointing down or to the rear) when the drums are installed.
7. Install the four 3/8"-16 nuts and bolts. Tighten to *60 Nm* of torque.
8. Slide the S-cam journal washer onto the S-cam and seat it against the cam tube assembly.
9. Using retaining ring pliers, hold open the retaining ring, and slide it on the end of the S-cam.
10. Lock the retaining ring into the groove on the S-cam.

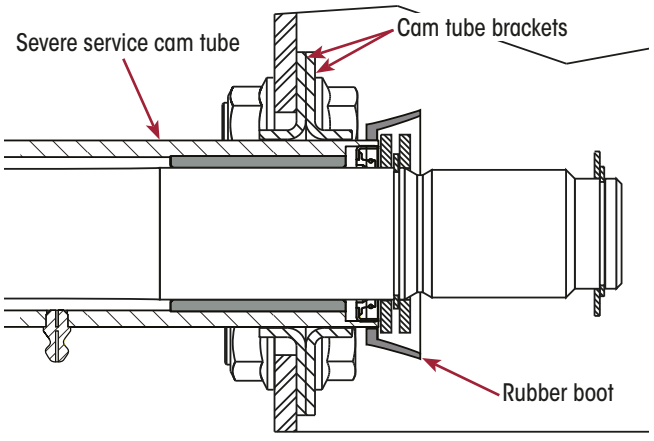


Figure 76: **INTRAAX Severe Service Rubber Boot Assembly**

11. Snap rubber cam tube boot (Figure 76) over and behind S-cam journal washer.
12. Slide the second S-cam journal washer onto the S-cam and seat it against the retaining ring.

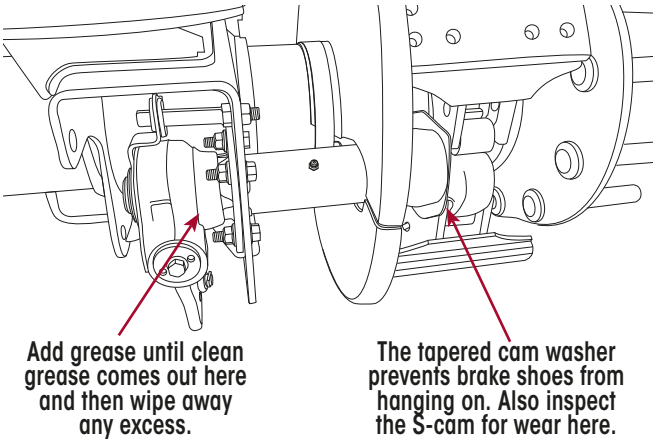


Figure 77: **INTRAAX S-Cam Lubrication & Inspection**

13. Lubricate the single, centrally located grease fitting (refer Figure 77) with EP NLGI #2 grease as follows:
    - A Wipe off the grease fitting before lubricating. This will help prevent contaminants from being injected into the grease fitting along with the grease.
    - B Fill the cam tube assembly with EP NLGI #2 grease until clean grease can be seen purging from the cam tube inboard seal.
    - C Wipe away excess grease purged from joints. This will help prevent contaminants from being attracted to the lube points and grease from getting on the brake linings.
14. Lubricate the splines of the S-cam with an anti-seize lubricating compound.
15. Install the slack adjuster. Refer to "Slack Adjuster Installation" on page 45.
16. Continue brake service. Refer to "Brake Shoe Installation" on page 30.

TRLAXLE® Cam Tube with Welded Mounting Plate

This procedure is service S-cam and cam tube for a weld mount bracket bolted to the L-bracket a TRLAXLE® or TOUGHLIFT™ axle model.

TRLAXLE S-Cam Tube Removal

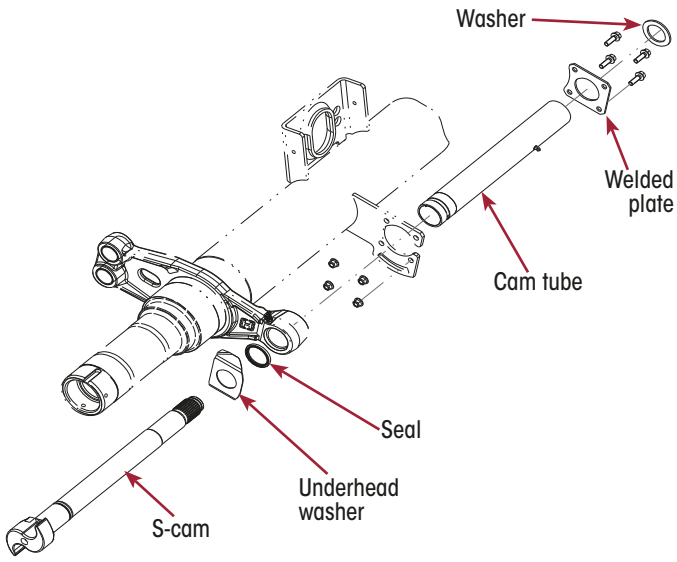


Figure 78: **TRLAXLE Cam Tube Assembly**

If only the cam tube assembly is being removed (not the S-cam), start with Step 2. This can be done on the inboard side of the wheel without removing the hub, tyre/wheel assembly or the brake drum.

1. Remove the tyre/wheel assembly and the brake drum.
2. Using retaining ring pliers, remove the spline retaining ring.
3. Remove the spline inner washers.
4. Disconnect the brake chamber push rod from the slack adjuster by removing the split pin(s) and clevis pin(s) from the slack adjuster clevis. Do not adjust or remove the push rod jam nut.
5. Retract the slack adjuster control arm(s) from the clevis. Refer to "Retracting Slack Adjuster Control Arm" on page 45 for complete slack retracting details.
6. With the slack adjuster control arm(s) retracted from the clevis, remove the slack adjuster from the S-cam.
7. Remove the S-cam journal washer.
8. Discard and replace all worn parts with new.
9. Loosen and remove bolts that secure the cam tube brackets to the suspension beam.

10. Pull the cam tube assembly free from the spider (use a back-and-forth rotating motion) and slide it out of the mounting L-bracket.

TRLAXLE S-Cam & Outboard Seal

The S-cam will only need to be removed if the S-cam or outboard seal are to be replaced. If these do not need to be replaced, then skip this part and proceed with "TRLAXLE Cam Tube Installation" on page 39.

NOTE: Depending on S-cam length, it may be necessary to remove the hub, along with wheel and brakes, to remove S-cam from spider.

1. Remove the wheel end, if necessary, after removing the cam tube assembly to allow room for S-cam removal.
2. Remove S-cam.
3. Remove outboard seal from brake spider with a screwdriver or another suitable tool.
4. Clean and inspect brake spider for cracks and other damage.

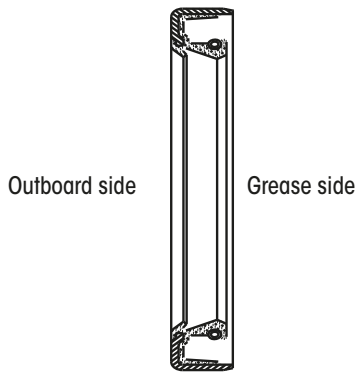


Figure 79: **TRLAXLE S-Cam Seal Orientation**

5. Install new seal, without any grease, on outboard side of spider cam bore with the seal oriented as shown in Figure 79 and press into spider bore with a suitable tool.

NOTICE:Do not pre-lube seal before installing.

6. Apply a smear of chassis grease to the seal lip.
7. Install S-cam into spider cam bore and cam bracket L leg.

NOTICE: Take care not to nick or damage the seal when installing the S-cam.

TRLAXLE Cam Tube Installation

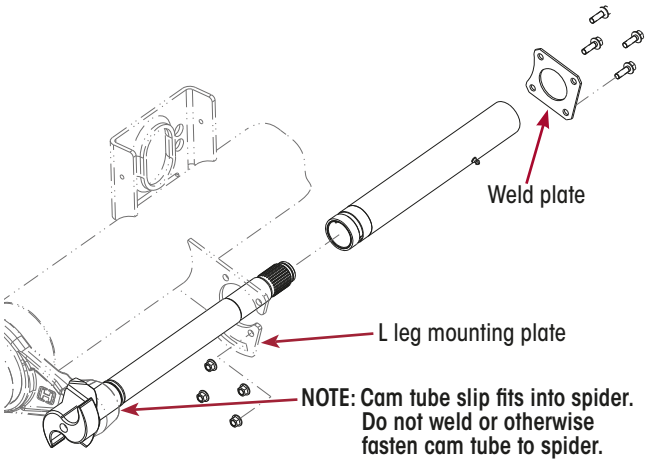


Figure 80: **TRLAXLE Cam Tube Assembly Overview**

1. Slide the new cam tube assembly (machined end first), from the inboard side of the axle, through the L-bracket and into the spider. The machined end should slip completely into the spider boss, but not press fit. Refer Figure 80.

IMPORTANT: Do not weld or otherwise fasten the cam tube assembly to the spider. The cam tube assembly simply slip fits into the spider.

2. Rotate the cam tube so the grease fitting is accessible and pointing rearward (refer to Figure 74).

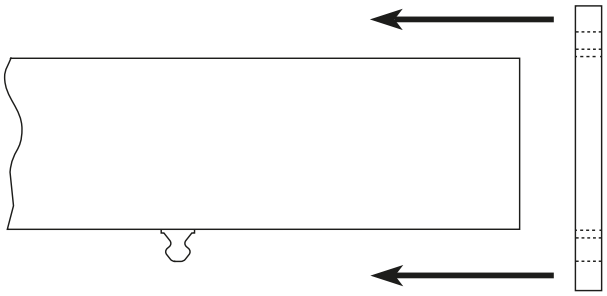


Figure 81: **TRLAXLE Install Weld Mount Bracket on Cam Tube**

3. Slide the cam tube mounting bracket onto the end of the cam tube assembly (Figure 81) until it contacts the Cam bracket L leg.
4. Rotate the cam tube mounting bracket until the holes align with corresponding holes in the L-bracket. If necessary, rotate tube to reorient grease fitting.
5. Install the four 5/16-inch nuts and bolts. Tighten to *40 Nm* of torque.
6. Confirm position of cam tube and cam tube bracket before welding. Rotate S-cam to ensure no binding is present.

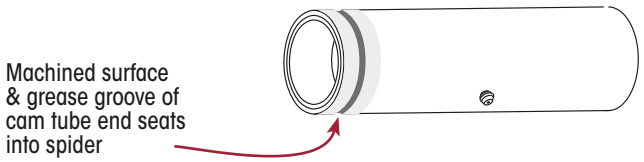


Figure 82: **TRLAXLE Cam Tube Orientation**

7. Cover and protect S-cam spline gear from weld spatter.

NOTICE: S-cam could be permanently damaged if spline gear is not protected from weld spatter.

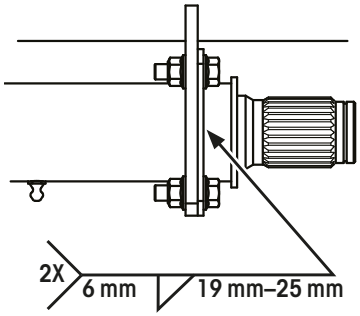


Figure 83: **TRLAXLE Weld Mount Bracket Weld Specifications**

8. Referring to Figure 83, weld the cam tube mounting bracket to the cam tube by placing two fillet type weld beads at accessible locations around the cam tube.

TRLAXLE Slack Adjuster Installation

1. Slide the S-cam journal washer onto the S-cam and seat it against the end of the cam tube assembly.

NOTE: Always use new washers supplied with the kit. The snap-ring groove is covered by the cam tube and not required for this installation.

2. Slide enough shims onto the S-cam to align slack adjuster to brake chamber push rod and clevis. The number of shims originally removed may be used as an initial guide to shims required.

NOTE: More shims (hardened washers) are included with S-cam hardware kits than may be necessary. Not all may be required to align slack adjuster and minimise lateral movement.

3. Install slack adjuster over the spline gear according to manufacturer's instructions.

4. Install enough shims and the spline inner washer to leave room for the Spline retaining ring to fit in the snap-ring groove.

5. Complete the installation by placing the spline retaining ring in the groove at the end of the S-cam shaft.

6. Check end play and ensure it is less than 1.5 mm (0.06"). Adjust installed shim quantity as needed.

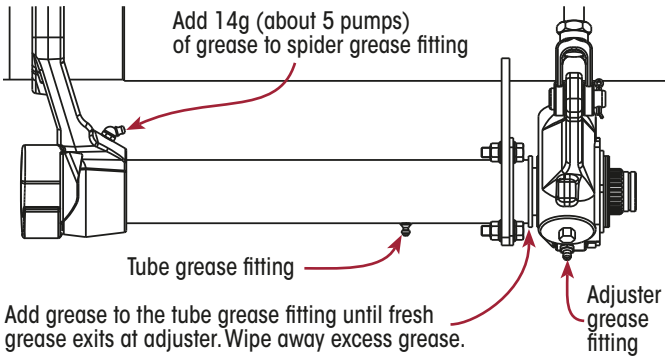


Figure 84: **TRLAXLE Cam Tube Lubrication**

7. Wipe off all grease fittings before lubricating. This will help prevent contaminants from being injected into the grease fitting along with the grease.

8. Lubricate the single, centrally located grease fitting on the cam tube. Add grease to cam tube until fresh grease can be seen purging from the end of cam tube at points shown in Figure 84.

9. Apply approximately 14 g (0.5 oz.) of grease to the fitting at the spider. Refer to Figure 84. This equates to around five pumps from a regular hand-held grease gun.

10. Apply grease to the slack adjuster through grease fitting.

11. Wipe away excess grease purged from joints. This will help prevent contaminants from being attracted to the lube points and grease from getting on the brake linings.

12. Continue brake service. If necessary, refer to "Brake Shoe Installation" on page 30.

S-Cam Without Cam Tube

The following procedures apply to both INTRAAX® and TRLAXLE® without cam tubes.

S-Cam Removal

1. Remove the tyre/wheel assembly, brake drum, brake shoes and hub assembly.
2. Retract the slack adjuster control arm from the clevis. Refer to "Retracting Slack Adjuster Control Arm" on page 45.
3. Disconnect the brake chamber push rod from the slack adjuster by removing split pin and clevis pin from slack adjuster clevis. Do not adjust or remove the push rod jam nut at this time.
4. Using retaining ring pliers, remove the retaining ring and hardened washers.

NOTICE: Note the number and position of the washers as you remove them. This will be a good guide to what will be required on reassembly.

5. Remove the slack adjuster from the S-cam.
6. Remove S-cam hardened washer(s).
7. Inspect the S-cam for contamination, such as dirt, rust or scale. If any contamination exists, remove it from the S-cam now.

IMPORTANT: Removing contamination from the S-cam at this time will make the S-cam easier to remove in the following steps.

8. Support the S-cam to remove tension from the spider retaining ring. Using retaining ring pliers, spread open the spider retaining ring and remove it from the groove in the S-cam.
9. Partially remove the S-cam by pulling on the S-cam head. Pull the S-cam far enough out of the S-cam bush so the spider retaining ring and inner washer can be slid off the spline end of the S-cam. When the spider retaining ring and the S-cam journal washer are removed, finish removing the S-cam and the under-head cam washer.

S-Cam Bush Removal

1. Loosen and remove the four bolts that secure the support bush assembly to the suspension beam.
2. Discard the used S-cam support bush assembly and fasteners.
3. Using a small screwdriver, carefully remove the inner S-cam seal from the spider.

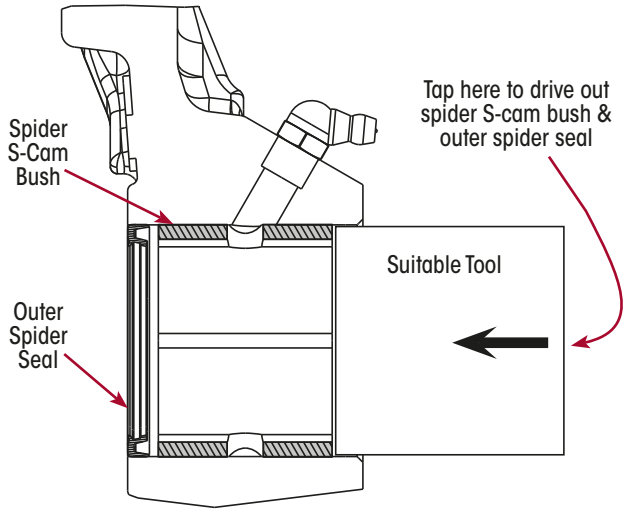


Figure 85: **Spider S-Cam Bush & Seal Removal**

NOTICE: Use caution to not to damage the inside diameter of the spider bore when removing the bush.

IMPORTANT: The tool or driver used to remove the bush and outer spider seal must have a diameter small enough to fit inside the spider but large enough to drive out the spider S-cam bush.

4. Using a suitable bush tool or seal driver, tap the spider S-cam bush and outer seal out of the spider bore. Refer Figure 85.
5. Discard and replace all worn parts with new.
6. Thoroughly clean spindle and spider assembly to remove all dirt and grease.

⚠ **WARNING**: Do not use petrol or other flammable cleaning solvents to clean the spindle and spider assembly. These solvents can explode, burn or disperse harmful vapours.

7. Thoroughly dry the spindle and spider immediately after cleaning to prevent rusting or pitting of the machined areas. Use clean cloths or low-pressure air to dry the parts.

⚠ **CAUTION**: Protect eyes and skin from particle penetration when using low pressure air.

8. Inspect the spider and spindle assembly damage, distortion, cracks. Repair or replace, as necessary.

S-Cam Bush Installation

NOTICE: When instructed to apply grease to a component in the following procedure, use Extreme Pressure NLGI #2 grease. Refer to "Lubricant Specifications" on page 103.

1. Lightly coat the inside diameter of a new S-cam support bush with fresh grease (EP NLGI #2 grease).
2. Install the new S-cam support bush assembly with four new attaching nuts and bolts. Only hand tighten the four attaching nuts and bolts at this time.
3. Using a suitable bush tool (the same used in Figure 85), carefully tap a new spider S-cam bush into the spider.

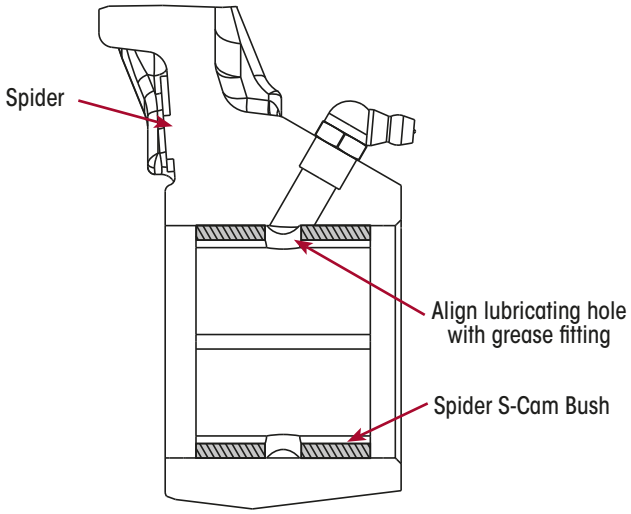


Figure 86: **Spider S-Cam Bush installation**

4. Orient the new bush so its lubrication hole aligns with the grease fitting in the spider. Refer Figure 86.

NOTICE: Failure to align the bush lubrication hole with the spider grease fitting may result in a lack of lubrication that could cause premature bush failure.

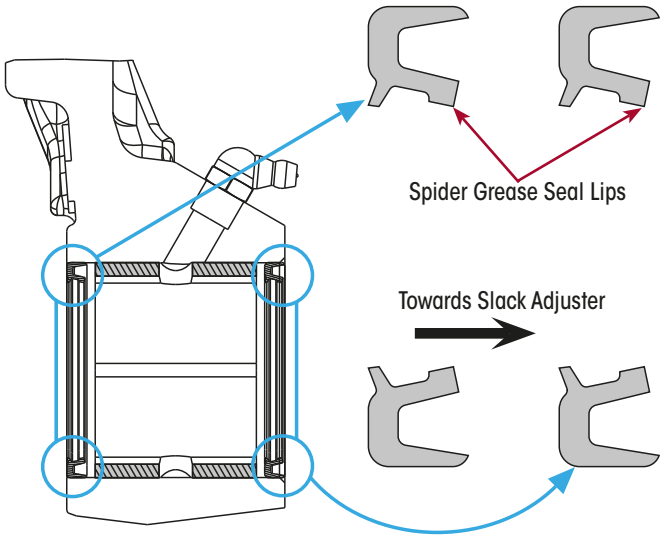


Figure 87: **Spider Grease Seal Orientation**

5. Install new inner and outer spider grease seals on each side of the spider S-cam bush. Refer Figure 87.

NOTICE: The lips of both seals must face inward toward the brake chamber. This seal orientation directs any excess grease away from the brake shoes.

6. Lightly coat the grease seal lips and bush with fresh grease (EP NLGI #2 grease) to aid S-cam installation.

NOTICE: S-cam support bush installation occurs along with S-cam installation to ensure correct support bush alignment.

S-Cam Installation

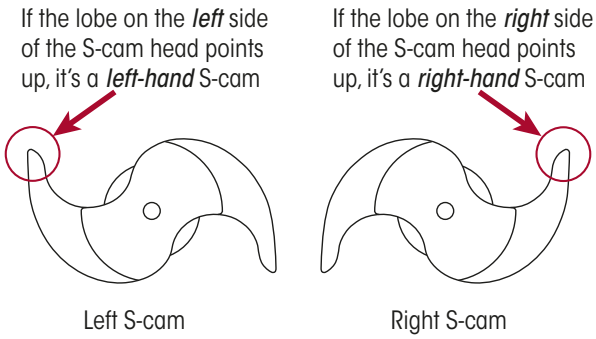


Figure 88: **Identifying S-Cam Orientation**

Left and right S-cams can be identified by holding them horizontally with the splines facing away from you and looking at the S-cam head. With the S-cam in this position, the upward pointing S-cam lobe is on the same side as the S-cam orientation left or right. Refer Figure 88.

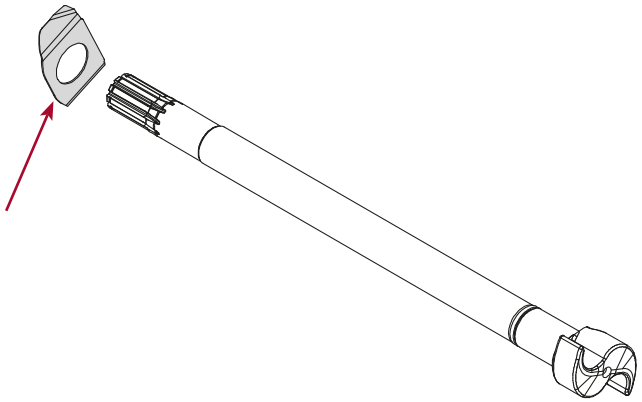


Figure 89: **Under-Head Washer Fitment**

1. Slide the under-head cam washer, facing onto the new S-cam, until it contacts the head. Refer Figure 89.
2. Apply grease to S-cam surfaces that will contact bushes. Ensure bushes and seals are coated with grease.

NOTICE: Use care when installing the S-cam in the following step to prevent damage to the spider grease seals.

3. Install the new S-cam (splines first) through the spider S-cam bush. Stop before the splines reach the S-cam support bush assembly so that the S-cam inner washer and spider retaining ring can be installed on the end of the S-cam.
4. Slide the S-cam inner washer onto the S-cam and seat it against the spider.
5. Using retaining ring pliers, hold open the spider retaining ring and slide it on the end of the S-cam.
6. Push the S-cam all the way through the S-cam support bush until it stops against the spider.
7. Lock the spider retaining ring into the groove on the S-cam.
8. Rotate the S-cam to see if it turns freely. If the S-cam is bound, adjust the S-cam support bush assembly position (using the four bolts) until the S-cam turns freely.
9. Tighten the four 5/16" S-cam support bush bolts to *40 Nm* of torque.
10. Install the S-cam hardened washer that was removed earlier.
11. Lubricate the splines of the new S-cam with an anti-seize lubricating compound.
12. Install the slack adjuster. Refer to "Slack Adjuster Installation" on page 45.

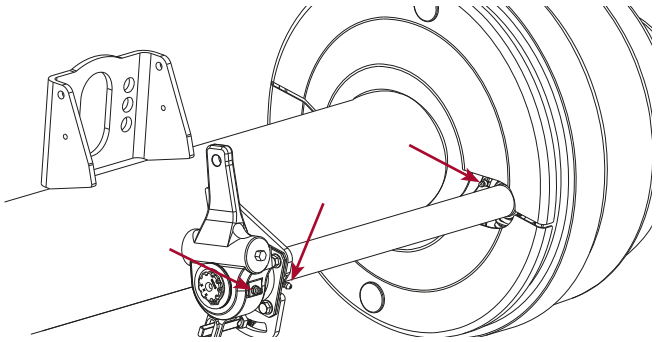


Figure 90: **Grease Points**

13. Lubricate the spider S-cam bush, the S-cam support bush assembly and the slack adjuster (refer Figure 90) with EP NLGI #2 grease as follows:
    A. Wipe off all grease fittings before lubricating. This will help prevent contaminants from being injected into the grease fitting along with the grease.
    B. Apply grease to the spider S-cam bush and the S-cam support bush assembly until new grease purges from the inboard seals. When the seals are correctly installed, grease will purge from the inboard side of the bush, away from the brakes and toward the slack adjuster.
    C. Apply grease to the slack adjuster through the fitting.
    D. Wipe away excess grease purged from joints. This will help prevent contaminants from being attracted to the lubricant points and grease from getting on the brake linings.
14. Install the hub assembly. Refer to "Wheel Ends" on page 20.
15. Continue brake service. If necessary, refer to "Brake Shoe Installation" on page 30.

SLACK ADJUSTERS

- Slack adjuster setup and application angles vary depending on slack adjuster, brake chamber and axle design. Torque is greatest when the slack adjuster is close to right angle (90° ±10°). Therefore, all designs will finish close to or pass through the 90-degree angle during operation. However, on full brake application (620 kPa / 90 psi) they may not be exactly at right angles. If the brake system has been set up correctly, the important brake operation measurements are the Free Stroke and Applied Stroke. These should be the same across all the trailer's brakes and not exceed the maximum for that type of chamber.

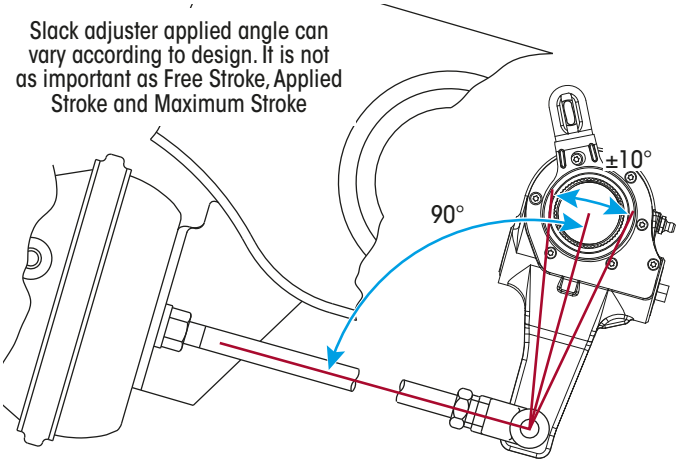
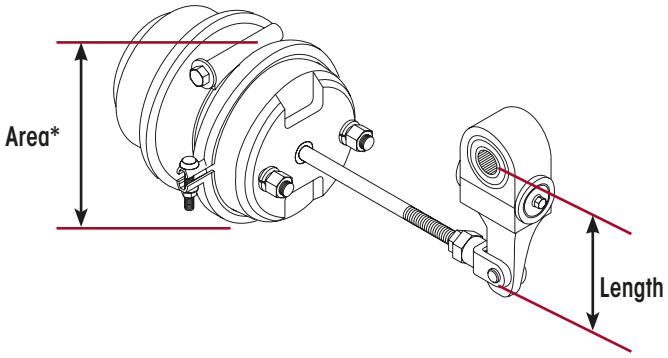


Figure 91: **Slack Adjuster Applied Angle**

- Apply anti-seize grease to S-cam spines before fitting slack adjuster.
- Adjust the slack adjusters by rotating the 7/16- or 9/16-inch adjusting bolt (located on the slack adjuster) clockwise until the brake linings contact the brake drum. When contact occurs, back the slack adjuster off by rotating the adjusting bolt anticlockwise one-half turn.
- Use slow steady pressure when backing-off the adjuster to avoid damaging the internal clutch mechanism. Note that significantly greater effort is required to retract the slack adjuster than to tighten it.
- An automatic brake adjuster only needs to be adjusted is during a foundation brake repair or on initial setup. Regularly adjusting an automatic brake adjuster can cause premature wear on internal components and could lead to the adjuster becoming inoperable.
- The emergency parking brake spring applies similar brake force to that of 345 to 415 kPa (50 to 60 psi) air pressure to the service brakes.
- Brake adjustment must only be made with wheels raised off the ground.

AL Factor & Design



AL Factor is determined by multiplying slack adjuster length by the operating area of the brake chamber

A (Area) x L (Length) = AL Factor

*** Area can be calculated from the operating diameter of the chamber by using the formula $A = (\pi/4) \times D^2$**

Figure 92: **Brake AL Factor**

- All slack adjusters on a trailer should be the same brand. Each slack adjuster manufacturer uses a distinct slack adjustment design. This means that they will each have slightly different adjustment points. Using different types of slack adjusters on a trailer may result in imbalanced braking with uneven wear and altered handling. For the same reason, brake chambers must be built to the same specification.
- The AL Factor is a mathematical description of the brake adjuster and brake chamber combination. The effective area of the brake chamber in square inches is A. The effective area (A) of a type 30 chamber is 30 square inches. L is the effective length of the slack adjuster in inches. Refer Figure 92.
- Multiply the area (A) by the length (L) to get the brake AL Factor. If we have a type 30 chamber with a 6-inch slack adjuster, then the calculation would be 30 X 6 = AL Factor of 180.
- Engineers use the axle load, brake size, friction material and the AL Factor to determine the correct brake setup for a trailer. Any change to the brake system components will change the braking characteristic of a trailer.
- Trailer brakes need to be maintained to the same standard/level required by the CTA (SARN) brake certification. Any modification from Hendrickson design, including using non-genuine brake linings or S-cam profiles, will mean that the brakes are no longer certified to comply with the required standard.

Retracting Slack Adjuster Control Arm

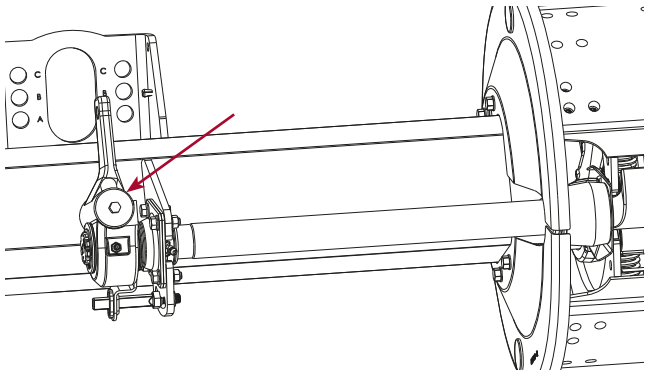


Figure 93: **Slack Adjuster Location**

In some instances, it may be necessary to retract the slack adjuster and brake shoes during servicing to:

A. Allow the drum to clear the brake shoe/lining assembly when removing.

B. Allow brake shoes to open and remove the brake shoe rollers and roller retaining clips.

C. Separate the slack adjuster control arm from the clevis so the slack adjuster can be removed from the S-cam.

In each of these cases, the slack adjuster control arm is retracted by rotating the manual adjusting nut on the automatic slack adjuster in an anti-clockwise direction.

NOTE: Significantly greater effort is required to retract the slack adjuster than to tighten it.

Slack Adjuster Removal

1. Ensure brake chamber push rod is fully retracted and caged.
2. Remove brake chamber clevis split pin and discard.
3. Remove brake chamber clevis pin.
4. Remove circlip from end of S-cam.
5. Remove slack adjuster and washers, taking note of washer numbers and positions as this will assist with reinstallation.

Slack Adjuster Installation

1. Ensure brake chamber push rod is fully retracted and caged.

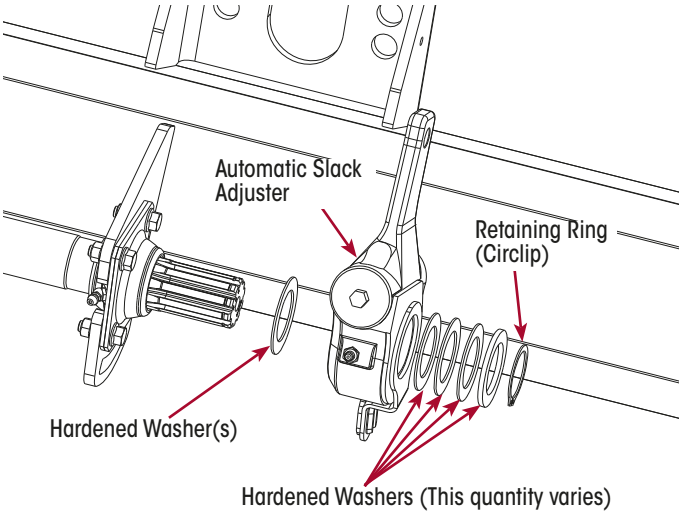


Figure 94: **Slack Adjuster Washer Installation**

2. Fit hardened washer(s) to S-cam spine end. A minimum of one washer is required here but more may be required. Refer Figure 94.

NOTICE: The number of washers installed here may need to be adjusted to position slack adjuster so that it is centrally aligned with the brake chamber.

3. Apply a film of anti-seize to camshaft spines.

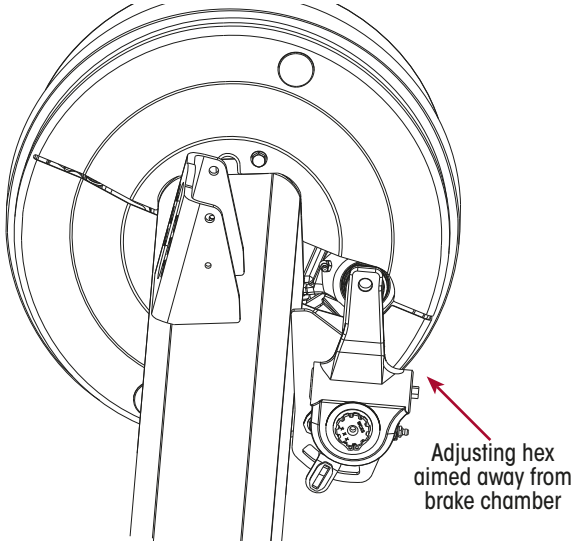


Figure 95: **Slack Adjuster Adjusting Hex Position**

4. Install brake adjuster onto camshaft with the arm close to the clevis and the manual adjusting hex pointed away from the brake chamber. Refer Figure 95.
5. Install enough hardened washers to ensure that there is less than 1.6 mm slack adjuster end play when

fully assembled with the retaining ring. A good starting position is to refit the same number of washers that were used before disassembly, recheck clearance, and then add or remove washers, as necessary.

6. Check to ensure the retaining ring (circlip) is fitted securely.
7. Turn the adjusting hex clockwise until the clevis hole aligns with the brake adjuster arm hole.
8. Apply anti-seize to clevis pin and install.
9. Insert new split pin into clevis pin and bend pin legs outward, away from each other, to secure pin.

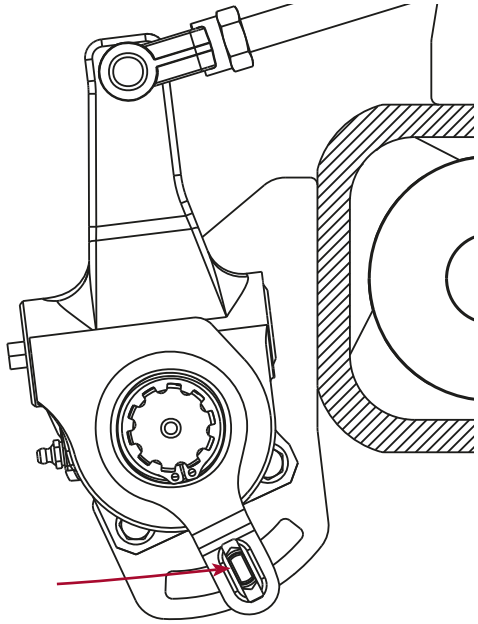


Figure 96: **Anchor Stud Installation**

10. Insert anchor stud into slack adjuster arm and then into anchor bracket. Refer to Figure 96.
11. Secure anchor stud with 7/16"-14 flanged nut and tighten to ***60 Nm*** torque.
12. Set initial slack adjuster position by turning adjusting hex clockwise until the linings contact the brake drum.
13. Use slow steady force to turn adjusting hex back 1/2 turn (180°) anticlockwise.

NOTICE: During normal vehicle servicing there is no need to turn adjusting hex. Doing so more than is necessary could cause the self-adjusting clutch to fail prematurely.

NOTICE: If new brake linings and/or brake drum have been installed, they will need to settle in before a consistent stroke measurement is reached.

14. Raise wheels off the ground when adjusting brakes to ensure that they do not drag. New brake linings expand on first use, so it is especially important that these have adequate clearance.

Adjuster Free Stroke

When correctly setup and adjusted the slack adjuster will have between 10 and 16 mm free stroke. Refer to "Brake Chamber Installation" on page 50.

Slack Adjuster Lubrication

Lubricate the slack adjuster grease fittings every 12 months, unless extreme operating conditions warrant increased service intervals. Use EP NLGI #2 grease. Refer to "Lubricant Specifications" on page 103.

IMPORTANT: Do not use molybdenum disulphide grease as this would cause permanent malfunction of the internal self-adjusting clutch.

NOTICE: Purging grease removes any collected moisture, contaminants or degraded lubricant. Continue to add grease until clean grease is visible. Wipe away any exposed excess grease.

BRAKE CHAMBERS

Brake chambers must be installed into the correct mounting holes to match slack adjuster and axle design. The actual mounting hole position will vary depending on suspension and brake specification.

If possible, refer to original suspension layout drawing or specifications. In any case, it is good practice to mark the brake chamber stud locations before removal to ensure they can be reinstalled in the same position. As a guide refer to "Brake Chamber Installation" on page 50.

Ensure mounting face is free of cracks, rust and debris. Torque nuts to correct torque and do not install washers between brake chamber and axle.

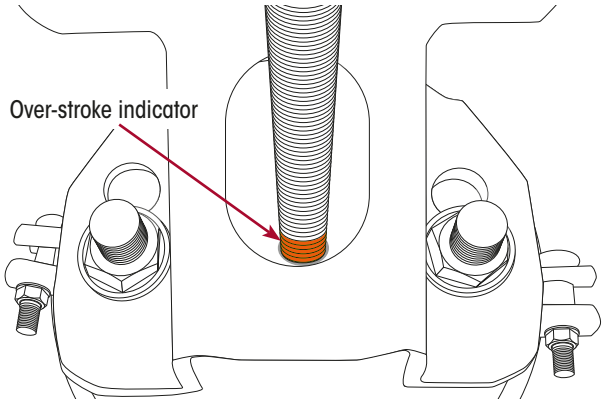


Figure 97: **Brake Chamber Over-Stroke Indicator**

Brake chamber pushrods have a coloured band stroke indicator to show that the chamber has only 20% stroke remaining. Inspect the brake system for wear or correct adjustment if the coloured stroke indicator becomes visible with the application of parking or normal service brakes. (Refer Figure 97) This 20% reserve movement is important because high braking temperatures will increase drum diameter and thus increase braking stroke.

It is possible to cut longer pushrods to size if brake chambers are not available with the correct pushrod length. Push rod length will be different for different slack adjuster setup and allowances may need to be made to accommodate different length clevis. Longer slack adjusters may require 3 inch stroke chambers along with shorter pushrods.

Inspection

Check brake chambers, air lines and connections for air leaks. Ensure that there is at least 620 kPa (90 psi) of pressure available and that the trailer is either raised off the ground or the wheels are chocked to prevent movement.

1. Apply both park and service brakes. Check for any leaks from air lines, connections or from the service brake diaphragm.
2. With both park and service brakes released, check for any leaks from air lines, connections or from the emergency brake chamber diaphragm.

Leaks of any nature are unacceptable. If necessary, use a foaming agent to confirm components are leak free. Refer to "Leak Detection Foaming Agents" on page 103.

Brake Chamber Stroke Identification

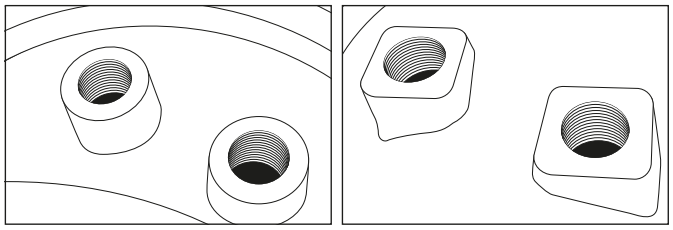


Figure 98: **Brake Chamber Stroke Identification**

As a guide, standard stroke brake chambers have round air ports, while long stroke chambers are identified by square air ports or port bosses and/or three-inch trapezoidal identification tags.

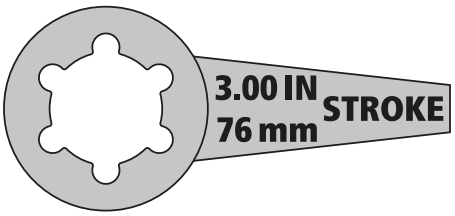


Figure 99: **Trapezoidal Stroke Tag Identification**

Refer to Figure 98, Figure 99 and to the brake chamber manufacturer's guidelines for more details.

Checking Free & Applied Stroke

If necessary, common brake chamber push rod lengths and clevis positions are tabled in Brake Parts List 97114-097.

NOTICE: All brake measurements and adjustments should be made with the wheels safely chocked, the spring brakes caged and the brake drums at ambient temperature. Brake adjustments must be made with the wheels raised, as this will make it possible to find faults such as a dragging brake.

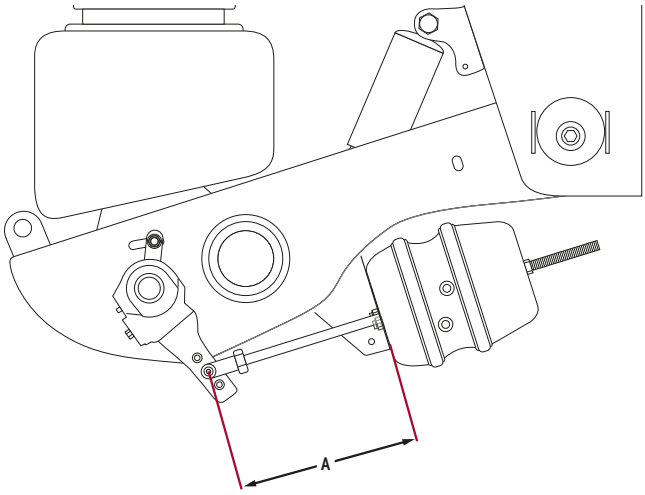


Figure 100: **Brake Chamber Retracted Length = A**

The distance measured from brake chamber to clevis pin (A) should be made with brake chamber fully retracted. This measurement is used when calculating brake **Free Stroke** and **Applied Stroke**. Refer Figure 100.

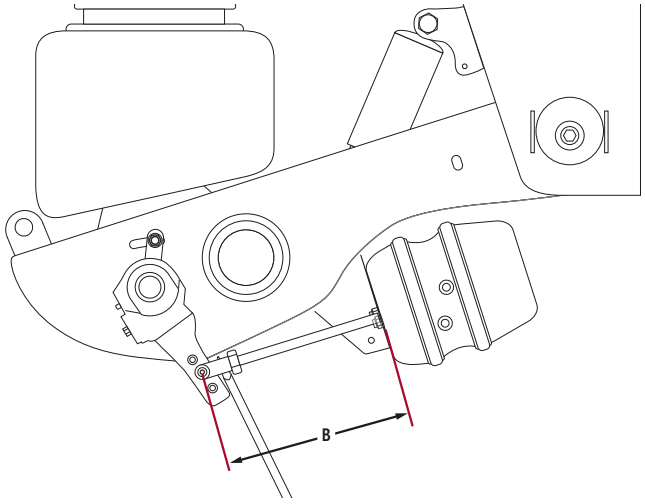


Figure 101: **Brake Chamber Free Stroke = B – A**

Free Stroke = B – A	Measurement
Free Stroke	10-16 mm

Table 7: **Brake Chamber Free Stoke**

Free Stroke is an indication of necessary brake shoe clearance. Use a bar or lever to move the brake adjuster from full retracted until the shoes contact the drum. Measure this movement (B - A) to get **Free Stroke**. If this measurement is correct, then the adjustment is correct. Refer Figure 101 and Table 7.

NOTICE: **Free Stroke** is especially important when installing new brake linings because they can expand slightly on first use.

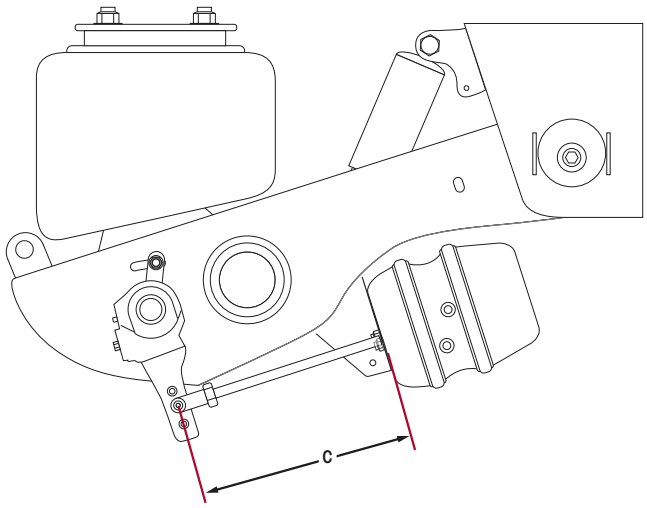


Figure 102: **Brake Chamber Applied Stroke = C – A**

Applied Stroke = C – A	Maximum
Standard Type 24	44 mm
Standard Type 30	51 mm
Long Stroke Type 24 & 30	63 mm

Table 8: **Brake Chamber Applied Stroke**

Measuring **Applied Stroke** (C - A) tests other sections of the foundation brake. To get an accurate measurement the applied pressure should be around 620 kPa (90 psi). If **Free Stroke** is correct but **Applied Stroke** is excessive, inspect the foundation brakes for worn, loose or cracked components. Refer Figure 102 and Table 8.

NOTICE: **Free Stroke** is especially important when installing new brake linings because they can expand slightly on first use.

TIP: Another common method of measuring free and applied stroke is to mark, or fit a marker, on the rod at the chamber body. Then measure the distance the rod moves when pulling on the brake adjuster (Figure 101) and when the brake is applied (Figure 102).

Brake Chamber Removal

1. Fully retract and cage brake chamber. If the chamber includes a parking brake chamber, and is still operational, temporarily apply air pressure to the park brake chamber to assist in engaging release bolt.
2. Release all air to brake chamber, including to park brake chamber.
3. Remove clevis split pin and discard.
4. Remove clevis pin.
5. Disconnect air lines and cover openings with dust plugs to reduce the possibility of dust/dirt contamination.
6. Remove the two nuts holding brake chamber to axle and remove chamber.

Brake Chamber Disassembly

NOTICE: It is recommended that faulty brake chambers are replaced with completely new units due to convenience, cost, reliability, and potential safety concerns.

It is possible to replace the service brake diaphragm on some brake chambers that include a park (emergency) brake chamber. Most brake chambers without park brake chambers do not have replaceable service diagrams.

WARNING: Brake chambers use mechanical springs that are stored under force. Improper service procedures can cause personal injury or even death. Never cut open chamber bands or clamps. Ensure safe industry standard work practices are always followed. Seek assistance from a skilled technician if unsure about any of the following steps.

7. Ensure park brake chamber is caged and removed from vehicle.

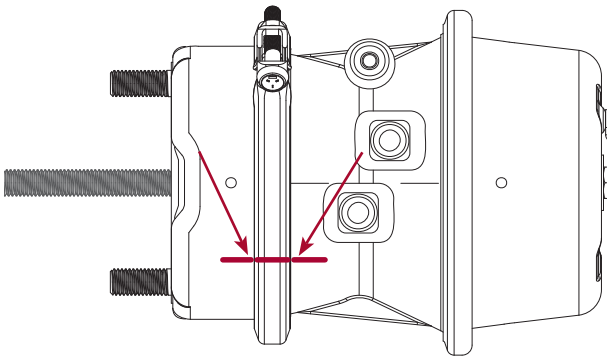


Figure 103: **Mark Front Housing, Clamp and Centre Body Position**

8. Mark orientation of the front housing and clamp relative to the centre body, to enable correct alignment of the air ports on reassembly. Refer Figure 103.
9. Firmly clamp the service push rod with a set of locking pliers to prevent release of the service brake chamber spring, which would hinder chamber reassembly. Refer Figure 104.

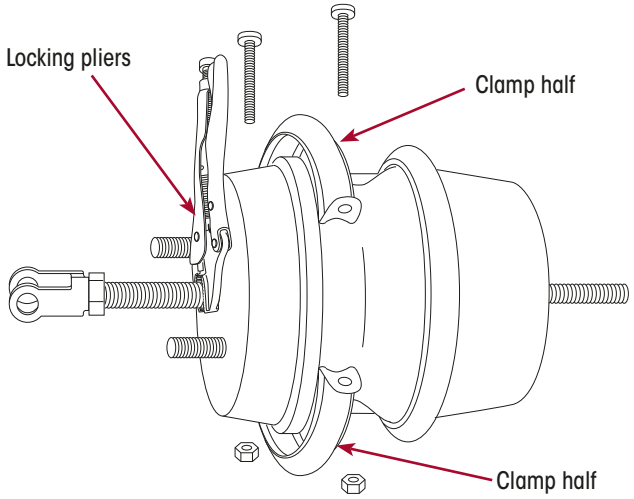


Figure 104: **Remove Clamp Assembly**

10. Remove bolts and clamp from service brake chamber. Refer Figure 104.

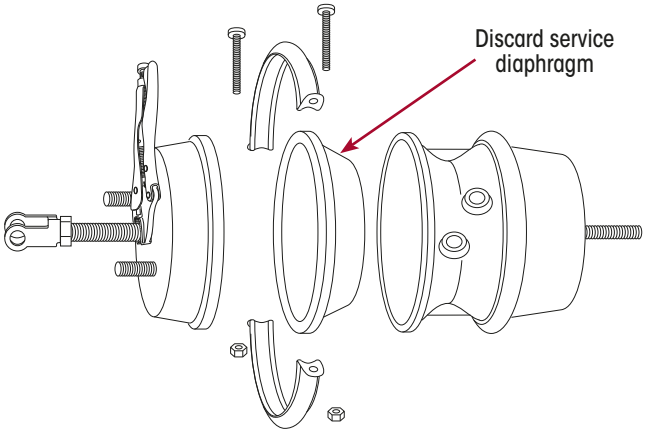


Figure 105: **Brake Chamber Disassembly**

11. Disassemble brake chamber. Refer Figure 105.
12. Discard old service diaphragm. Clean and inspect components. Check for cracks, damage and wear. If there is any doubt about component serviceability, replace with a new brake chamber.

Brake Chamber Assembly

1. Ensure push rod plate or free of any grease, oil or dirt.

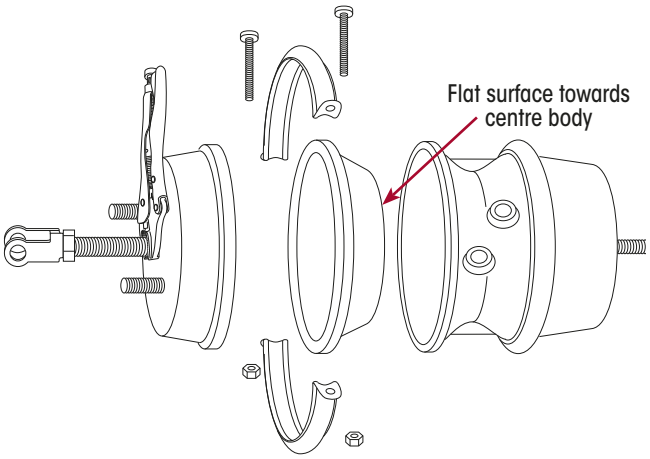


Figure 106: **Brake Chamber Assembly**

2. Place new diaphragm into the centre body with the flat surface towards the centre body. Refer Figure 106.
3. Place front housing onto centre body, aligning marks made earlier to ensure correct air port orientation. If marks are no longer visible, determine correct orientation by using the trailer as reference.
4. Install service clamp assembly.
5. Tighten the bolts evenly. Alternately turn each bolt one turn until both bolts are tight. Torque clamp bolts to *27-40 Nm*.
6. Remove locking pliers from the service push rod.
7. Inspect clamp, housing and centre body for proper seating.
8. Check service brake chamber for leaks by applying 8-bar air pressure to the service port and using a foaming agent. Refer to "Leak Detection Foaming Agents" on page 103.

CAUTION: Ensure air pressure is applied in a safe manner, while using appropriate personal protective equipment.

WARNING: Do not allow the brake chamber to exceed the maximum of 8-bar air pressure.

9. If no leaks are found, reinstall brake chamber. If any leak at all is found do not place back into service until the fault is rectified or replaced with a new chamber.

Brake Chamber Installation

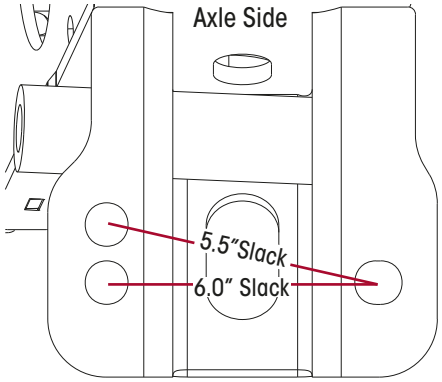


Figure 107: **INTRAAX 3-Hole Brake Chamber Stud Position**

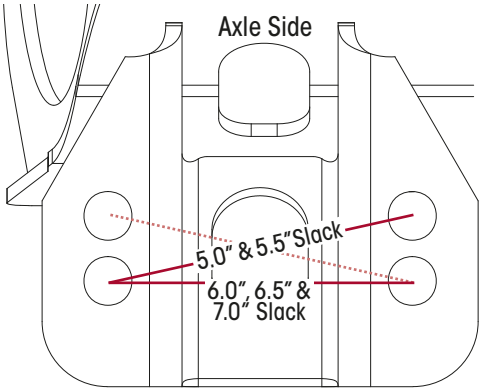


Figure 108: **INTRAAX 4-Hole Brake Chamber Stud Position**

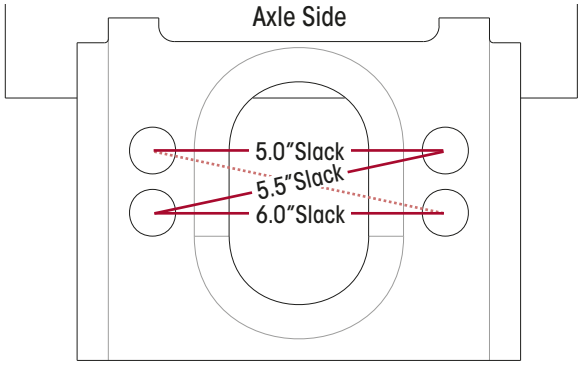


Figure 109: **TRLAXLE™ 4-Hole Brake Chamber Stud Position**

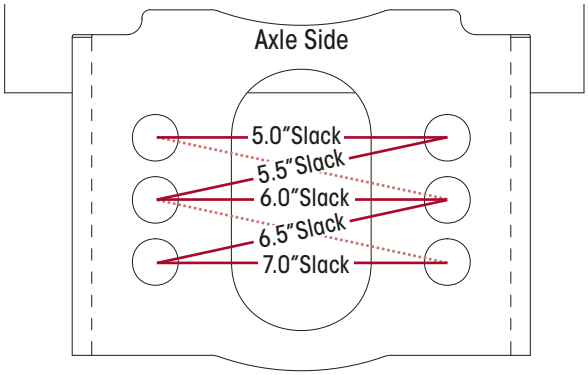


Figure 110: **TRLAXLE 6-Hole Brake Chamber Stud Position**

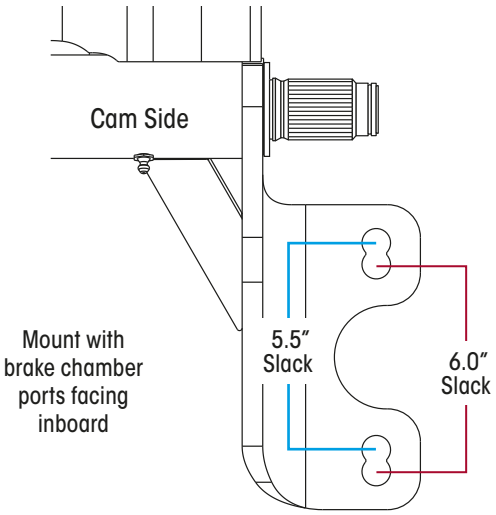


Figure 111: **CONNEX™ ST 4-Hole Brake Chamber Bracket Position**

Brake chambers must be installed into the correct mounting holes to match slack adjuster and axle design.

1. Ensure mounting face is free of cracks, rust and debris. Do not install washers between brake chamber and axle.
2. If the brake chamber has a park brake chamber, ensure that it is correctly caged into the fully retracted position.
3. Install brake chamber with the port(s) orientated so that they match the air line position(s). Install brake chamber studs into the mounting holes, which were marked before removal.
   If necessary, and if the trailer has been in service for some time, there will also be witness marks from the original installation. Refer to Figure 107, Figure 108, Figure 109, Figure 110 and Figure 111 for common mounting configurations.
4. Fit the mounting nuts and torque in two steps. First to *70 Nm* and then to the final torque of *180 – 210 Nm*.

NOTICE: Check brake chamber position to ensure that there is enough clearance between brake chamber body and other components, such as shock absorbers, to ensure there will be no contact throughout suspension travel.

5. Ensure the slack adjuster hole is aligned with the brake chamber clevis. If not, then turn the adjuster hex until it does.
6. Coat clevis pin with anti-seize lubricant and install.
7. Insert new split pin and bend both legs so that the pin cannot come out and will not interfere with chamber operation.
8. Remove the brake chamber port dust covers, which were fitting at removal ("Brake Chamber Removal" on page 49), from brake chamber opening(s) and reconnect the air lines.
9. New brake chambers may have their drain points covered with rubber plugs. Ensure that the drain plug is removed from lowest point of the brake chamber.
10. If the chamber has been caged, apply air pressure to park brake to release and then remove release bolt.

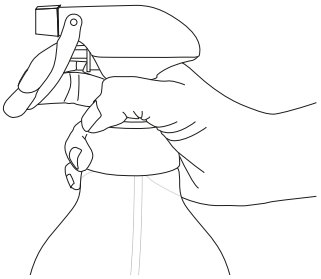


Figure 112: **Check for Leaks with a Suitable Foaming Agent**

11. Check brake chambers, air lines and connections for air leaks. Ensure that there is at least 620 kPa of pressure is available. Refer Figure 112.
    - Apply air pressure to the park brake chamber and check for air leaks from around the chamber, air line and fitting.
    - Apply air pressure to the service brake chamber and inspect for leaks around service brake chamber, air line and fitting.

IMPORTANT: Leaks of any nature are unacceptable. If necessary, use foaming agent to confirm components are leak free. Refer to "Leak Detection Foaming Agents" on page 103.

NOTICE: Torque specifications are available in Hendrickson Manual 97117-251.

DUST SHIELD

Inspect dust shields for damage, security and corrosion. Re-attach, straighten or replace, as necessary.

Dust Shield Removal

1. Remove the clamp holding dust shield onto axle.
2. Remove dust shield.

IMPORTANT: Carefully open shield during removal to ensure that it does not become deformed or damaged.

Dust Shield Installation

1. Install dust shield.
2. Install the clamp finger tight.
3. Ensure dust shield is mounted symmetrically and does not contact brake drum or ABS sensor (if fitted).
4. Tighten dust shield mounting to specification.

NOTICE: Torque specifications are available in Hendrickson Manual 97117-251.

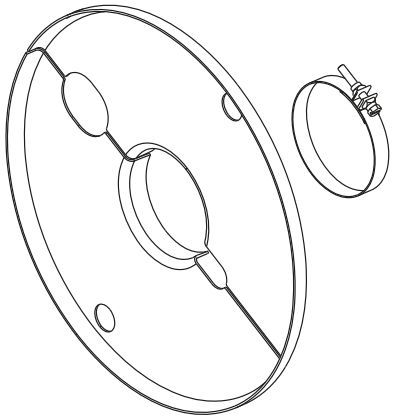


Figure 113: Dust Shield Clamp

ABS SENSORS

ABS sensors do not require regular maintenance or servicing. However, they may require replacement if wiring or sensor has been damaged. This will be indicated by a fault logged by the ABS/EBS controller. Keep in mind that sensor fault codes can also be caused by ABS/EBS controller faults, wiring faults in the harness to the sensor or problems with the ABS sensor tone ring.

If no faults are obvious from visual inspection, check sensor operation using a suitable ABS/EBS diagnostic controller. The sensor resistance may be tested if still unsure about whether the sensor is faulty.

Specifications

Description	Specification
Sensor Resistance	1100 to 1500 Ohm @ 20° C
Sensor to Ring Air Gap	0.4 mm Maximum
Tone Ring Runout	0.2 mm Maximum

Table 9: **ABS Sensor Specifications**

Sensor Air Gap

Position sensor by pushing it against the tone ring. The sensor will then automatically move to the optimum position during operation.

ABS Sensor Removal

1. Remove tyre/wheel assembly and brake drum.
2. Disconnect sensor connector from wiring harness.
3. Cut any cable ties holding sensor cable in place.
4. Slide sensor out of axle ABS bracket.
5. Remove and replace sensor sleeve if it has lost tension.

ABS Sensor Installation

1. Install sensor sleeve by compressing the outer diameter of the sleeve until sleeve can be inserted into the inner diameter of the ABS sensor bracket. For later disc brake axles, the sensor should be installed into the fourth opening in the brake spider (i.e. not the calliper mounting hole). Insert the sleeve from the inboard side of the axle and press sleeve toward the outboard end of the axle until the bent over tabs on the sleeve contact the end of the ABS bracket tube. Refer Figure 114, Figure 115 and Figure 116.

NOTE: Early disc brake axles use a bracket welded to the axle tube for sensor mounting. These sensors must be installed, and their cables routed, similar to the drum brake axles.

2. After the sleeve has been installed, insert the ABS sensor into the inboard side of the ABS sensor bracket. Press the sensor in until it contacts the ABS tone ring.

NOTICE: Tone ring runout will normally move the sensor to the correct operating clearance once the vehicle is in operation.

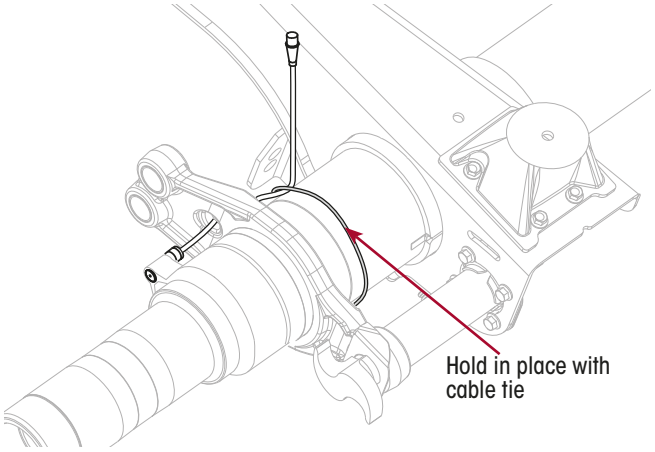


Figure 114: **Drum Brake Straight ABS Sensor Installation**

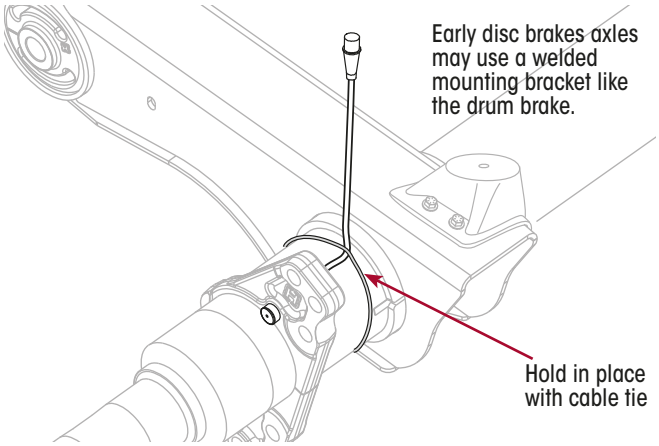


Figure 115: **Disc Brake Straight ABS Sensor Installation**

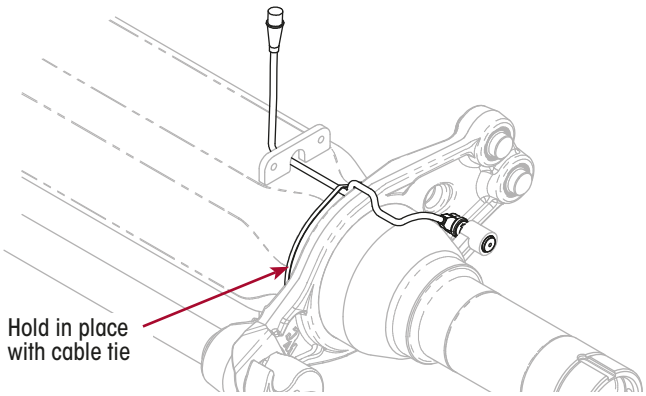


Figure 116: **Drum Brake 90° ABS Sensor Installation**

3. Routing of the sensor cable will vary depend on whether it is a right angle or straight sensor with disc or drum.
   - Straight Sensor Drum: Feed sensor cable through the opening in the brake spider plate behind the sensor and through opening in dust shield. Refer Figure 114.
   - Straight Sensor Disc: Tie sensor cable to ensure it does not foul during suspension movement. Refer Figure 115.
   - Right-Angle Sensor Drum: Feed the sensor cable around the brake spider and through the opening in the dust cover or dust cover flange as shown. Refer Figure 116.
4. Fasten the sensor cable to the axle with nylon cable tie where necessary to prevent excessive movement or loose loops of cable.
5. Verify that the cable is secure and does not rub or chaff against the brake drum or rigging.
6. Refit brake drum and tyre/wheel assembly.
7. Verify trailer brake and sensor operation.

INSTALLING BRAKE DRUM AND TYRE/ WHEEL

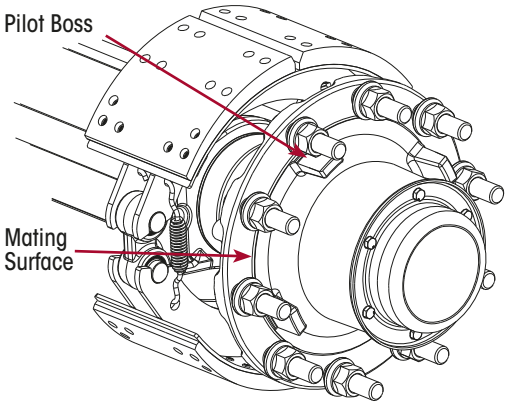


Figure 117: **Hub Piloted Wheel End**

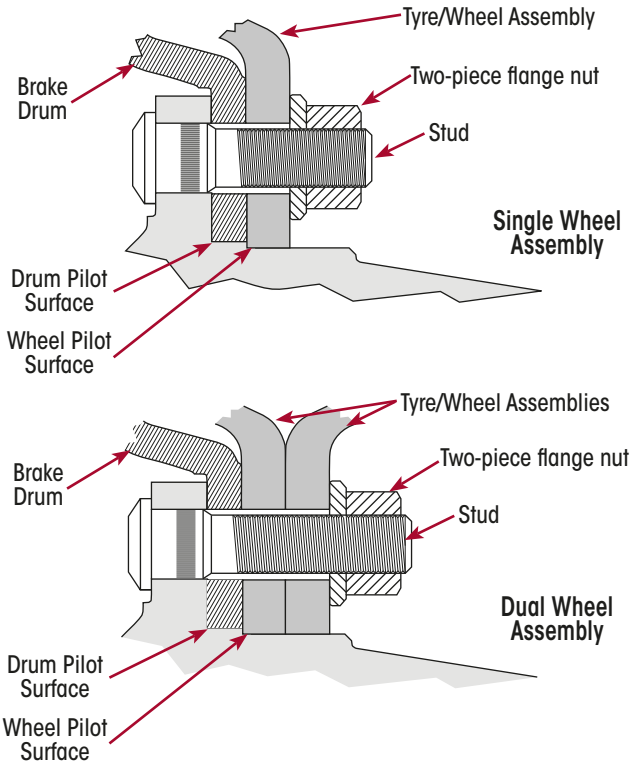


Figure 118: **Hub Piloted Wheel Mounting System**

The hub pilot system is used on Hendrickson hubs. It uses pilot bosses, which are machined into the hub, to centre the brake drum and tyre/wheel assembly on the hub. The entire wheel assembly is fastened together by a single flange nut on each wheel stud. Refer to Figure 117 and Figure 118.

Installation Procedures

⚠ **WARNING**: Read and follow the outlined instructions when installing or servicing the hub, improper installation could result in property damage, injury, or death.

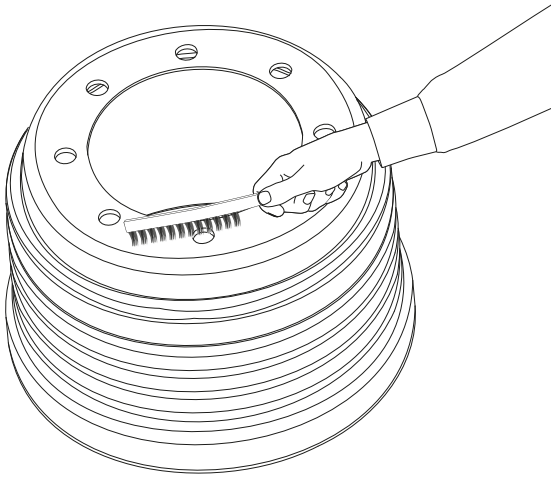


Figure 119: **Clean Drum & Wheel Mating Surfaces**

1. Clean all mating surfaces on hub, drum, wheels, and nuts. Refer to Figure 119.

NOTICE: It is essential to remove corrosion and dirt from the wheel contact surface, hub flange, drum face and drum pilot. If this is not carried out, the drum will not seat correctly and may crack the drum at the flange. The wheel mounting face must also be clean and free of any rust, dirt, or grime. This will help prevent wheel runout and relative wheel movement.

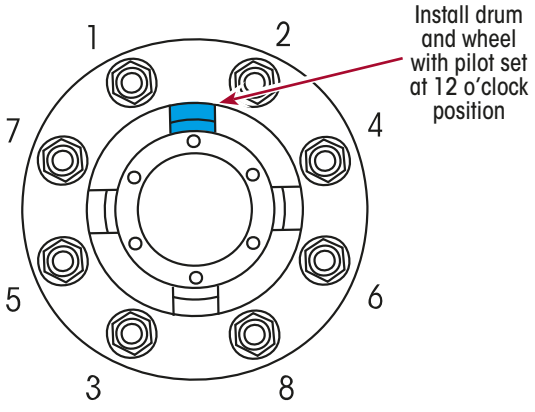


Figure 120: **8 Stud Tightening Sequence**

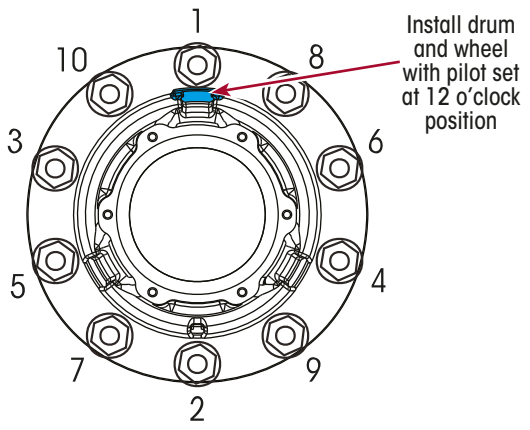


Figure 121: **10 Stud Tightening Sequence**

2. Rotate hub until a pilot boss is at the top (12 o'clock) position. This will help hold the drum up in position when being fitted and reduce likelihood of drum catching on pilot. Refer Figure 120 or Figure 121.

3. Mount brake drum on hub so it seats on drum pilot and is flush against hub face.

⚠ **CAUTION**: Check to ensure the drum is flush against the hub mating surface and does not get caught on the pilot. If this occurs, the drum could crack at mounting flange when the nuts are tightened, or the wheel may work its way loose and separate from trailer. Refer Figure 118.

IMPORTANT: If reusing two-piece flange nuts, apply two drops of SAE 30W motor oil at the point between the flange and hex of the nut. Refer to Figure 122.

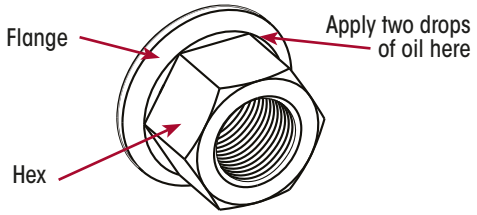


Figure 122: **Two-Piece Flange Nut**

4. Before reusing two-piece flange nuts that have already been used in service:

   A. Inspect the nut to ensure it is in good condition and the flange continues to rotate freely. If not, discard and replace with new.

   B. Apply two drops at the point between the flange and hex of the nut. Refer to Figure 122.

5. With a hub pilot at 12 o'clock, mount wheel on hub and hold in place by hand installing wheel nuts.

6. Snug top (12 o'clock) and bottom (6 o'clock) wheel nuts and apply *70 Nm* of torque to draw wheel and brake drum fully against the hub.

7. Inspect to ensure proper assembly with wheel and brake drum positioned on pilot bosses before tightening remaining wheel nuts.

8. Using the applicable sequence shown in Figure 120 or Figure 121, tighten all wheel nuts to initial torque of *70 Nm*.

9. Repeating sequence shown, retighten all wheel nuts to a final torque of *610 Nm*.

10. Check seating of wheel and brake drum at the pilot bosses. Rotate wheel and check for any rotational irregularity.

⚠ **CAUTION**: Re-torque all wheel nuts after 80 to 160 km travel. Proper torque is essential for the service life and integrity of the wheel end.

NOTICE: Torque specifications are available in Hendrickson Manual 97117-251.

DRUM BRAKE TROUBLESHOOTING CHART

Table 10: Drum Brake Trouble Shooting Chart

Condition	Possible Causes	Checks	Remedies
Brake Drum Badly Scored	Dust or dirt becoming embedded in brake linings.	Dust shields not fitted/damaged or operating in severe conditions.	Fit/replace brake shields and replace drums and linings.
Brake Drum Cracked	Brake drum not installed correctly or dropped prior to installation.	Cracks can be caused by not cleaning hub/drum, catching drum edge on pilot or mishandling prior to installation.	Replace drum, thoroughly prepare hub and install carefully.
	Rapid heating or cooling.	Excessive heat can build up quickly due to component failure or aggressive driving at speed. Rapid cooling can occur if driving hot brakes into a substantial amount of water.	Check for cause, rectify cause/ retrain driver and replace any affected drums.
Brake linings Wear Out Quickly	Non-genuine brake linings fitted.	Check make of brake shoes.	Replace with genuine Hendrickson brake shoes.
	Slack adjuster not releasing.	Check for brake chamber air leaks or over adjustment of slack adjuster.	Adjust or repair, as necessary.
	Trailer overloaded or poor braking technique.	Confirm driving habits and trailer loads.	Re-educate driver.
Poor Braking	Auto slack adjuster not self-adjusting.	Inspect slack adjuster, control arm and anchor pin. Check slack adjuster operation.	Replace any non-functioning or damaged components.
	Excessively worn brake linings or drums.	Check drums for oversize and linings for wear.	Replace, as necessary.
	S-cam bushes worn.	Measure S-cam bushes for radial play.	Replace camshaft tubes (and S-cams if necessary).
	Slack adjuster not adjusted correctly.	Check slack adjuster setting.	Follow correct adjustment procedure.
	Slow operating brake chamber.	Check for air leaks and that drain plug is removed from lowest point of brake chamber.	Repair or replace, where necessary.
Smoke Coming from Brakes	Air leak at emergency brake chamber.	Check for air leaks at or to emergency brake chamber.	Repair or replace, where necessary.
	Contaminated brake linings.	Grease or oil leaking onto friction materials.	Replace linings and repair leak.
	HXS brake shoes fitted to standard S-cam.	Inspect brake shoes and S-cams for compatibility.	Fit standard brake shoes.
	Over adjusted slack adjuster.	Incorrect adjustment on service.	Follow correct adjustment procedure.
Vibration When Braking	Contaminated brake linings or drums.	Check brake linings for grease or oil contamination.	Repair any lubricant leaks and replace linings.
	Drums cracked or out of round.	Remove drums to measure and inspect.	Replace or machine.

This page is left intentionally blank.

DISC BRAKES

NOTICE: This information is designed as a quick reference and is not a compressive air disc brake repair manual. For more details, refer to relevant component manufacturer manuals and to Hendrickson T72009 MAXX22T installation and maintenance service manual.

Disc brakes spike to higher temperatures than drum brakes for the same stop because there is less mass in the rotor. The rotor cools quicker but is more susceptible to thermal fatigue cracks because of the temperature spike.

The piston boot, guide pin boots, brake chamber, adjuster boot, and adjuster plug must be in good condition and properly installed to function correctly. If water or dust gets into the calliper, it will cause ongoing damage to the internal mechanism until the brakes fail.

More frequent maintenance inspections are needed for dirty or off-road applications to detect contamination or damage before it causes severe problems.

NOTE: Brake pads and calliper guides are components that can normally be replaced without the need for replacing the entire calliper assembly. However, any issues with the calliper piston usually require replacement of the entire calliper. This is due to the potentially severe consequences that can arise from a seized calliper piston or a malfunctioning self-adjuster mechanism.

A seized calliper piston or a self-adjuster that fails to operate correctly can lead to brake drag, uneven brake application, or even complete brake failure.

INITIAL INSPECTION

On level ground, with the wheels chocked and the parking brake temporarily released, check for lateral movement of the brake calliper.

- A small amount of movement, less than 2 mm, in the inboard/outboard direction indicates that the brake calliper is sliding properly on its guide pins.
- If the calliper has no movement or appears to move more than 2 mm, a full wheel-removal inspection will be necessary.

An indication of pad friction material wear can be obtained, without removing the wheels, by checking relative calliper position.

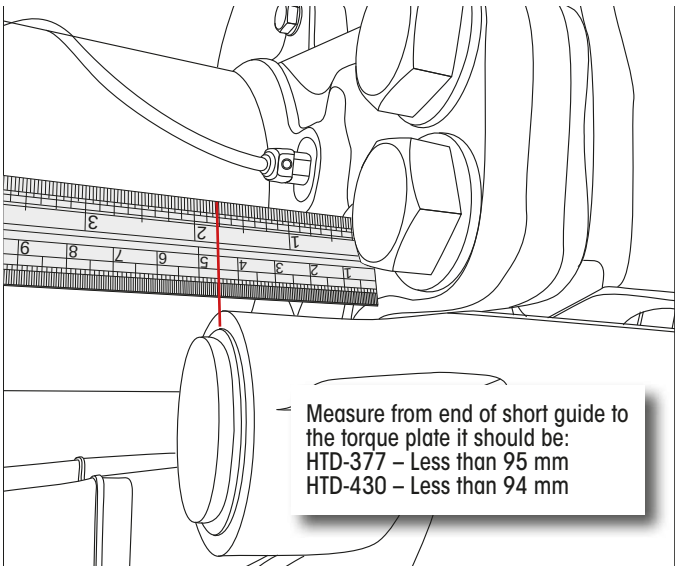


Figure 123: **Brake Pad Inspection HTD-377 & HTD-430**

HTD-377™ should have less than 95 mm between the end of the short guide and the face of the torque plate. HTD-430™ should have less than 94 mm between the end of the short guide and the face of the torque plate. Refer Figure 123.

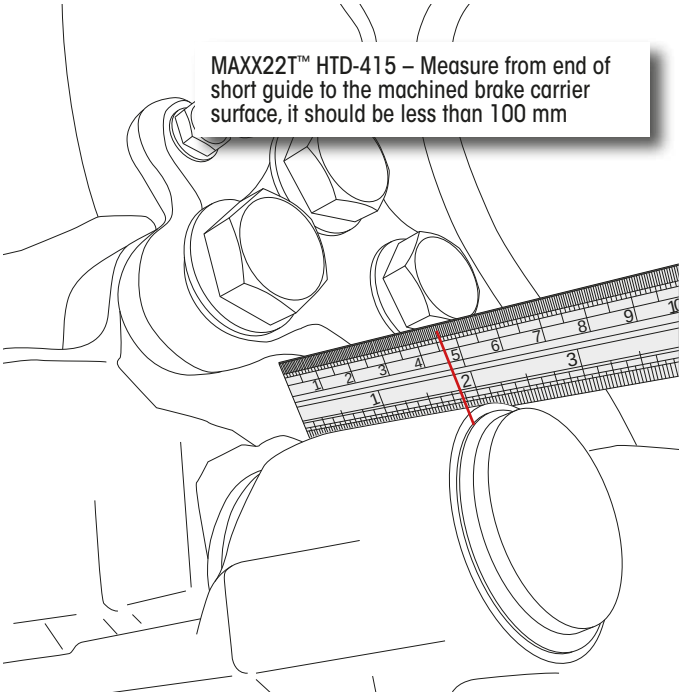


Figure 124: **Brake Pad Inspection MAXX22T ™ HTD-415™**

MAXX22T HTD-415™ measure between the end of the guide and the machined brake carrier surface. It should be less than 100 mm. Refer Figure 124.

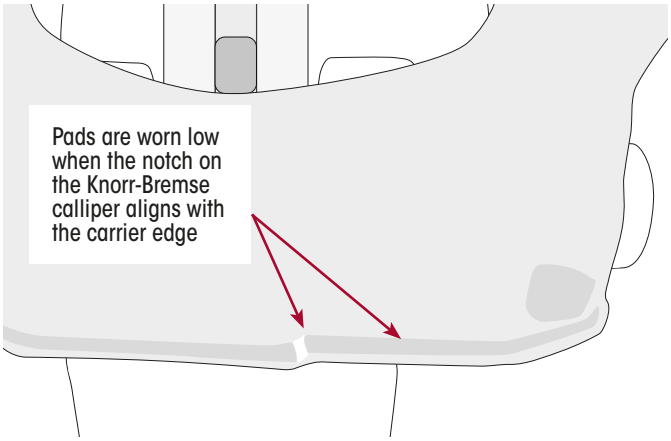


Figure 125: **Brake Pad Inspection Knorr-Bremse SN7**

Knorr-Bremse callipers have a notch in the edge of the calliper, which will align with the top edge of the carrier when the pads are at their wear limit. Refer Figure 125.

NOTICE: Always remove the wheel for a closer inspection there is any doubt about brake serviceability.

BRAKE PADS

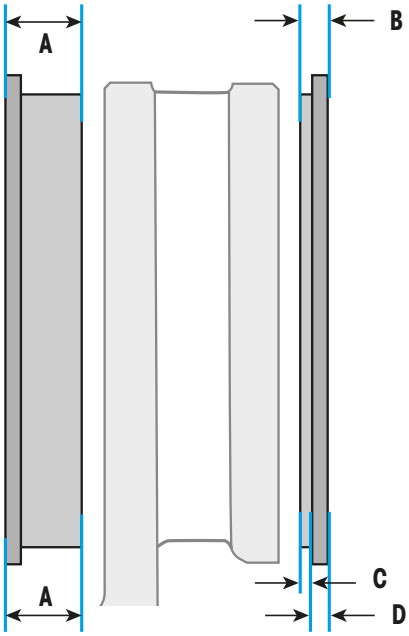


Figure 126: **Measuring Brake Pad Lining Thickness**

Item	Measurement	Specification
A to A	Pad Thickness Variation Maximum	2 mm
B	Pad Thickness Minimum	11 mm
C	Friction Material Minimum	2 mm
D	Backing Plate Thickness	9 mm

Table 11: **Brake Pad Thickness Specifications**

Refer to Figure 126 and Table 11 for brake pad inspection specifications.

1. Both the inner and outer brakes pads should be individually checked for wear at the top and bottom. The minimum thickness of the friction material is 2 mm. Therefore, consider the trailer service schedule and usage to ensure that there will still be adequate friction material until the next planned service check.
2. Compare the thickness of the friction material between the top and bottom of the same pad. The difference should be less than 2 mm. If not, replace the brake pads and inspect the guide pins; service, repair or replace, as necessary.
3. Compare the thickness of the inboard and outboard brake pad friction material. There must be less than 3.5 mm difference in thickness. If there is a difference in pad thickness, then check for anything that could restrict calliper movement, such as seized or sticky guide pins, a tight air line or stretched wiring to the pad wear sensors. Replace pads as part of the repair.
4. Check the brake pads for damage or fragmentation. Minor damage at the edges is acceptable but replace the pads if major friction material damage is found.
5. Inspect all the brake pad retaining springs. Check that none of them are missing, losing tension, worn, broken or cracked.
6. Remove glaze from the rotor braking surface with 80-grit emery cloth before installing the new brake pads to help bed in the new friction material.

NOTICE: It is not necessary to remove the calliper to replace pads.

⚠ **WARNING**: Always replace the brake pads by axle to ensure even braking. The use of genuine brake pads will ensure even wear and braking efficiency.

⚠ **CAUTION**: Never allow brake pads to wear below the 2 mm minimum because it may allow the pads to dislodge, cause brake failure and loss of vehicle control.

DISC ROTOR

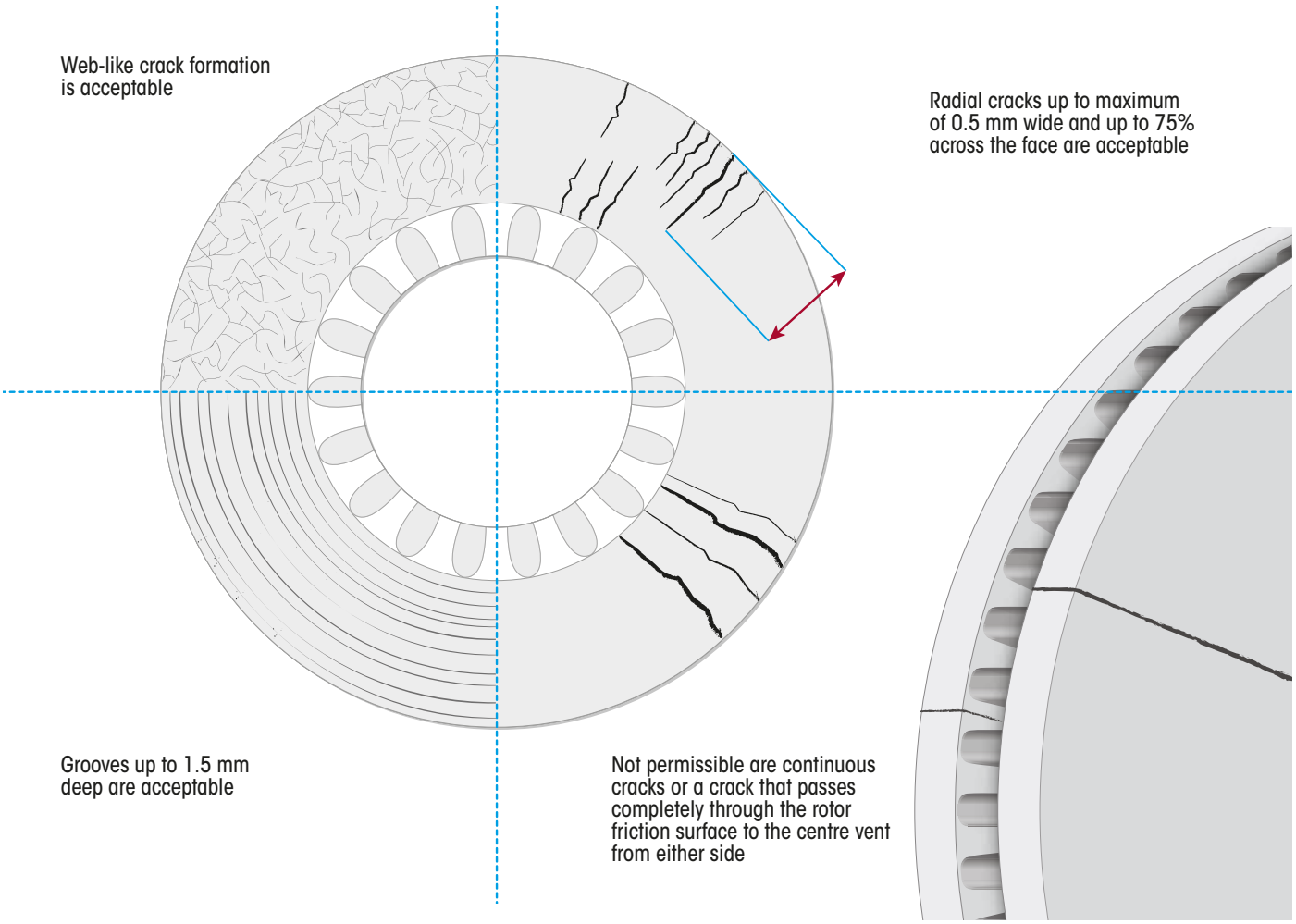


Figure 127: **Brake Rotor Inspection**

Visually inspect rotor for heat discolouration, contamination, scoring, runout and large or continuous cracks. Mark rotor and turn through one complete rotation to inspect the entire the braking surface. Refer Figure 127.

Measure rotor thickness at 3 points, 120 degrees apart to ensure it is wearing evenly. Refer to Table 12 for minimum rotor thickness, which is also stamped into the edge of brake rotors. Some rotors have a 30° chamfer on the edge to indicate minimum thickness. Refer Figure 128.

Measure rotor runout with a suitable dial indicator. There should be no more than 0.15 mm (0.006") runout. Discs with excessive runout can be machined if there will be at least 2 mm above minimum thickness after machining to ensure good service life.

NOTICE: Always replace the hub seal if the hub is removed for any reason. PreSet hubs also require a new spacer, along with the seal.

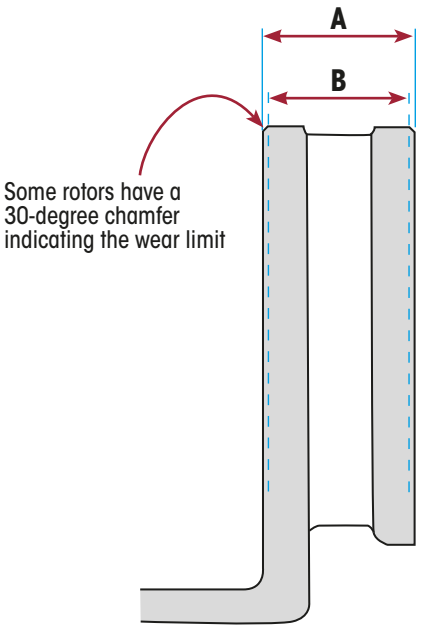


Figure 128: **Brake Rotor Measurement**

Rotor	MAXX22T HTD-415	KIC HTD-377/430	ConMet
Diameter	415 mm	370 & 430 mm	430 mm
A – New Thickness	43 mm	45 mm	45 mm
B – Thickness Minimum	37 mm	37 mm	37 mm [1]
Rotor Run Out Maximum	0.5 mm (0.02″)	0.5 mm (0.02″)	0.5 mm (0.02″)
Rotor Thickness Variation	0.13 mm (0.005″)	0.13 mm (0.005″)	0.13 mm (0.005″)
Calliper Guide Pin Play Maximum	2 mm (0.08″)	2 mm (0.08″)	2 mm (0.08″)

[1] Revised specifications

Table 12: **Brake Rotor Specifications**

BRAKE CHAMBERS

Brake chambers are a vital but often neglected part of the braking system. This is because they are reliable and usually replaced as a unit if there are any problems. However, there are things that technicians can do to ensure that customers get the most out of their brake chambers and that any repair work maximises brake life.

Brake chambers can be affected by dirt and corrosion if exposed to water and mud. Flood waters contain grit and grime that can accumulate inside the chamber on the piston rod bellows, which will cause accelerated abrasion of the bellows. If in doubt, it may be best to replace chambers that have been covered in flood waters. They can also be damaged from debris and going over rough off-road surfaces.

Carefully inspect brake chambers for corrosion and damage. Damage at the joins between chamber segments are the main cause for concern. So, pay particular attention to these joins. If you need to remove or replace a chamber, keeping an eye on the following points will help complete the job successfully and ensure maximum life from the braking system.

Brake Chamber Removal

1. Fully retract and cage brake chamber. If the chamber includes a parking brake chamber, and is still operational, temporarily apply air pressure to the park brake chamber to assist in engaging release bolt.
2. Release all air to brake chamber, including to park brake chamber.
3. Disconnect air lines and cover openings with dust plugs to reduce the possibility of dust/dirt contamination.
4. Remove the two nuts holding brake chamber to calliper and remove chamber.

Brake Chamber Installation

NOTICE If not previously caged, manually cage the brake chamber according to brake chamber manufacturer's procedures before removing the chamber from the calliper. And then remember to remove the caging bolt before sending the vehicle back into service. Torque specifications are available in manual 97117-251.

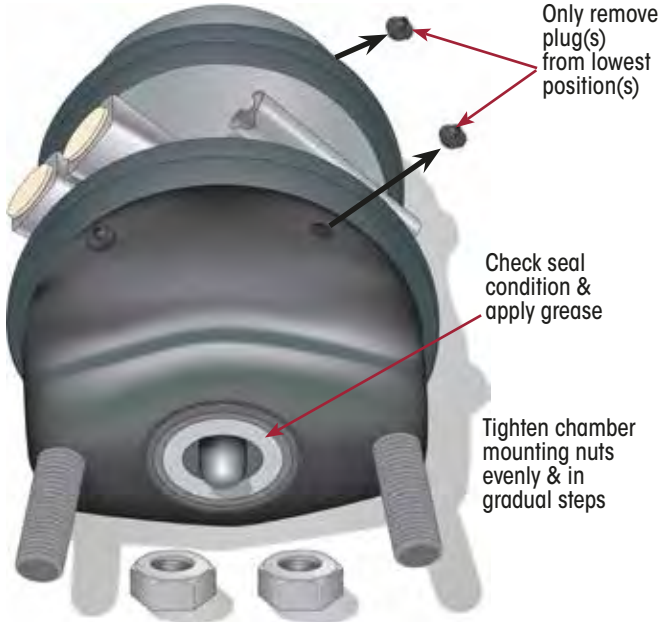


Figure 129: **Disc Brake Chamber Installation**

1. Ensure that only the lowest drain hole in the brake chamber has the rubber plug removed to minimise ingress of any contaminants. On installation, remove the lower housing plug from each chamber. This means that if it is a dual park/emergency brake chamber then two plugs will need to be removed. Failure to remove these plugs will make the calliper release slowly, which will cause brake drag and excessive pad wear. Refer Figure 129.

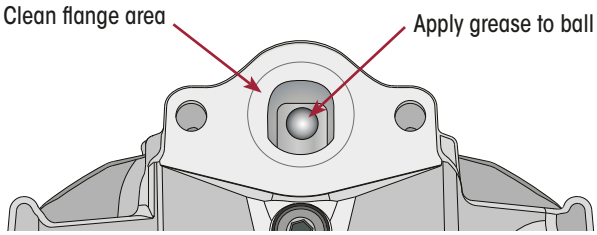


Figure 130: **Clean & Lubricate Calliper Chamber Mount**

2. Lubricate the brake lever ball cup with a white lithium-based grease before installing the brake chamber. Refer Figure 130.
3. Ensure the brake chamber to calliper seal is in good condition. Apply a smear of grease to this seal, before fitting chamber, to help protect calliper against contaminants. Refer Figure 129.
4. Clean the brake calliper flange area to ensure a good seal to the brake chamber. Refer Figure 130.
5. Torque the brake chamber nuts evenly and in steps to ensure correct mounting and engagement of piston rod and ball cup. Uneven tightening can cause the calliper to cock over and not sit flush, while under or over torquing can cause distortion or movement that will allow for water leaks. Refer Figure 129.

NOTICE Damage to the brake lines can occur if they are installed incorrectly or allowed to rub against other parts.

6. Ensure brake lines are free of twists and chaffing or rubbing against any other components. Brake air lines must also have sufficient freedom of movement that they do not restrict calliper movement. This problem can become evident as the calliper changes position when the brake pads wear.
7. Check brake chambers, air lines and connections for air leaks. Ensure there is at least 620 kPa (90 psi) of pressure available and the trailer is either raised off the ground or the wheels are chocked to prevent movement.
8. Apply both park and service brakes. Check for any leaks from air lines, connections or from the service brake diaphragm.
9. With both park and service brakes released, check for any leaks from air lines, connections or from the emergency brake chamber diaphragm.

NOTICE Leaks of any nature are unacceptable. If necessary, use a foaming agent to confirm components are leak free. Refer to "Leak Detection Foaming Agents" on page 103.

CALLIPER & GUIDES

⚠ **WARNING**: To prevent damage to the adjuster boot, never turn the adjuster on HTD-430, HTD-377 and MAXX22T HTD-415 without the pressure plate in place.

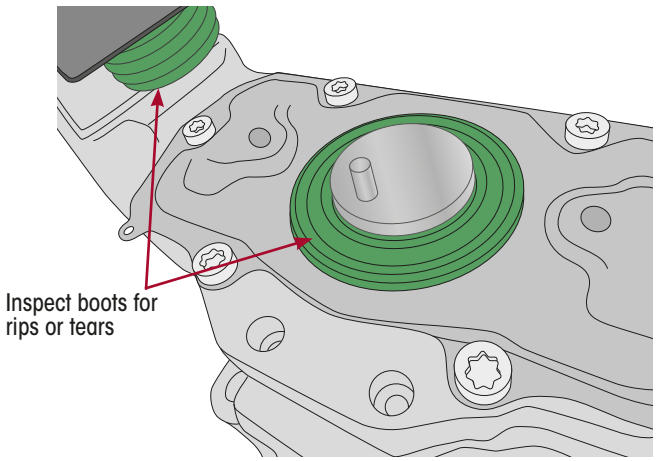


Figure 131: **Inspect Boots**

Inspect piston boot. Refer Figure 131. The self-adjusting mechanism needs to be completely free from contaminants like dust and corrosion to work effectively. If a torn boot is discovered during service, inspect the piston for signs of dust or moisture. Dirt, dust, moisture or corrosion will cause the calliper self-adjuster to stop operating or lever arm to seize altogether. If there is any doubt at all, replace the entire calliper to ensure reliable operation in service.

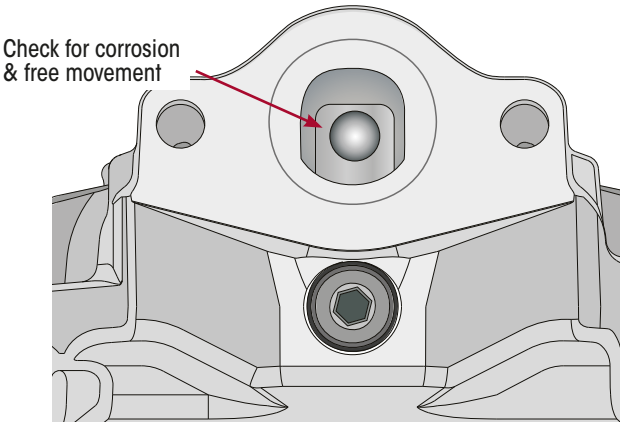


Figure 132: **Check Adjuster Lever Arm & Adjuster For Free Movement**

Inspect operation of adjuster lever arm to ensure that it moves freely, extends piston when moved and for presence of corrosion on arm. Replace calliper if it displays any of these issues. Refer Figure 132.

Pad Retainer Bar Holes

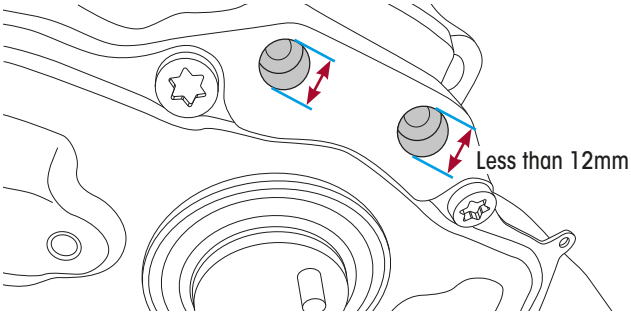


Figure 133: **Inspect Pad Retainer Bar Hole Wear**

The HTD-430, HTD-377 and MAXX22T HTD-415 callipers must be inspected for excessive wear at the holes for the brake pad retainer bar. If the holes are worn or look out of round, measure them at their widest point. The holes must be less than 12 mm. Replace complete calliper assembly if the holes measure 12 mm or more. Refer Figure 133.

Calliper Contact Wear Inspection

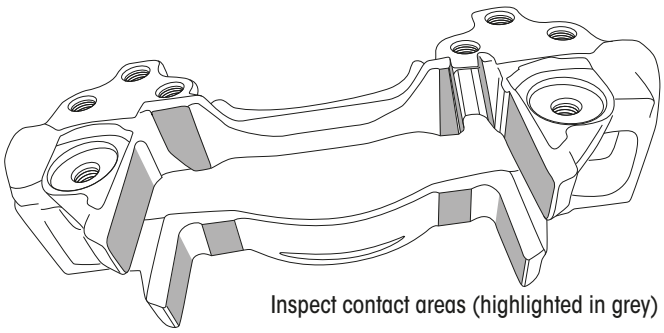


Figure 134: **Inspect Calliper Contact Areas**

If the brake pads and anchor plate wear grooves into the calliper, it will cause sticking callipers and uneven pad wear. With the pads and anchor plate removed, inspect contact areas for significant wear. Refer Figure 134 for HTD-430, HTD-377 and MAXX22T HTD-415 inspection. Replace complete calliper assembly if there is any substantial grooving of these areas.

Calliper Guides

Calliper guide pin bushes wear out, guide pin boots can be torn by debris, and guide pin caps can be punctured by stones and rocks. Inspect guide pin boots and caps for punctures or deterioration. Guide pin bushes should not have more than 2mm of free play. Replacing worn guide bushes minimises calliper movement and uneven pad wear.

Carefully examine the guide pin caps. Ingress of moisture, through even slightly damaged end caps, will cause the pins to seize. Guide pin caps, boots and guide pin bushes are available as service parts.

Inspect adjuster guide pin boots and piston boot for cracks, tears and correct fitment. Refer Figure 131.

Guide Inspection for HTD-377/430, MAXX22T Callipers

1. Remove brake pads and push calliper assembly fully outboard.

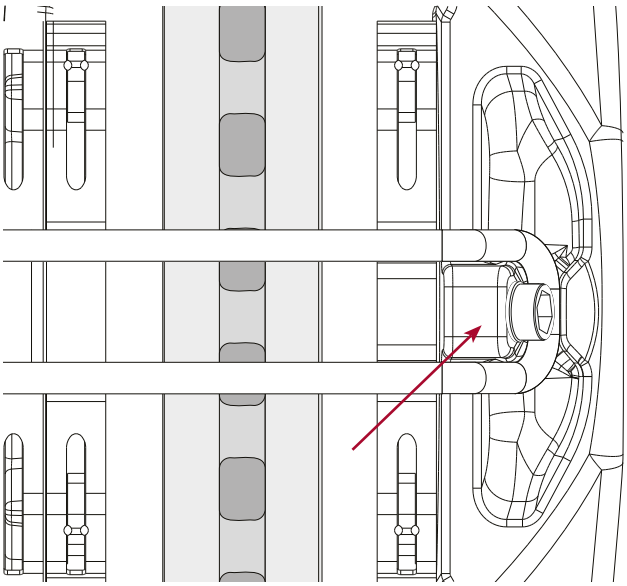


Figure 135: **Dial Gauge Measuring Point on Calliper**

2. Attach dial indicator firmly to brake carrier or axle. Mount so that the measuring pin touches the calliper at a convenient point near the pad retaining bar bolt. Refer Figure 135.

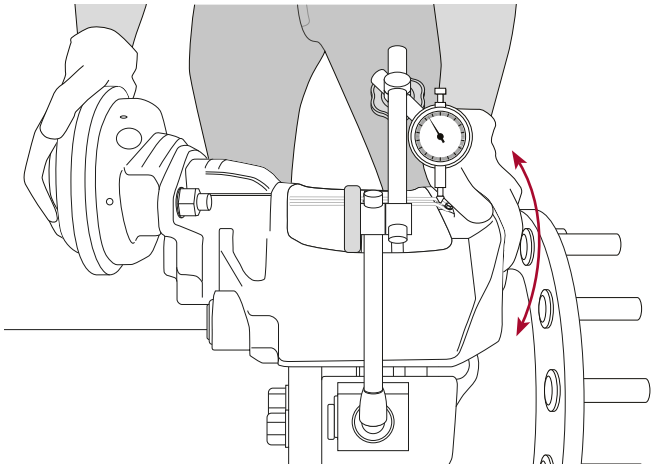


Figure 136: **Rocking Calliper to Measure Guide Play with Dial Gauge**

3. Tilt calliper towards axle and set dial indicator to zero. Refer Figure 136.
4. Pull calliper away from axle and read indicator. Calliper free play should not be more than 2 mm (0.080”). Refer Figure 136.

Guide Inspection for Knorr-Bremse Callipers

1. Remove brake pads and push calliper assembly fully outboard.

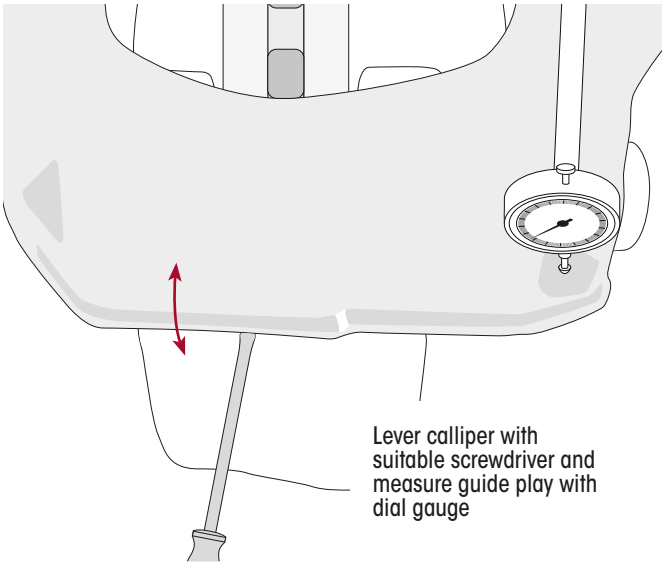


Figure 137: **Knorr-Bremse Guide Inspection**

2. Attach dial indicator to carrier on the short guide side of the calliper. Mount the gauge so that the measuring pin touches casting tag on the calliper and set to zero. Refer Figure 137.
3. Lever the calliper away from the carrier using a suitable screwdriver and read movement. The free play should not be more than 2 mm (0.080”). Refer Figure 137.

CHECKING ADJUSTER OPERATION

The brake calliper adjuster is sealed against water and dust in two ways: a boot around the adjuster and an adjuster plug. The adjuster boot needs to be clean and in good condition. The yellow adjuster plugs are removed for pad replacement and are often not replaced, which leaves the adjuster boot unprotected to deal with dirt and grime on its own. Mud, dust, and regular movement will wear away the sealing face of the adjuster boot. This is why the adjuster plug must always be reinstalled after service.

1. To check the calliper self-adjuster operation, the brake chamber, brake pads and pressure plate must all in place.

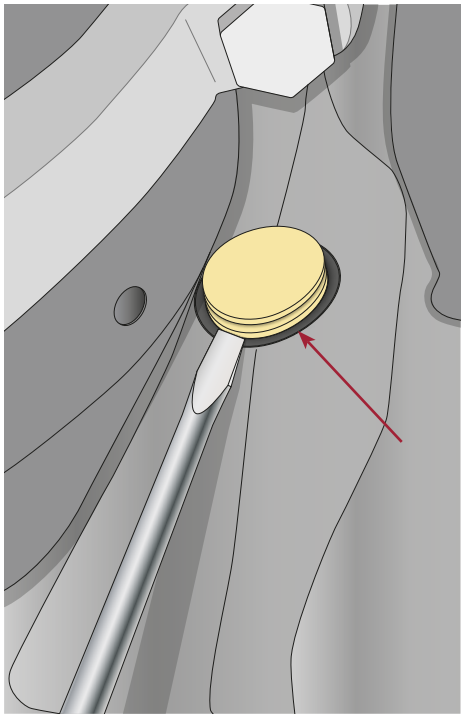


Figure 138: **Remove Adjuster Plug Without Damaging Boot**

2. Carefully remove the adjuster plug from the back of the calliper. Ensure that you do not to damage the surrounding adjuster boot. Refer Figure 138.

⚠ **WARNING**: Make sure you reinstall the adjuster boot afterwards to inhibit water entry, which may eventually cause the calliper to seize.

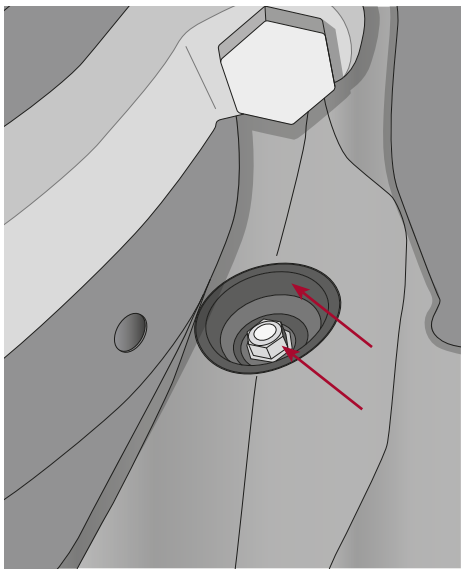


Figure 139: **Inspecting Adjuster & Boot**

3. Inspect the adjuster boot and plug for wear, damage or deterioration. Refer Figure 139.

4. Turn the adjuster half a turn clockwise for HTD-430, HTD-377 and MAXX22T HTD-415 with 8-mm deep offset spanner (anticlockwise for Knorr-Bremse using a 10-mm deep offset box spanner or a standard ring spanner paired with the adaptor socket from the service tool kit). Do not use an open-ended spanner.

5. Leave the spanner on the adjuster.

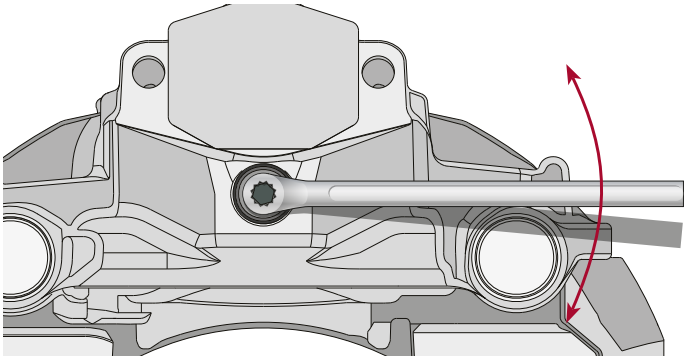


Figure 140: **Checking Spanner Movement on Brake Application**

6. Get an assistant to gently apply the brakes five times while you watch the spanner for movement.

⚠ **CAUTION**: To prevent injury, keep your hands away from calliper and spanner during movement.

7. If the adjuster is operating correctly, the spanner will move anticlockwise for HTD-430, HTD-377 and MAXX22T HTD-415 (and clockwise for Knorr-Bremse) with each brake application. The most movement should be on first application and then become progressively smaller.

8. Replace the calliper if there are any issues such as the adjuster does not move, turns only on first brake application or goes backwards and forwards with every application.

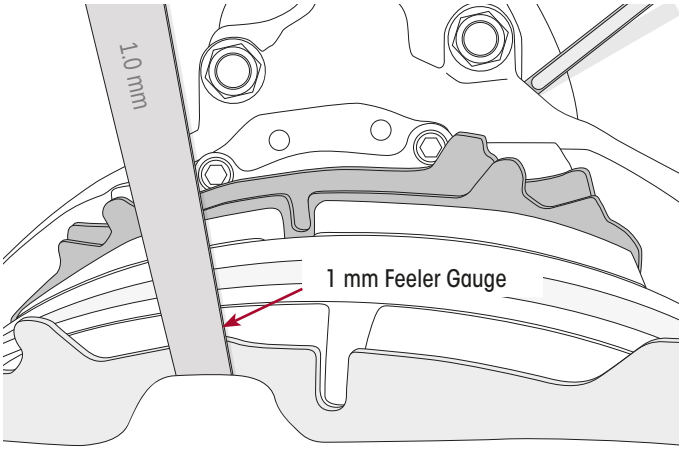


Figure 141: **Use Spanner to Set Clearance**

9a. , HTD-377, HTD-430 and MAXX22T HTD-415 callipers have one central tappet. Adjust brake pad clearance to 1 mm (0.040") using a long feeler gauge in the centre of the pad, between the outboard side of the calliper and the back of the brake pad. After completing adjustment, remove feeler gauge and rotate wheel hub to ensure it spins freely without any brake drag. Refer Figure 141.

9b. The Knorr-Bremse SN7 calliper adjuster includes a shear adapter. The shear adjuster is designed to break off if excessive torque is applied. This can happen if the adjuster sticks because it hasn't been operated for a while, but can also be from a serious calliper problem. It is usually best to rock the adjuster back and forth to free it up before trying to move it. If the shear adapter breaks, try again with a second shear adapter, but if this one also breaks from excessive torque then you must replace the calliper.

Knorr-Bremse brake callipers have two tappets, and therefore brake clearance must be set with two feeler gauges. Long 1.0 mm (0.040") feeler gauges should be inserted between the tappets and the brake pad backing plate. After completing adjustment, remove feeler gauges and rotate wheel hub to ensure it spins freely without any brake drag.

10. Install adjuster plug with a smear of white lithium-based grease to aid installation and to help seal against water entry.

CALLIPER LEFT/RIGHT IDENTIFICATION

Excessive and tapered brake pad wear may occur if the callipers are incorrectly positioned, left to right. MAXX22T HTD-415 callipers are designed to prevent improper positioning and can only be fitted on the correct side.

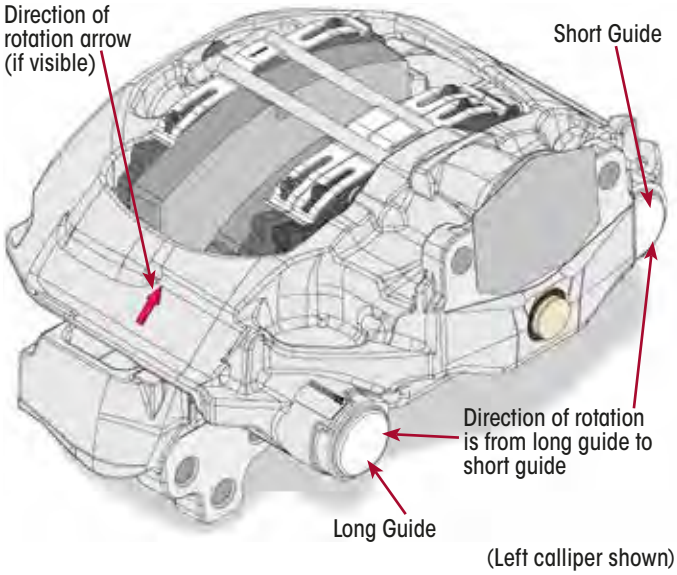


Figure 142: **WABCO Left/Right Calliper Identification**

MAXX22T HTD-415, callipers have direction arrows cast into the calliper that point in the direction of wheel rotation. HTD-377 and HTD-430 have painted arrows when new, but these can be hard to see over time and Knorr-Bremse don't have arrows. If the direction arrows become hard to see or are non-existent, note that wheel rotation is from the long guide to the short guide. Refer Figure 142. For more information on brake calliper identification, refer to Hendrickson Brake Systems Parts List 97114-097.

ABS SENSORS

For installation and inspection of ABS wheel speed sensors refer to "ABS Sensors" on page 52.

BRAKE CARRIER BOLTS

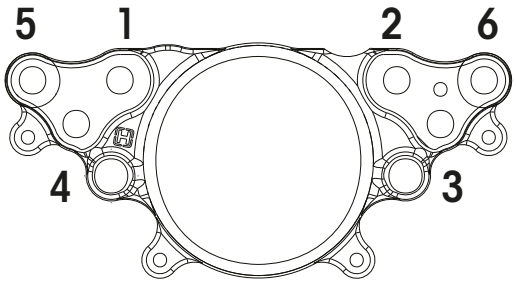


Figure 143: **HTD-377/430 & Knorr-Bremse Calliper Torque Sequence**

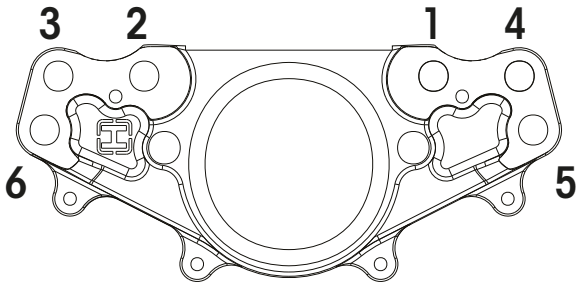


Figure 144: **MAXX22T HTD-415 Calliper Torque Sequence**

Carrier bolts must be torqued evenly and in sequence to avoid distortion of carrier and torque plate. Torque the M20 bolts to ***475 Nm*** (refer Figure 143) and the MAXX22T M18 bolts to ***380 Nm*** (refer Figure 144).

DUST SHIELD

Inspect dust shields for damage, security and corrosion. Re-attach, straighten or replace, as necessary.

Dust Shield Removal

1. Remove the clamp or bolts holding dust shield onto axle.
2. Remove dust shield.

Dust Shield Installation

1. Install dust shield.
2. Install the clamp or mounting bolts finger tight.
3. Ensure dust shield is mounted symmetrically and does not contact brake drum or ABS sensor (if fitted).
4. Tighten dust shield mounting to specification.

NOTICE: Torque specifications are available in Hendrickson Manual 97117-251.

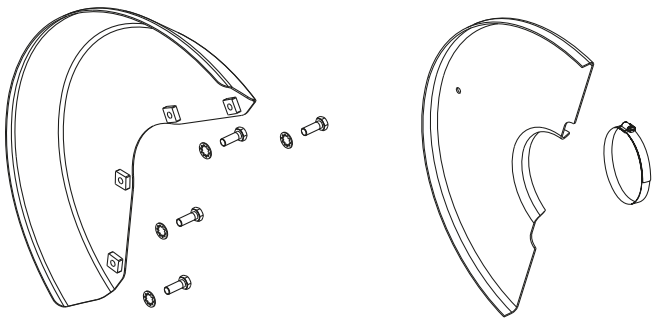


Figure 145: **Dust Shield Options – Bolt-On and Band**

DISC BRAKE TROUBLESHOOTING CHART

Table 13: Disc Brake Trouble Shooting Chart

Condition	Possible Causes	Checks	Remedies
Unbalanced Braking	Calliper seized.	Check calliper and slides for free movement.	Replace slides or callipers.
	Air circuit malfunction.	Check for air leaks or kinked lines.	Repair, as necessary.
	Brake chamber slow to respond.	Check that the lowest drain plug has been removed.	Remove lowest drain plug from brake chamber.
	Linings contaminated.	Check linings and rotors for oil or grease contamination.	Replace brake pads (and rotors if necessary).
Tapered Pad Wear	Damaged or seized callipers or slides.	Check callipers and slides for damage and free movement.	Repair or replace, as necessary.
	Callipers swapped left to right.	Check direction arrows or calliper casting/ part numbers.	Remove and correctly refit callipers.
External Pad Only Worn Out	Slide pins jammed or seized calliper.	Check calliper and slides for damage.	Repair or replace calliper.
Brake Pads Wear Out Quickly	No approved brake pads fitted.	Check brake pad supplier.	Replace with genuine brake pads.
	Trailer overloaded or poor braking technique.	Confirm driving habits and trailer loads.	Re-educate driver.
	Calliper seized.	Check calliper and slides for free movement.	Replace slides or callipers.
	Brake chambers slow to respond.	Check that the lowest drain plugs have been removed.	Remove lowest drain plug from brake chambers
	Air circuit malfunction.	Check for air leaks or kinked lines.	Repair, as necessary.
Smoke Coming from Brakes	Friction linings contaminated.	Check linings and rotors for oil or grease contamination.	Replace brake pads (and rotors if necessary).
	Air circuit malfunction.	Check for air leaks or kinked lines.	Repair, as necessary.
	Calliper over adjusted during service.	Check rotor to pad friction material clearance.	Follow correct adjustment procedures.
	Calliper seized.	Check calliper and slides for free movement.	Replace slides or callipers.
Poor Braking	Air circuit malfunction.	Check for air leaks or kinked lines.	Repair, as necessary.
	Brake pads/rotor worn below minimum.	Measure friction material and rotor thickness.	Replace, as needed.
	Brakes not self – adjusting.	Check self-adjuster operation.	Replace callipers.
	Calliper/slides seized.	Check calliper and slides for free movement.	Replace slides or callipers.
	Linings contaminated.	Check linings and rotors for oil or grease contamination.	Replace brake pads (and rotors if necessary).
	Trailer overloaded.	Confirm trailer loads.	Re-educate driver.
Brake Vibrations or Shudder	Contaminated brake discs or friction material.	Check linings and rotors for oil or grease contamination.	Replace brake pads (and rotors if necessary).
	Rotor run out or thickness variation.	Measure rotor run out and thickness at three locations.	Machine or replace rotors.

QUIK-ALIGN INSPECTION

QUIK-ALIGN® pivot hardware and pivot connections must be inspected regularly.

- Movement inspection as part of driver's daily visual inspection.
- Condition checked at every service inspection.
- Torque checked at every three-month service inspection.
- Hanger checked for cracks or gouging due to movement of loose QUIK-ALIGN fasteners or from pivot wear washer movement.

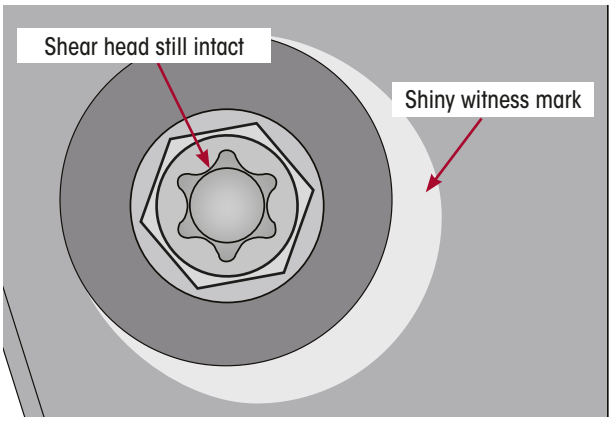


Figure 146: **Inspect For Insufficient Torque & Movement**

Inspection should include checking that the shear Torx head has snapped off after wheel alignment. If the head is still intact, then this is an indication that the QUIK-ALIGN bolt has not been correctly torqued. These fasteners have been especially designed to make it easy to torque correctly using just a rattle gun capable of over 800 Nm and an E20 Torx socket. Tightening by any other means will be either difficult or not carried out correctly. Refer to "Special Tools" on page 104. For more details refer to Hendrickson manual 97117-251.

A loose pivot connection will move in service and leave either shiny or rusty marks where the connection has moved and has left bare metal. This can normally be spotted quickly by the driver on their daily check or at the service inspection. Refer Figure 146.

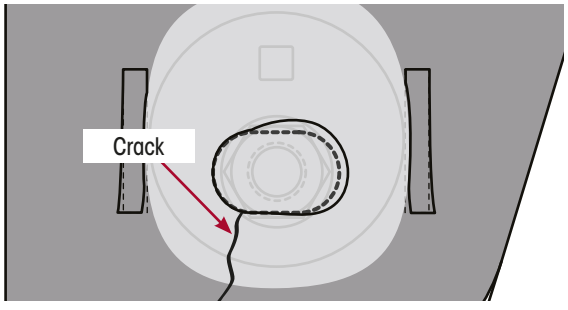


Figure 147: **Cracked Hanger**

Hangers must be inspected for cracks. These may occur if the pivot bolts is not checked for torque regularly and has worked its way loose. Repair kits are available if this occurs. Refer to "Suspension Hangers" on page 77 and Figure 147.

TRI-FUNCTIONAL PIVOT BUSH

The TRI-FUNCTIONAL™ bush (TFB™) is a key factor in both ride quality and roll stability of Hendrickson suspensions. The bush voids allow articulation that provides exceptional control during turning and roll events. The design of the bush and the void contours enhance the axle's ability to function as a torsion bar resisting trailer roll forces.

TFB INSPECTION

NOTICE: This section shows TFB inspection procedures. Bush replacement procedures are detailed in Hendrickson manual L427.

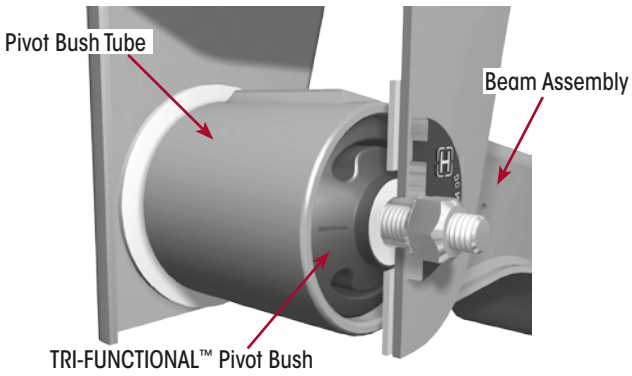


Figure 148: **Pivot Bush Assembly**

Periodic inspections are an important part of your air suspension maintenance routine. Of particular importance is the pivot bush, which is housed within the beam assembly's bush tube. All such inspections should include an evaluation of all pivot bushes on the trailer. Refer Figure 148.

Depending on the age of the suspension, the used bush may experience various states of fatigue that could include surface cracks or cracks forming between voids. However, the pivot bush may still have many years of service life remaining.

NOTICE: Under no circumstances should a shaker table or extended iron pry bar be used as a method to determine the functionality or serviceability of a TRI-FUNCTIONAL Bush. A shaker table will merely demonstrate the ability of the TFB to absorb the primary road forces, whilst an iron bar may compress the TFB at the void area where it is designed to move.

Hendrickson does not recommend disassembling the pivot connection for general pivot bush inspection. The recommended procedure is to make measurements in the relationship between the beam tube and the frame bracket.

On an unloaded trailer, measure from the bottom of the beam assembly to the bottom of the frame bracket as shown in Figure 149.

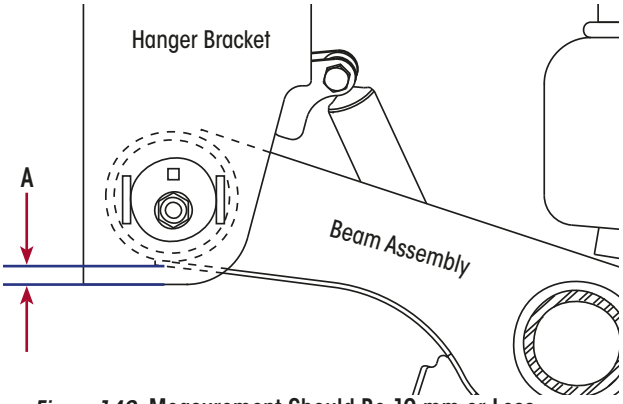


Figure 149: **Measurement Should Be 19 mm or Less**

- If the measurement at A is less than or equal to the 19 mm, then the bush is OK.
- If A is greater than 19 mm, then the pivot connection must be disassembled, and beam assembly lowered to enable closer inspection.

It is important to take the measurement at the correct position, to get an accurate reading. Place a straight edge or steel ruler across the frame bracket, underneath the pivot bolt, just past where the beam assembly is welded onto the bush tube. (Refer Figure 150). A measurement should then be taken between the straight edge and beam assembly.

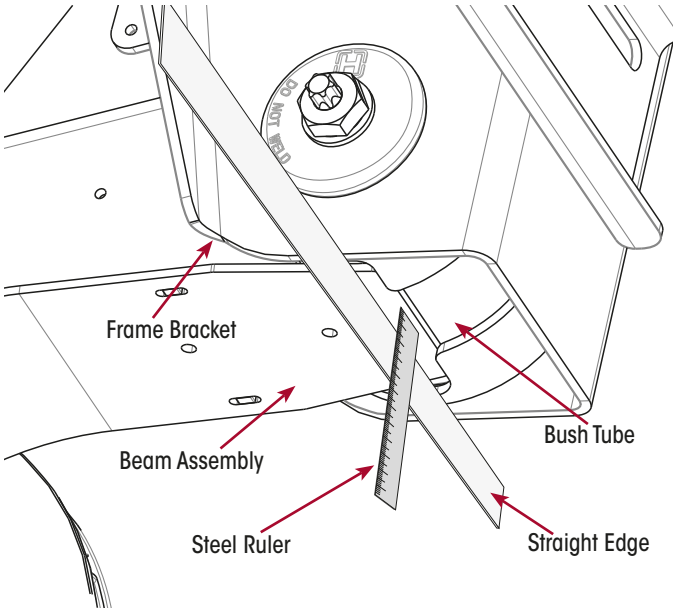


Figure 150: **Measuring Relative Beam Position**

NOTES:

- Trailer Must Be Unloaded before Measuring.
- Checking the bush for movement with a large metal bar is not a true gauge of bush serviceability, because the TRI-FUNCTIONAL™ bush is designed to 'give' in service.
- Mechanical testing devices, such as shaker tables, cannot be used to check TRI-FUNCTIONAL bushes due to their inherent elasticity.

The pivot bush can be inspected from underneath the trailer without disassembling the pivot connection. With the trailer wheels chocked and the trailer properly supported, look up at the bush tube and inspect the side of the tube that offers more access, or in other words, has the larger gap between the bush tube and the frame bracket. Use a screwdriver to push the bush tube spacer against the frame bracket and out of the way so a portion of the pivot bush can be seen. Use a torch to illuminate and inspect the end of the pivot bush. Refer Figure 151.

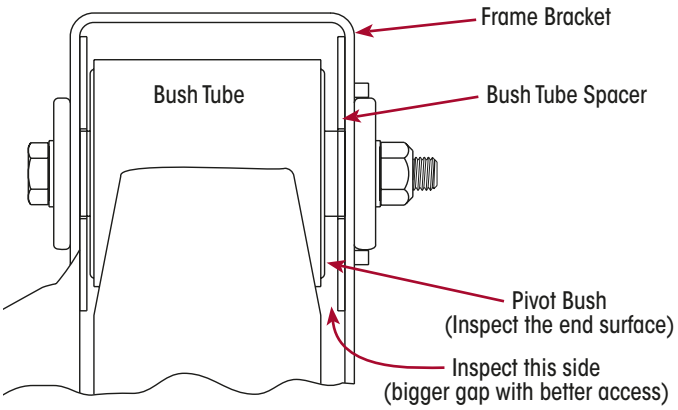


Figure 151: **TRI-FUNCTIONAL Pivot Bush Visual Inspection**

During this inspection, look specifically at the bush voids (the "cavities" or "holes" in the end of the rubber bush material). In most cases, it will not be possible to clearly see both top and bottom voids, but enough of the bush can be seen to make an evaluation. By design, the bush voids will be at the 12 o'clock and 6 o'clock positions (±5 degrees) when the suspension is at the designed ride height.

Bush Visual Inspection

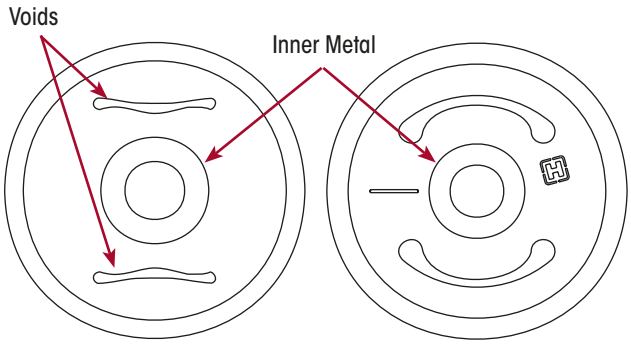


Figure 152: **Newly Installed Bush**

New and unloaded the bushes will have a symmetrical appearance. Refer Figure 152.

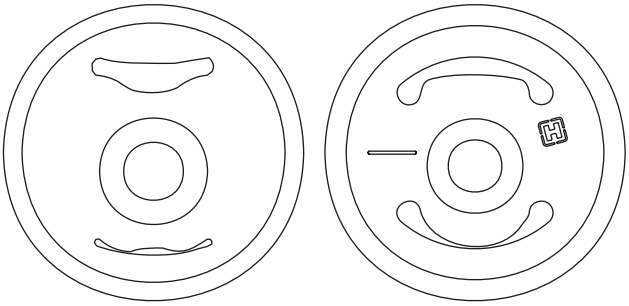


Figure 153: **Normal Appearance of In-Service Bush**

The pivot bushes will typically settle in the vertical direction upon suspension installation.

It is normal for the voids to have this settled appearance due to cargo and trailer weight loading the bush. Refer to Figure 153.

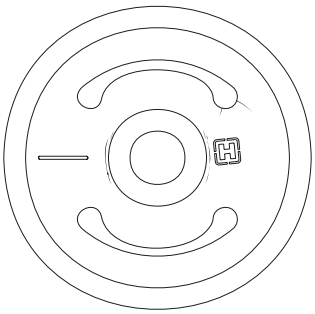


Figure 154: **Serviceable Used Bush**

Minor superficial cracks will appear over time that have no detrimental effect on bush performance and therefore no action is required. Refer Figure 154.

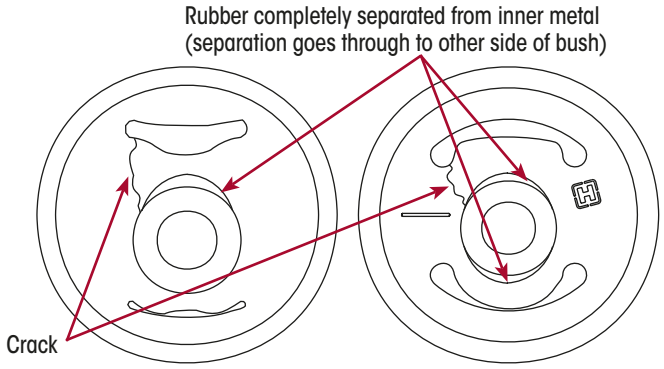


Figure 155: **Bush Needing Replacement (cracks)**

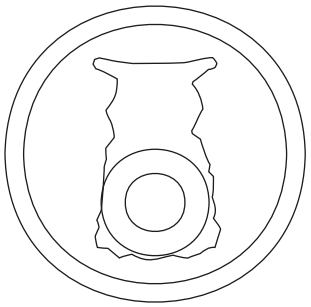


Figure 156: **Bush Needing Replacement (inner metal separation)**

However, cracks in the rubber extending between the void and the bush's inner metal or an excessive amount of vertical movement can indicate that the bush may need to be replaced. Refer to Figure 155 and Figure 156.

If you do not see an excessive amount of vertical movement (based upon your normal application and experience) or cracks in the rubber extending between the void and the bush's inner metal, then no further inspection is required at this time. The bushes are in a serviceable condition.

The appearance of smeared blackened rubber or hanging strands of rubber around the bush tube edges or bush tube spacers is a sign the bush is heating up and melting. The source is likely to be continuous rapid vibration induced into the bush through the beam. It is usually caused by an imbalanced wheel-end on the same side as the affected bush. A wheel-end can be out of balance due to several reasons that will require further inspection for correct diagnosis. These reasons may include issues with the tyre(s), improper assembly, dropped or out-of-round drum, mud or debris collected on the rim and non-functioning shock absorber.

TFB SPACER INSPECTION

Periodic inspections of the TRI-FUNCTIONAL™ bush tube spacers are an important part of your air suspension maintenance routine. A typical inspection should include an evaluation of all bush tube spacers on the trailer.

Visually verify that the bush tube spacers are intact and that they are not missing, cut, worn through or otherwise deteriorated. Due to the pivoting motion inherent with this connection, some bush tube spacer wear is expected. Bush tube spacer "cupping", where the bush tube spacer forms around the bush tube and resembles a shallow dish, is also normal. If you see these conditions, then no further inspection is required at this time. Your bush tube spacers are in serviceable condition. Refer Figure 157.

However bush tube spacer "wear through", where the bush tube spacer is completely missing or has been cut or worn through, is considered abnormal. If these conditions exist, a closer, more detailed inspection is required to prevent more serious or costly problems and to prolong the life of the suspension. Refer Figure 157.

NORMAL
Serviceable

An example of a normal bush tube spacer in a good and serviceable condition.

CUPPED
Serviceable

An example of a cupped bush tube spacer. Friction-generated heat causes the spacer to form or cup around the bush and tube. This is normal and serviceable provided that the bush tube spacer remains intact and does not become cut or worn-through.

WORN THOUGH
Unserviceable

Examples of worn-through bush tube spacers. This spacer is an example of extreme wear. Its circumference has been completely trimmed by the bush tube. The spacer is not in serviceable condition.

Figure 157: **TFB Spacer Visual Inspection**

SHOCK ABSORBERS

Shock absorbers absorb energy to prevent suspension oscillation. They convert the kinetic energy from body movement and wheel vibrations into heat. Movement of oil within a shock absorber is restricted by calibrated damper valves. This dampens relative movement between the body and suspension. The resultant heat is absorbed by the oil and released by the shock absorber body into the surrounding air. For more details regarding shock operation, refer to shock absorber inspection manual 97117-208.

Shock absorbers are also used as rebound stops in Hendrickson air suspensions and limit air spring extension, which prevents the air spring from being over extended and pulled apart. However, in severe service applications it is best to use shock straps or Auxiliary Rebound Limiter (ARL) straps/chains to limit axle movement during rebound rather than relying solely on shock absorbers. Refer to "Auxiliary Rebound Limiter & Down Stop" on page 76.

Shock absorbers do not determine ride height or carry weight. Their primary function is to dampen suspension movement and aid in controlling vehicular movement.

Shock Absorber Visual Inspection

Misting shock absorbers are often misdiagnosed as failures. Shock absorber rod seals rely on a thin film of oil to keep the seal lubricated and in good condition. As the shock absorber extends, some of the hot oil coating the piston rod evaporates before condensing in the cooler outside air onto the shock absorber body.

This forms an oily film on the outside of the shock absorber body. Over time, this film will collect dust and grime, which will often coat the entire body of the shock absorber. Misting is a perfectly normal and necessary function of the shock absorber. The fluid that disperses through the seal area helps to lubricate and prolong the life of the seal.

Mechanics may find it difficult to differentiate between a misting shock absorber and leaking shock absorber that needs replacing. Figure 158 can be helpful in determining shock absorber serviceability.

Truck and trailer shock absorbers have reservoirs that may contain up to a litre of oil. A typical heavy vehicle shock absorber would have to lose more than 10% of its

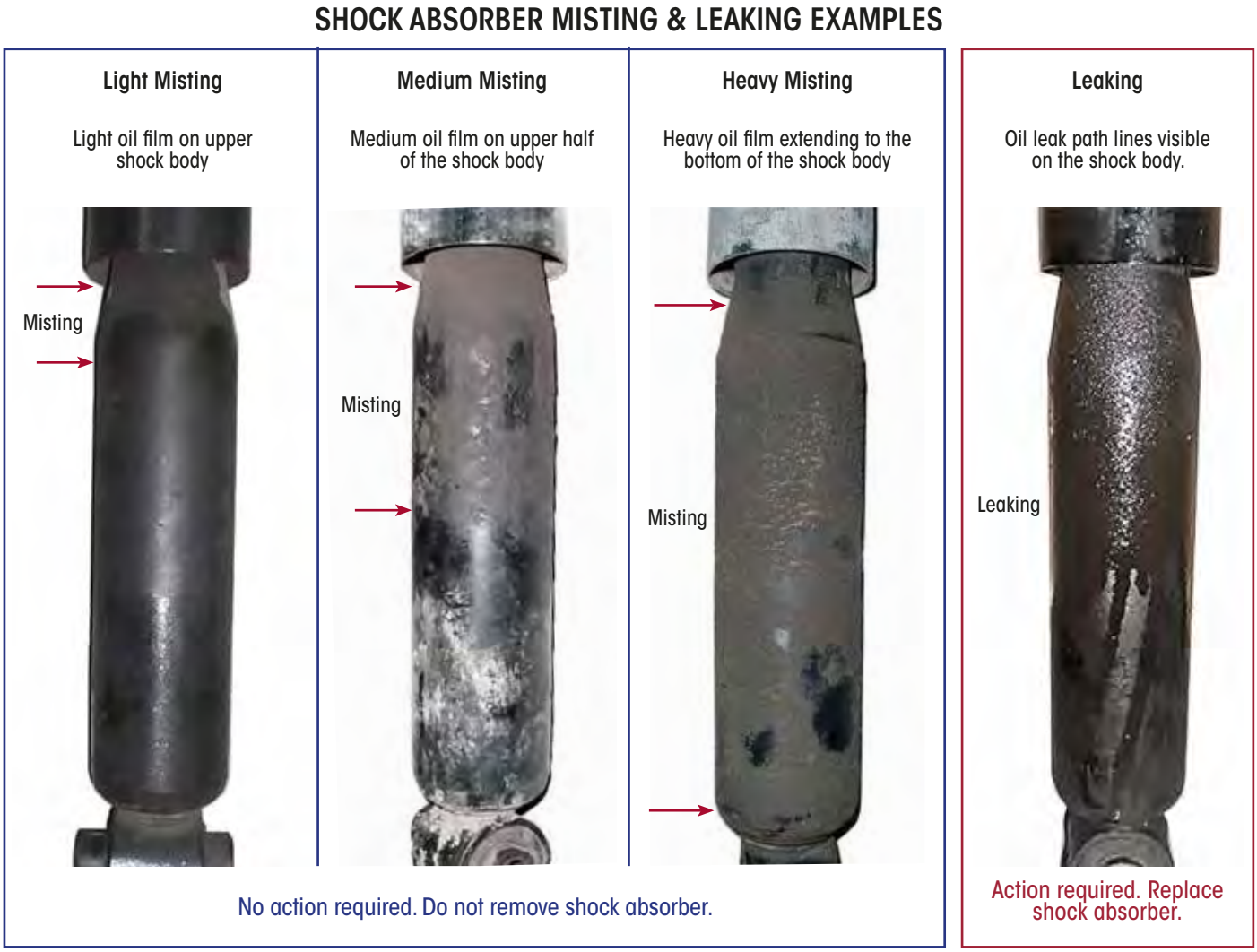


Figure 158: Shock Absorber Visual Inspection

oil volume before damping performance will be affected. Shock absorber upper seals may leak because of extreme wear, contamination, or a defect. A leaking shock absorber will show clear signs of fluid leaking in streams from the upper seal, which may drip from the shock absorber.

If you are unsure about the condition, then raise the chassis to fully extend the shock absorber. The entire shock absorber body may then be inspected without removing it from the suspension.

Other Inspection Points

In addition to looking for oil leaks, there are other shock absorber checks that must be carried out regularly.

- Check the mount bolts for tightness and security.
- Check for broken upper or lower mounts.
- Check the mounting bushes for wear or deterioration.
- Check for broken or damaged dust shields.
- Check the shock body to see if it is severely dented.

A loose mounting bolt will usually leave witness marks around the mounting bolt washer from the relative movement between the parts. Refer Figure 159.

Fitting the wrong shock absorber, an incorrect ride height setting, or adverse operating conditions without jounce limiting will often cause a broken mount or even internal shock damage.

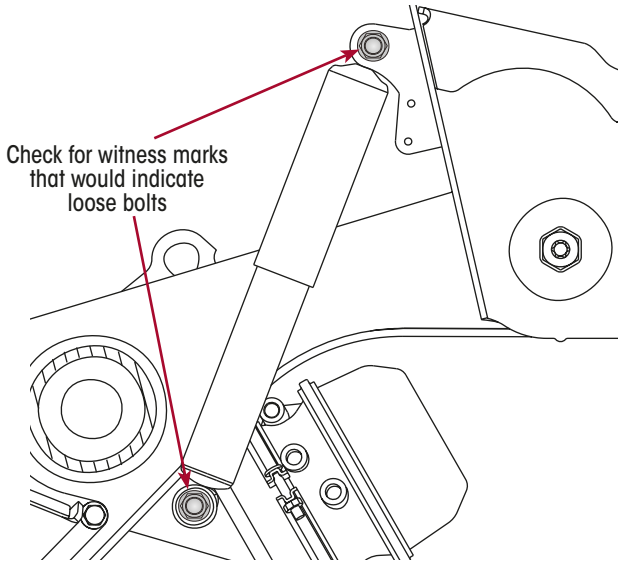


Figure 159: **Check for Movement Witness Marks**

NOTICE: Wipe any built up oil and dust from the shock absorber body after inspection. This will allow you to complete a clearer assessment of shock absorber condition at the next inspection.

Heat Testing Shock Absorbers

Shock absorbers function at temperatures ranging from ambient to 175 degrees C. A shock absorber's role is to dampen suspension movement by transforming kinetic energy into heat and then dissipating it via the oil. As a result, the shock absorber should be at least slightly warm to touch after normal use, depending on driving conditions.

If ride deterioration is experienced and there is suspicion that a shock absorber has failed internally, which is visually undetectable, perform the following shock absorber heat test:

⚠ **CAUTION**: Shock absorbers can reach temperatures sufficient to burn your skin after being driven over corrugated roads. Therefore, it is usually best to check the shock temperature with an infrared thermometer. However, with a little care the temperature can be checked quite simply with the back of your hand. Do not touch the shock absorber if there appears to be excessive heat with your hand near it.

1. Operate the vehicle at moderate speeds for at least fifteen minutes.
2. Within a few minutes of driving the vehicle, check the temperature of the metal frame near the shock absorbers to establish a reference ambient temperature.
3. Check the temperature of each shock absorber on the body below the dust cover or tube. Temperature checks must be carried out quickly, within a few minutes of driving the vehicle.
4. All shock absorbers should be warmer than the vehicle frame. Any shock absorber that is noticeably cooler than the corresponding one on the other side of the axle may have failed. A differing temperature on any axle warrants removal and further examination of the cooler shock absorber.
5. To inspect for an internal failure, remove and shake the suspected shock absorber. Listen for the sound of metal parts rattling inside. Rattling of metal parts can indicate that the shock absorber has an internal failure and requires replacement. A shock that presents no resistance when stroked will have lost all oil or have some other mechanical issue.

⚠ **CAUTION**: Do not lift the truck or trailer without the shock absorbers in place. If shock absorbers are not in place, overextension of the air springs will occur. Damage may occur to the overextended air springs.

CHECKING SHOCK ABSORBERS BY HAND

Removing shock absorbers to check their movement by hand is not a generally recommended procedure.

Heavy vehicle shock absorbers are difficult to check accurately by hand. Different shock absorbers have differing rates of movement depending on design. It is also not possible to move a heavy vehicle shock absorber by hand with the same force that is exerted on it when fitted to the vehicle. This means that oil flow around the shock piston will be different when checked by hand to that when fitted to the vehicle.

If the shock has been removed from the vehicle, it should be possible to extend and compress the shock to check for resistance to movement. A shock absorber that has leaked sufficient fluid will have little to no resistance or have inconsistent movement as it is compressed and extended.

All Hendrickson shock absorbers are double acting. They will commonly compress a little easier than on rebound. However, the damping rates will depend on the manufacturer and intended suspension application.

MOUNTING INSPECTION

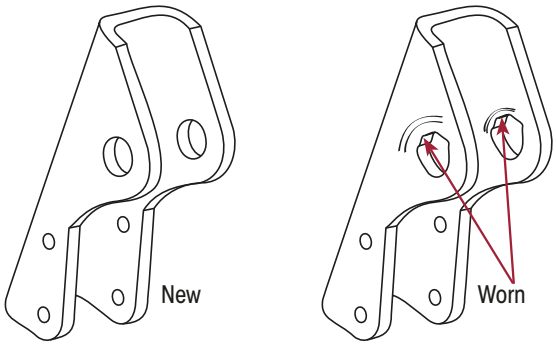


Figure 160: **Inspecting Shock Bushes & Mounts**

Damage to mounting holes by a loose shock absorber bolt must be replaced or repaired. Otherwise, it may cause the new shock absorber to also come loose. Refer Figure 160.

Incorrect ride height, fitting the wrong shock absorber and deteriorated shocker bushes can cause damage to shock absorber mountings. Some applications require installation of shock straps or separate Auxiliary Rebound Limiters (ARL).

SHOCK ABSORBER REPLACEMENT

1. Safely support trailer chassis at ride height. If necessary, raise trailer chassis to ease installation and then raise suspension until it is at relative ride height. Ensure both chassis and axle are supported safely.
2. Remove shock absorber fasteners and shock absorbers. Discard fasteners.
3. Inspect shock absorber mountings for damage or wear that may allow shock to come loose in service. Refer Figure 160.

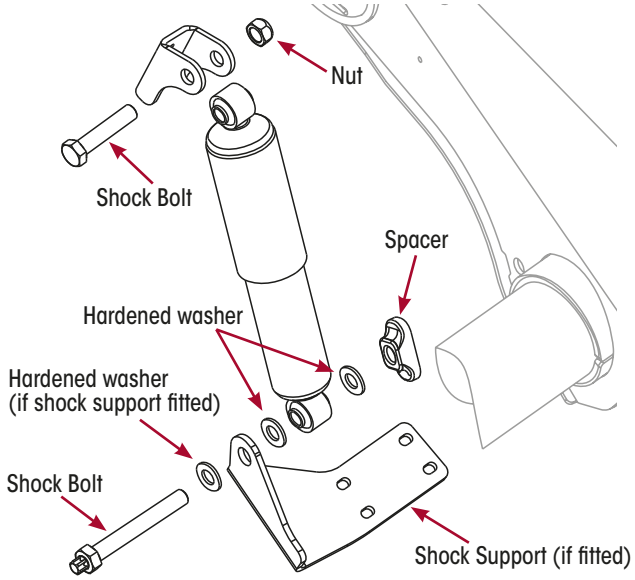


Figure 161: **Shock Absorber Installation (AANT shown)**

4. Install the upper shock absorber mount to the upper clevis using the bolt and lock nut provided with the kit. Do not fully tighten yet. Refer Figure 161.

NOTE Some shock absorbers can be difficult to extend by hand. In these cases, raise the suspension to allow shock fasteners to be installed and then drop to relative ride height before fully tightening fasteners.

5. On suspensions where the HCV lower linkage mounts to the shock absorber mount, install the mount onto the new shear-head bolt before fitting a hardened washer. Otherwise simply slide a hardened washer onto the shear-type bolt. Refer Figure 161.
6. Insert the shear-type bolt through the lower shock support bracket (if fitted), the second hardened washer (only use if support bracket is fitted), the shock absorber mount, the third hardened washer and then the spacer, as shown in Figure 161 and hand tighten.

7. With suspension at ride right, hold nut and tighten the upper shock absorber bolt to a torque of 320 Nm for a Grade 5 or 430 Nm for a Grade 8 bolt. For bolt identification and full torque specifications refer to Trailer Suspension Torque Manual 97117-251.

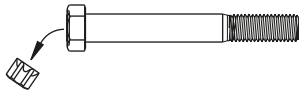


Figure 162: **E20 Torx Shear Head Lower Shock Bolt**

8. If lower bolt has a separate nut, hold this with a suitable spanner. Use an E20 Torx socket to tighten the shear-type lower shock mount bolt until the Torx head shears off, which occurs at around 320 Nm. Refer Figure 162.

9. Remove safety stands.

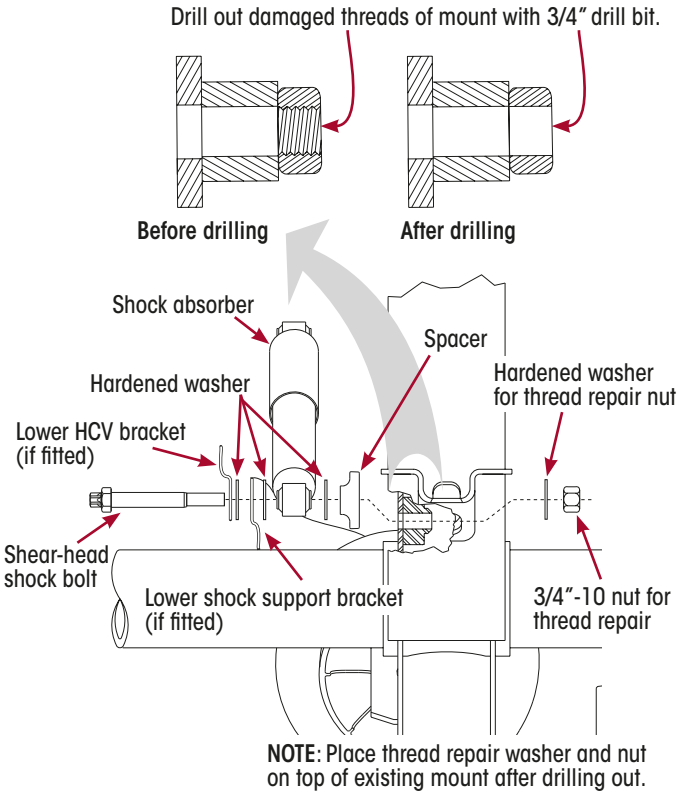


Figure 163: **Repairing Damaged Lower Mount Thread**

NOTE: For both most INTRAAX® suspensions the beam lower mount nut is tack welded inside the beam. If the threads are damaged and the nut is not reusable, a repair kit is available, which includes instructions. Refer to Figure 163 and the relevant parts list.

IMPORTANT: Only tighten and torque shock bolts at the specified suspension ride height. Premature failure of bush, seal, or piston may result from not following this process.

SHOCK STRAP INSTALLATION

In some applications shock straps may be used to limit suspension rebound, which could otherwise cause damage to shock absorbers. More severe applications may require separate strap or chain auxiliary rebound limiters (ARL). For strap or ARL inspection refer to "Auxiliary Rebound Limiter & Down Stop" on page 76.

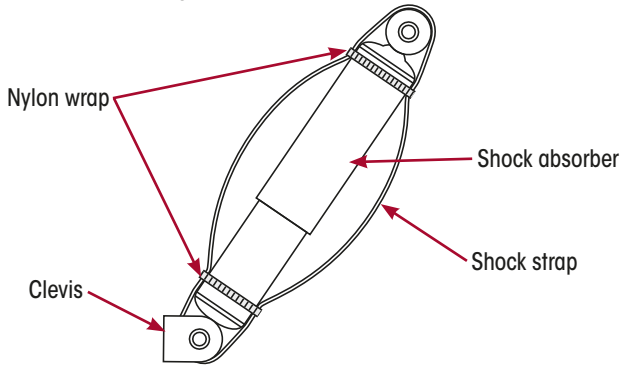


Figure 164: **Typical Shock Strap Installation**

Straps are usually installed onto the shock using the nylon wrap (ties) supplied in the kit. Refer Figure 164 for a suggested installation example.

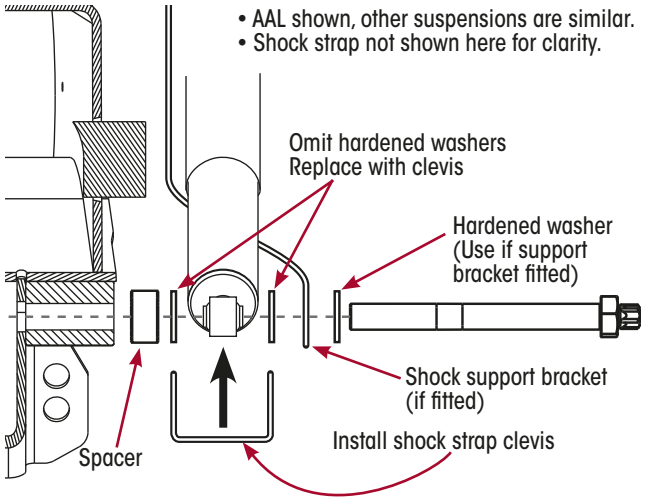


Figure 165: **Shock Strap Clevis, Washers & Bolt**

Applications without a lower shock support bracket require installation of the lower shock strap clevis. However, those with lower shock support brackets may not require the clevis to control strap movement.

If installing clevis, remove two of the hardened washers from the mounting kit and replace with the shock strap clevis. Refer Figure 165. Install the shock, including strap, onto the suspension using new hardware and torque to specifications shown in Trailer Torque Manual 97117-251.

> **Fastener Tightening**
>
> Shock bolts must only be tightened and torqued at the specified suspension ride height.

AUXILIARY REBOUND LIMITER & DOWN STOP

Severe applications may require installation of Auxiliary Rebound Limiters (ARL) to prevent damage to air springs, shock absorbers and mountings. ARLs provide additional support that would otherwise be left to the shock absorbers alone, limiting shock stroke and axle movement during rebound. As a result, they prevent air springs from overextending.

ARLs must be in good condition to prevent damage to air springs, shock absorbers and their mountings. Therefore, axle restraints and mountings should be inspected regularly for cracking and for serviceable condition. Replace all worn or damaged ARL components.

Chain down stops are also used in ZMD applications. They prevent excessive rebound movement that would otherwise be carried out by shock absorbers, which are not used in ZMD applications.

Chain Inspection

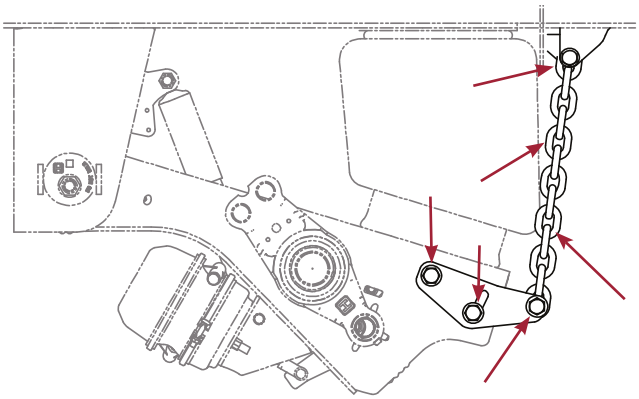


Figure 171: **Checking ARL/Downstop Chain Condition & Mounting**

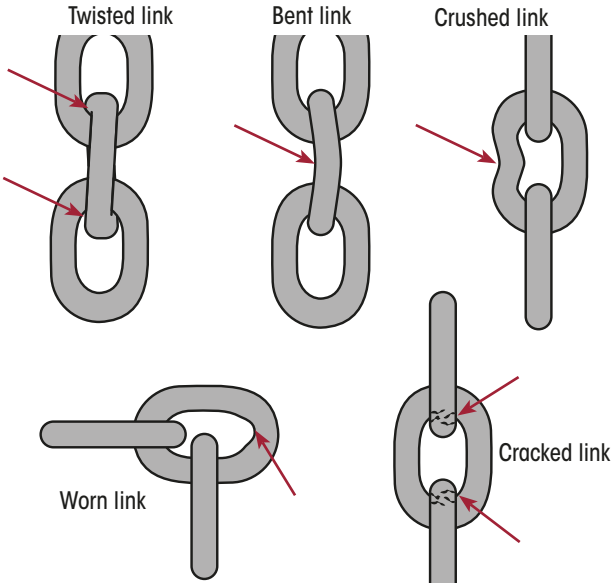


Figure 172: **Some Possible ARL/Down Stop Chain Faults**

Refer Figure 171 & Figure 172. Examine the chains for:

- Twisted, stretched, gouged, bent or worn links
- Loose, bent, cracked or badly rusted attaching hardware

NOTE: Chains should be replaced if links are worn down to a maximum wear limit of 15 percent of nominal (non-worn) thickness at any point.

Strap Inspection

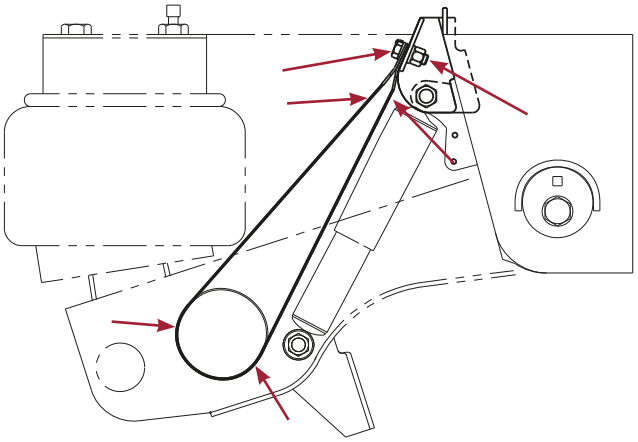


Figure 173: **Checking ARL Strap Condition & Mounting**

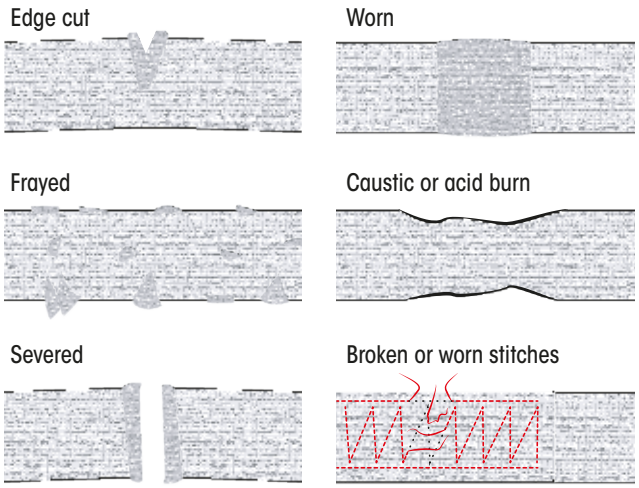


Figure 174: **Some Possible ARL Strap Faults**

Refer Figure 173 & Figure 174. Examine the straps for:

- Wear, fraying, punctures or tears
- Broken stitches
- Weld splatter or any burnt areas
- Harm caused from UV, such as being very stiff or badly faded
- Stones or other particles embedded in the webbing
- Loose, bent, cracked or badly rusted attaching hardware
- Excessive or out of the ordinary webbing wear at the point of contact with hardware

SUSPENSION HANGERS

Suspensions hangers should be a maintenance free component. However, this depends to a large degree on whether trailers are serviced correctly, including regular inspections by drivers and maintenance technicians. Inspection by a technician should include checking of the pivot bolt torque regularly.

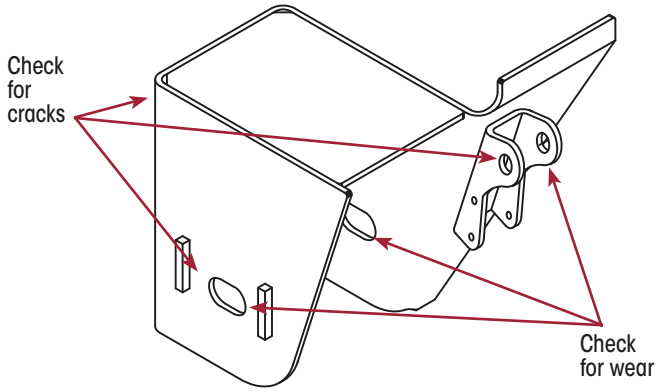


Figure 166: **Check Hanger for Signs of Movement, Wear & Cracks**

Checking the pivot bolt torque will make up for any possible give or movement in the pivot connections before they cause any serious problems. The pivot connections should be checked regularly for any signs of movement that would indicate a loose connection. Hangers should also be checked for stress cracks that may occur due to driving conditions, poor servicing or due to failure of other suspension components. Refer Figure 166.

If left unchecked pivot connections can move around, wearing away and damaging components. Loose pivot connections may be caused by incorrect installation, contaminants on the pivot hardware, unusually thick paint on hanger, installer not shearing the bolt shear head (applying insufficient torque) and not regularly rechecking bolt torque. Refer to "QUIK-ALIGN Inspection" on page 68.

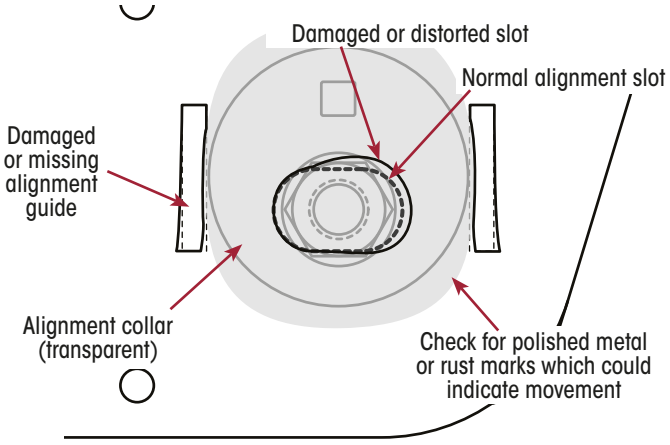


Figure 167: **Hanger and Pivot Inspection**

Inspect alignment bolt, collar and hanger assembly for signs of movement or damage. (For more details refer to Hendrickson manual L579.)

Refer to Figure 167 and check for problems such as:

- Misaligned or loose axle
- Damage, wear or cracks in frame bracket
- Worn or damaged frame bracket alignment slots and alignment collars
- Deteriorated bush or damage to the ends of the bush inner metal that contacts frame bracket
- Wear of the alignment slot
- Wearing down of the nose on the collar, which extends through the alignment slot

Replace pivot connection hardware and repair or replaced the frame bracket hanger, as required. If necessary, replace TFB pivot bushes. Refer "TFB Inspection" on page 68.

IMPORTANT: The pivot bolt and hardware must be replaced and cannot be reused. Refer to the QUIK-ALIGN® and Shear-Head Bolts section in Trailer Suspension Torque manual 97117-251 for more information.

Hanger Repair Kits

Hendrickson have a field repair kits that can be used to repair hangers that have damage around the pivot connection but are otherwise sound. Plates are welded to each side of the hanger to provide a stable pivot connection support. Refer to Technical Manual 97117-101.

Left Right Identification

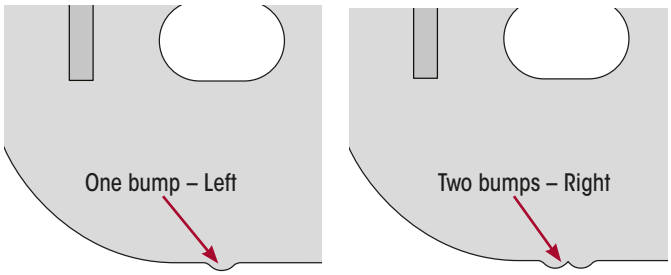


Figure 168: **Hanger – Left and Right Identification**

Some hangers can be identified as left or right by bumps at the bottom of the hanger. The Left-Hand hanger has one bump and the Right-Hand has two bumps. However, this identification method does not apply to all hangers. Refer Figure 168.

AIR SPRINGS

Air springs will last almost indefinitely in most applications. However, they fail quickly when rubbed, scuffed, or punctured. If an air spring fails, the trailer will settle on the internal rubber bumpers, allowing the driver to safely proceed to the nearest service facility at a lower speed. Close inspection of air springs is often neglected because of their normally long and trouble-free service life. To avoid unexpected failure, it is important to check and correct any issues during service.

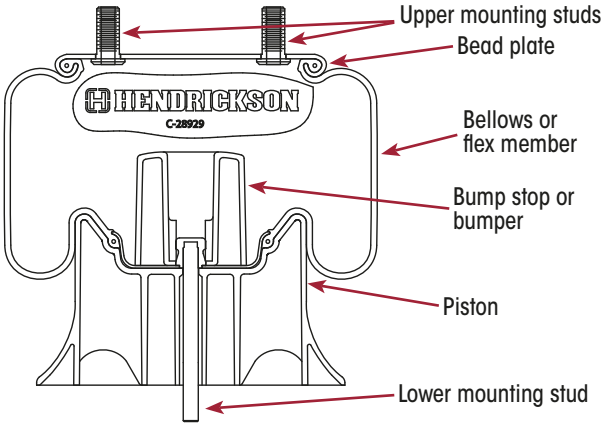


Figure 169: **Check Component Serviceability**

Look for chafing or any signs of component damage. Look for misplaced air lines that may rub on air spring bellows. Check to ensure truck or trailer ride height is at specification. Operating at an incorrect ride height will place extra strain on air springs, shock absorbers, axle restrain limiters and bump stops. Refer Figure 169.

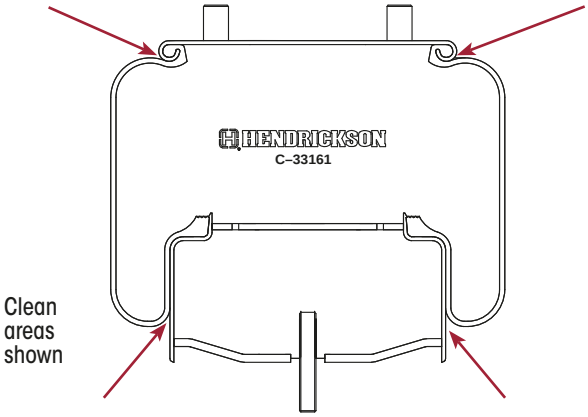


Figure 170: **Clean Bellows of Grit & Grime to Prevent Wear**

Ensure that the upper bead plate is tight against the mounting bracket and that the mountings show no sign of movement. Air springs should be cleaned regularly of dirt and dust that may build up around the bead. Any grime in this area will eventually wear through the rubber bellows and cause premature failure to occur. Refer Figure 170.

Skel and Tipper Applications

When tippers are raised for tipping it is advisable that the air suspension is dumped of all air from the system. This is to increase stability when the centre of gravity is raised as the load is raised. Also, if the air springs are pressurised when the load is released suddenly; then the air springs will extend forcefully and put extreme loads on the shock absorbers and mounts. For this reason, container skels, and similar applications where loads are removed suddenly, should also be dumped of air prior to removal of the load.

When air suspensions are fitted to tip over axle tippers a pressure retention system should be fitted to the air suspension layout. The purpose of this system is to retain some residual pressure in the air springs so that the air spring bellows do not become caught between the piston and plate, where they may get damaged as the axle lowers back to the ground.

It is important to not simply add a pressure valve to the exhaust port on most height control valves. Adding a pressure retention valve to the exhaust port will inhibit valve operation and will not retain any pressure in the air springs when dumped. This is because many valves, such as Haldex, dump through a port in the body and not through the exhaust port that is used for height control. A system to retain some air spring pressure regardless of height control valve operation, such as Hendrickson AK-136-1 (refer to "Air Spring Residual Pressure" on page 88), should be installed between the air springs and height control valve.

⚠ **CAUTION**: Due to the geometry of all trailing beam air suspensions, the trailer moves forward when air exhausts from the suspension and trailer brakes are locked. Precautions must be taken if exhausting air from the suspension, when supported by the trailer's landing gear, because this movement may damage or collapse the legs.

Air springs can be ripped apart if axle movement is not restrained by an axle restraint system, such as shock absorbers, chains or straps. Some applications require installation of auxiliary rebound limiters (ARL) to prevent damage to shock absorbers and mountings. Refer to "Auxiliary Rebound Limiter & Down Stop" on page 76.

ZMD™ SUSPENSION SYSTEM

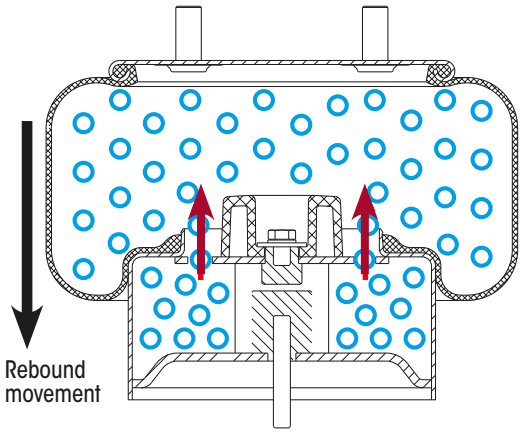


Figure 175: **Air Movement within ZMD Air Spring in Rebound**

The ZERO MAINTENANCE DAMPING™ (ZMD™) suspension system eliminates conventional shock absorbers and integrates the damping function into the air spring. ZMD air springs have an air chamber built into the lower air spring piston. Refer Figure 175.

The air spring chambers exchange air through calibrated openings in the top of the piston. When the suspension hits a bump in the road, the piston is pushed up into the bellows, air in the bellows becomes pressurised and moves through the openings into the piston chamber.

On rebound, the bellows area increases in volume and the air in the piston chamber moves through the openings back to inside the bellows. This action provides the controlled suspension movement that is necessary for good ride quality, eliminating the need for shock absorbers.

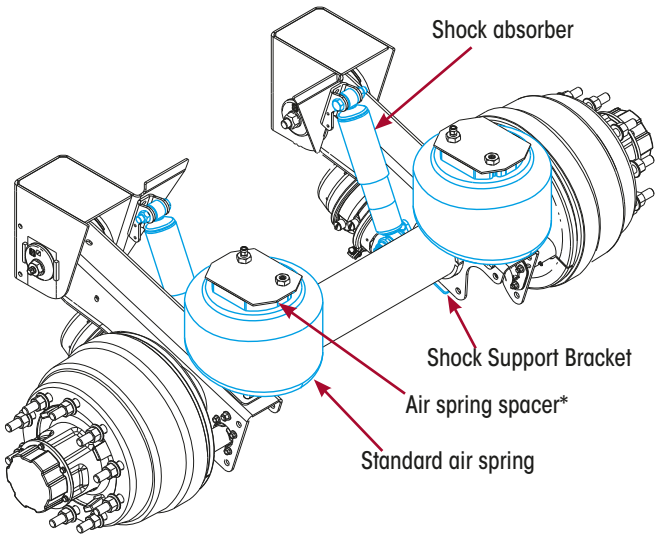
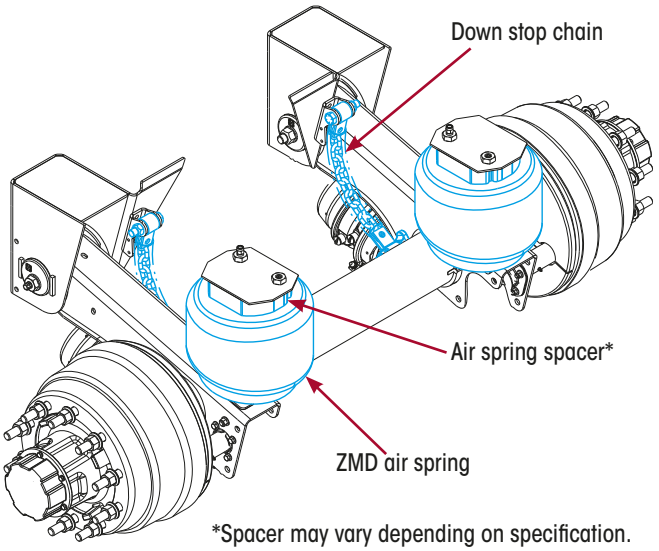


Figure 176: **Standard Shocked Suspension Components**



*Spacer may vary depending on specification.

Figure 177: **ZMD Suspension Components Differences**

ZMD suspensions are similar to standard suspensions and share most components. The ZMD air spring looks like a standard air spring, with rubber bellows and a steel or plastic piston. However, the internal design components of this patented air spring are specifically designed to perform the suspension damping function traditionally performed by the shock absorber. Refer Figure 175.

However, one function air springs are not able to achieve is rebound limiting. Therefore, to prevent excessive axle rebound movement ZMD suspensions use down stop chains. Refer to Figure 176 and Figure 177 for a comparison between ZMD and standard suspension components. The air spring spacer may also be different, depending on type of suspension and ride height.

ZMD suspensions rely almost entirely on the air spring for suspension control. Therefore, correct ride height, cleaning and inspection of these air springs plays a critical role in suspension reliability.

IMPORTANT: The specialised ZMD air springs cannot be interchanged with standard air springs.

NOTICE: Ensure that mounting hardware, air springs, spacers and down stop chains are in good condition and correct for the designed suspension ride height. Any worn, damaged or mismatched parts may result in damage to the suspension and suspension components. Refer to "Air Springs" on page 78 and "Auxiliary Rebound Limiter & Down Stop" on page 76.

NOTICE: Torque specifications are available in Hendrickson Manual 97117-251.

PNEUMATIC 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 the air supply is dry and without leaks. The demands on the truck air supply have 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. For reference, a typical truck pneumatic layout is shown in Figure 178. Refer to Figure 181 for a typical trailer pneumatic layout.

Compressor

The compressor is the starting point for the air supply system. It needs to be able to supply enough 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, such as when it is 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 damages 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.

Air feed to the compressor must be completely free of dust and dirt for reliable compressor operation. Air filtration may be made by using one of three methods. Filtration will be either by through polyurethane sponge strainers that need to be cleaned regularly, papers element filters that must be replaced at regular intervals or the air might come from the engine air intake after the air filter. Filtered engine air may be taken from after the turbo charger, where it will already have been compressed to some degree.

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

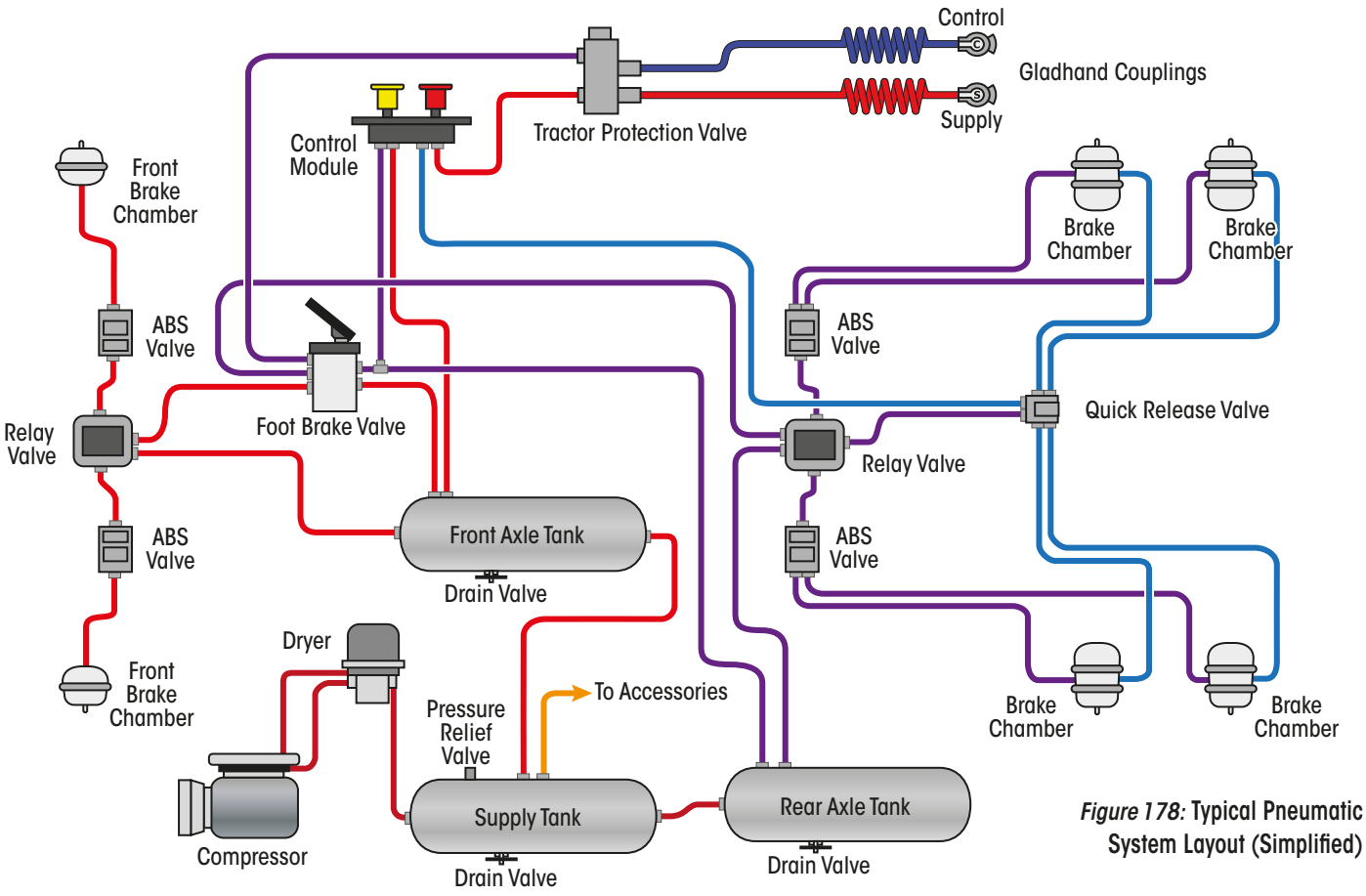


Figure 178: **Typical Pneumatic System Layout (Simplified)**

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.

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 and advanced automatic tyre pressure control systems are particularly susceptible to dust and moisture contamination.

Air Dryers

Air naturally contains a certain amount of moisture. If left unchecked, this moisture will cause corrosion and damage to pneumatic components, such as brake valves, height control valves and brake chambers. It is the dryer's task to remove as much moisture as possible before it passes into the rest of the pneumatic system.

Compressing air adds a lot of energy some of which appears as heat and can reach up to 150°C after leaving the compressor. It is important therefore to reduce the air temperature, otherwise it becomes very difficult to remove any moisture. Initial cooling occurs in the outlet pipe from the compressor, but most dryers also have an 'aftercooling' function to allow the compressed air to cool further. Some even use external cooling fins to improve cooling efficiency.

Before removing any moisture, it is important to remove any oil vapour that may have been dis-charged by the compressor. Therefore, most dryer designs use mesh, baffles, or a series of passages as an initial stage to separate any oil mist, so that it does not contaminate the desiccant. Refer Figure 179.

The main feature of the dryer is the desiccant, which is quite different to the silica gel desiccant found in packaged goods. It is usually made up of special ceramic beads. These beads are designed to condense moisture onto their outer surface as the air passes by them. The water, now in liquid form, adheres to the beads until the purge cycle.

Dryers use a purge cycle to force air, in reverse, down past the beads and out the purge valve. Refer Figure 180. When air pressure is applied to the purge control port it will open the purge valve, which releases air through the vent at the bottom of the dryer body. The purge air carries the liquid water away from the desiccant, along with any accumulated oil, dispelling it from the dryer. This ensures that dryer is regularly cleared of waste matter, which would otherwise choke it. There is a delivery check valve to ensure only air in the dryer is released. The purge volume areas in the dryer ensure that there is sufficient air volume and flow to clear the dryer of condensed water and oil.

Eventually the desiccant beads will lose efficiency and require replacement. Therefore, dryer cartridge replacement must be carried out at recommended manufacturer replacement intervals or if water starts accumulating in the tanks. Systems with high air requirements benefit from using twin cartridge dryers. These twin cartridge systems enable high air flow without any reduction in air quality.

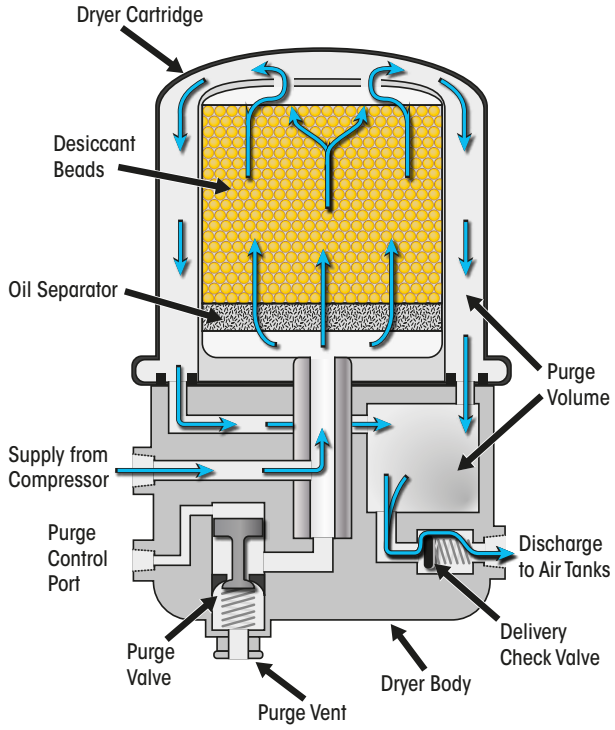


Figure 179: Typical Drying Cycle Operation

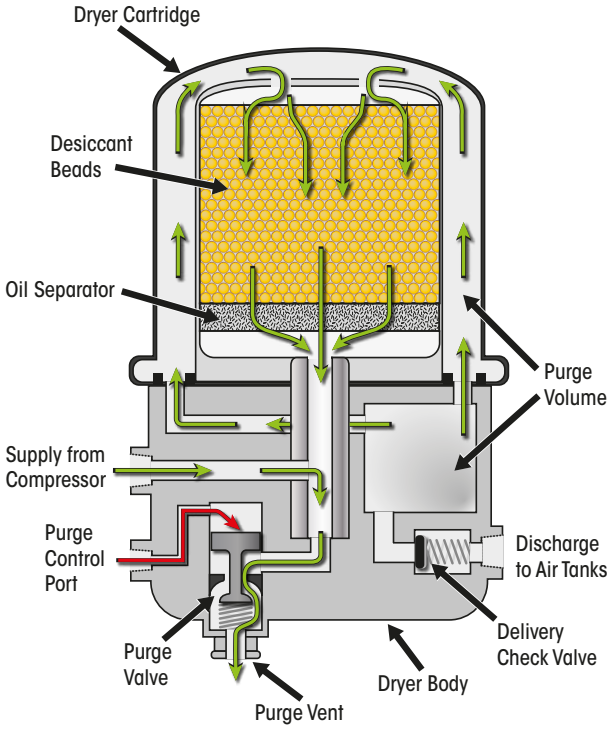


Figure 180: Typical Purge Cycle Operation

HEIGHT CONTROL VALVE

The primary function of the trailer suspension air system is to regulate the vehicle ride height. The system outlined here operates from the vehicle's compressed air supply. A brake protection valve should be installed to ensure brakes continue to be operational if there is a significant air pressure loss in the suspension system. It is highly recommended a high-quality filter is installed between the protection valve and the HCV (Height Control Valve). The HCV automatically responds to the relative position of the axle and vehicle frame and meters air into or out of the air springs.

Hendrickson recommends the HCV to be positioned on the front axle in tandem arrangements and the centre axle on tri-axle arrangements. Positioning the valve onto the right-hand side of the vehicle will assist valve service life operation. This is because the left-hand side, the side of the vehicle closest to the edge of the road, naturally undergoes more bumps and undulations, which will cause greater component wear and possible operational issues.

When the actuating lever or control arm of the HCV moves vertically upwards, the valve opens and supplies air to the air springs. When the actuating lever moves down, the valve exhaust port opens to vent air from the air springs. When the suspension is at the pre-set ride height no airflow occurs because the control arm will be in the neutral (horizontal) position. Refer Figure 182 on page 83.

Hendrickson suspensions are designed to use only one height control valve per suspension group. However, there are some configurations or suspension models where multiple valves may be used.

NOTICE: Use of more than one height control valve per axle group without express written approval by Hendrickson engineering will void Hendrickson warranty.

Plumbing diagrams are available for all suspension models. Contact Hendrickson or the vehicle manufacturer for individual requirements prior to performing any modifications to the pneumatic control system. The suspension assembly number and/or part number must be provided to correctly determine the plumbing diagram required. Refer to Figure 181 for a typical pneumatic layout.

Dump Function

The air dump function increases the vehicles stability during loading and unloading. When the air suspension is exhausted, the suspension is supported by the bump stops that can support the suspension and limit the suspension movement. A pressure retention system should be fitted if there is a possibility of an axle raising when dumped. (Refer to "Air Spring Residual Pressure" on page 88)

The dumping of air is recommended in the following situations:

- When coupling and uncoupling trailers
- Parking vehicles for an extended period
- Loading or unloading of a vehicle that could cause load shifting (e.g. tipper)
- A vehicle experiencing a sudden offloading of cargo (e.g. container)

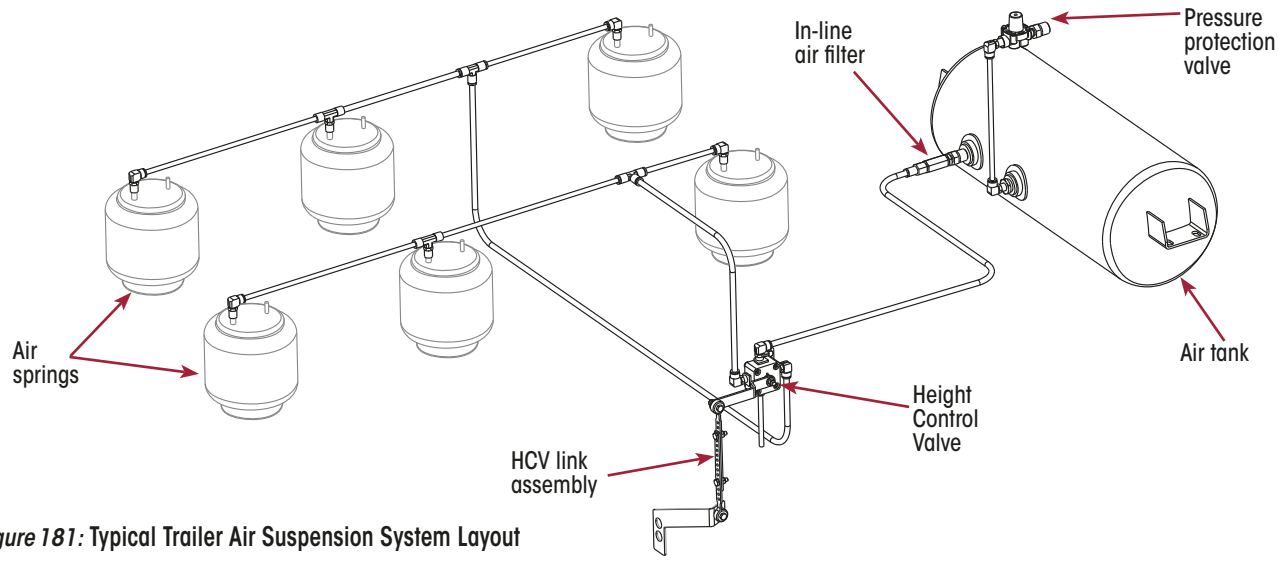


Figure 181: **Typical Trailer Air Suspension System Layout**

Height Control Valve Air Circuit Operation

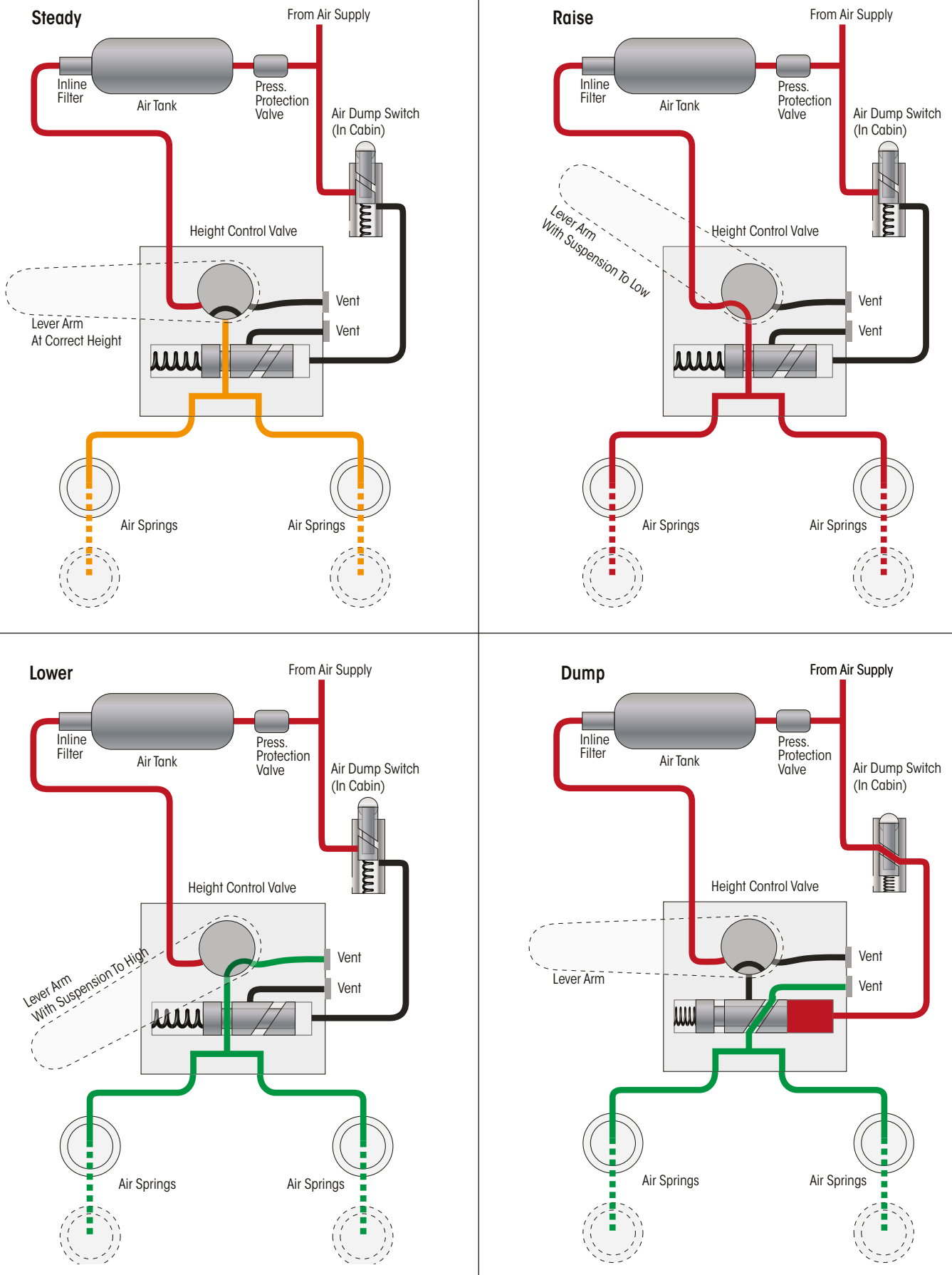


Figure 182: Height Control Valve Air Circuit Operation

Important HCV Notes

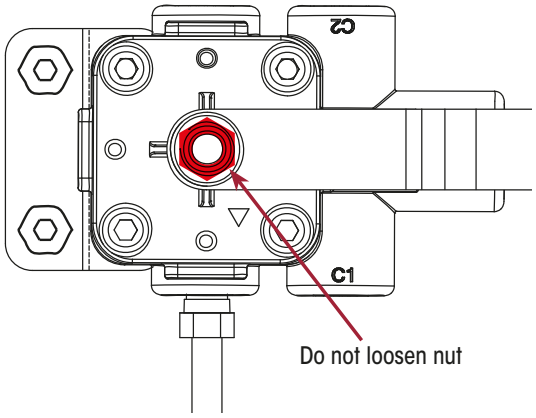


Figure 183: **Don't Loosen Barksdale Height Control Valve Nut**

⚠ **WARNING**: Barksdale height control valve assemblies include the lever arm. The nut that retains the lever arm to the HCV shaft is held tight with thread lock and must not be removed! Attempting to remove the nut will most likely result in fracture of the HCV shaft. Refer Figure 183.

NOTICE: When necessary, temporarily install wooden or plastic centring dowel pin to hold the Barksdale height control valve in position. Do not use a metal pin, which would cause permanent damage to the HCV if the suspension moved. Refer Figure 194.

Removal

Before adjusting ride height, the trailer should be unloaded and placed on a flat, level work surface with the wheels chocked. The trailer should be parallel to the work surface and supported at operating height by the landing gear legs or coupled to a vehicle.

⚠ **CAUTION**: If trailer has liftable axles installed, ensure they are properly supported or have been lowered.

1. Disconnect and remove the link rod assembly.
2. Lower the HCV control arm below horizontal and purge or exhaust the air in the trailer's suspension system.
3. Disconnect all air lines from the valve.
4. Remove the height control valve.

Installation

1. Rotate the control arm fully 3-5 times in both clockwise and anticlockwise directions to minimise any adverse effects of storage.

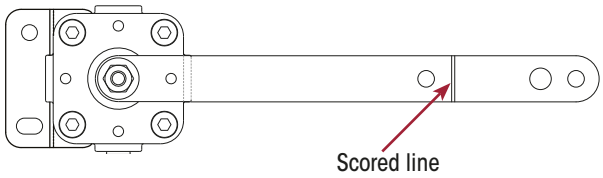


Figure 184: **HCV Scored Arm Line**

2. Determine the proper control-arm length. For example, if a short control arm is required, break or cut the control arm off at the scored line. Refer Figure 184.

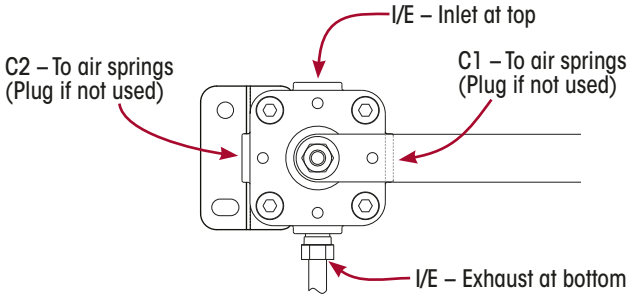


Figure 185: **HCV Port Description – Without Dump**

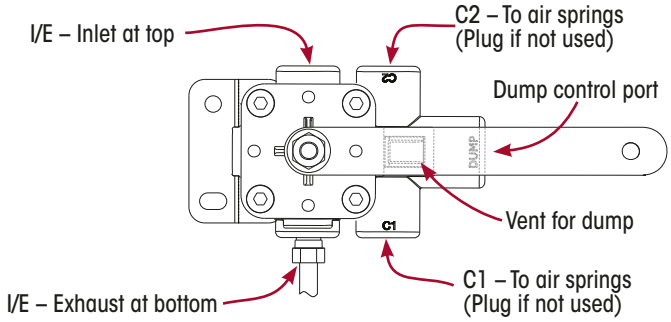


Figure 186: **HCV Dump Valve Port Description**

3. Install fittings into HCV ports. Use a drop of oil or thread sealant to lubricate the threaded connections. Fit blanking plug to the unused ports if both are not used. The fitting for air supply will always be at the top of the valve for either orientation. Install exhaust fitting and PVC hose to lower HCV port. If being operated in adverse or harsh conditions, fit a longer tube and loop it to prevent ingress of dirt, dust or mud. Refer to the relevant parts list for the suspension being serviced. Refer to Figure 185 and Figure 186.

IMPORTANT: Do not use a pipe compound or Teflon tape. These materials may contaminate the air system.

4. Attach the HCV to the mounting bracket with the nuts provided and torque to *10 Nm*.

5. Connect air lines to fittings, ensuring correct positioning.

NOTICE: Cut tubing with a specialised tube cutter to ensure surface is clean and cut is square.

6. Pull on tubing to confirm they are properly connected.

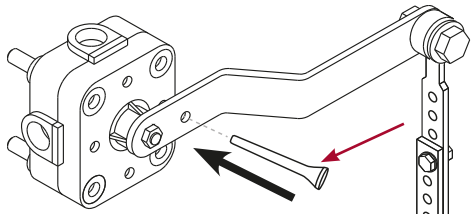


Figure 187: **Insert Wooden Dowel**

7. If not already fitted, install wooden centring pin to hold valve in neutral position. Refer Figure 187.

8. Charge the HCV air supply system.

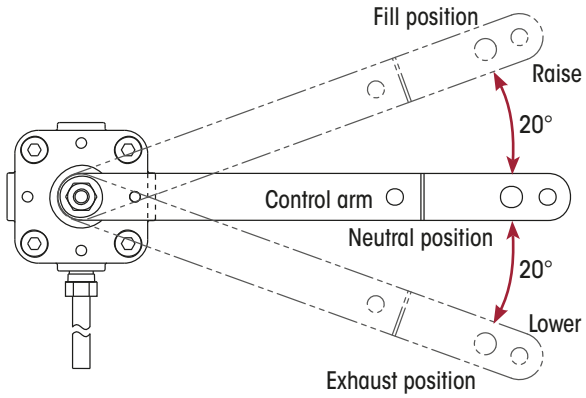


Figure 188: **Ride Height Adjustment**

9. Remove wooden pin and confirm the height control valve is properly installed by raising the control arm approximately 20 degrees above horizontal. (Refer Figure 188.) Air pressure should begin inflating the air springs. If the air springs do not inflate:

   A) Verify the air supply pressure is sufficient to open the pressure protection valve, which is at least 550 kPa (80 psi).

   B) Recheck the air lines for proper port connections, that the air lines have not become blocked and that there are no kinks in the lines.

   C) Check the dump switch has not been activated.

10. If the HCV correctly inflates the air springs, rotate the control arm downwards approximately 20 degrees below horizontal. (Refer Figure 188.) Verify that air is flowing through the exhaust port of the HCV and that the air springs are deflating.

11. Move the suspension through the vehicle's entire suspension range and ensure adequate component clearances from high to low.

SERVICE HINT: The most accurate way to measure ride height is by dropping it down and allowing it to rise to the set height.

12. Adjust ride height to manufacturer's specification, by raising or lowering the HCV lever, until correct ride height is achieved.

13. Move valve to neutral position and reinstall wooden pin.

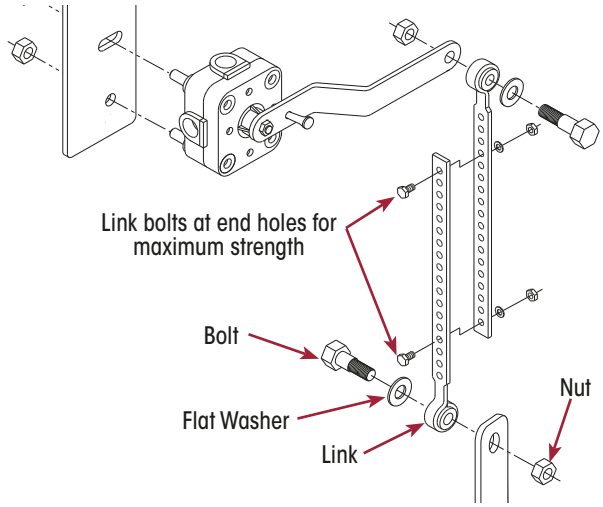


Figure 189: **HCV Link Assembly**

14. Fasten half the link to the height control valve control arm and the other half to the lower mounting bracket with the provided shoulder bolts. Position the washer and bolt head on the link side and the nut against the lower bracket or HCV arm. Refer Figure 189.

NOTICE: Ensure that the links rotate freely and do not bind. If the links do not rotate freely it can result in damage to the link, brackets and/or suspension.

15. If using band clamp, install clamp and lower bracket loosely on the axle, with the clamp roughly at the top.

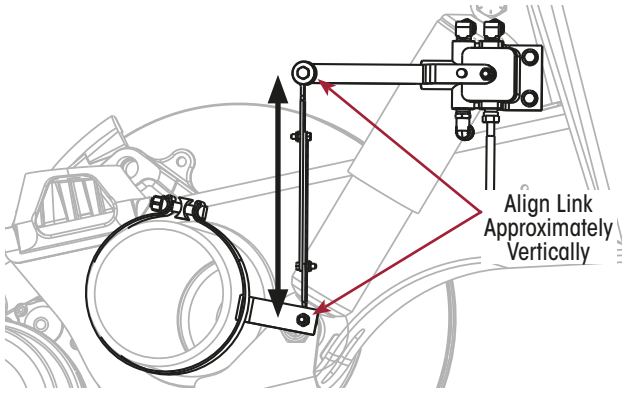


Figure 190: **Check HCV Link Angle at Ride Height**

16. If using band clamp, rotate the lower bracket, with lower height control valve link, around the axle until the link can be joined vertically (or at least close to vertical). Refer Figure 190.

17. Line up the nearest set of holes on both halves of the link. Install the link bolts at the ends and tighten. Refer Figure 189.

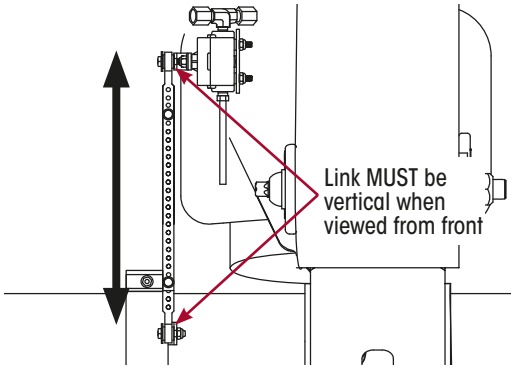


Figure 191: **Ensure link is vertical when viewed from front**

18. Ensure the link is positioned vertically when viewed from front. If using band clamp, tighten without changing bracket position to 80 Nm for 5" axle or 45 Nm for 5.75" axle. Refer Figure 191.

IMPORTANT: When tightening the band clamp, avoid changing bracket position.

19. Remove wooden centring pin.

20. Minor adjustments to HCV position and ride height can be made by loosening the nuts attaching the valve to the bracket and moving the valve around in the slotted holes.

21. Spray all air connections and fittings for leaks with a suitable foaming detergent. Verify all air fittings and fasteners are tight and that no leaks are present. Refer to "Leak Detection Foaming Agents" on page 103.

IMPORTANT: Do not use any detergents that contain ammonia because this may trigger embrittlement of brass fittings, which will eventually cause the fittings to crack and fail.

22. Ensure that all fasteners are tight and that there are no air leaks before placing the trailer back into service.

RIDE HEIGHT SETTING

The ride height is measured from the centre of the axle to underside of the chassis. This can also be calculated as the distance from the bottom of the chassis to the top of the axle plus half the diameter of the axle. There are two acceptable methods of measuring ride height, either with a tape measure and some simple calculations or by using Hendrickson Ride Height Gauges.

More details about setting and adjusting trailer suspension ride height can be found in Hendrickson Trailer Ride Height manual L459.

IMPORTANT: Before adjusting ride height, the trailer should be unloaded and placed on a flat, level work surface with the wheels chocked. The trailer should be parallel to the work surface and supported at operating height by the landing gear legs or coupled to a vehicle.

NOTICE: Unless otherwise specified, the ride height is measured on the axle where the HCV is mounted.

Tape Measure

Measure the distance from the top of the axle to the mounting surface of the suspension. This is usually the underside of the chassis rail. Add half of the axle diameter (radius) to this measurement to determine your suspension's ride height. Therefore, add 63.5 mm to the measurement on a 5" axle or add 73 mm to the measurement on a 5.75" axle. Refer to "Identifying Axle Diameter" on page 16 for details on how to identify 5" (127 mm) and 5.75" (146 mm) LDA axles.

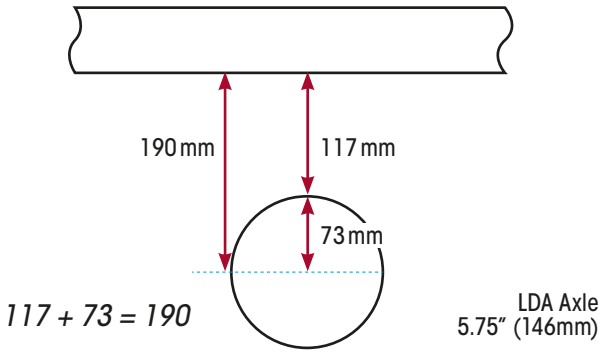


Figure 192: **Ride Height Calculation with LDA (5.75") Axle**

For example, 117 mm (4.6") from underside of chassis to axle tube plus 73 mm (which is half the diameter of a 146 mm (5.75") axle), equals a total ride height of 190 mm (7.5"). Refer Figure 192.

Ride Height Gauges

Hendrickson have ride height gauges to simplify ride height measurement. They take into account axle diameter (5" and 5-3/4") without having to add the axle radius from the measurement. There are two gauges depending on ride height; S-23445 is for 8.5 to 14 inches (top mount) and S-23442 is for ride heights of 13.5 to 19 inches (low ride).

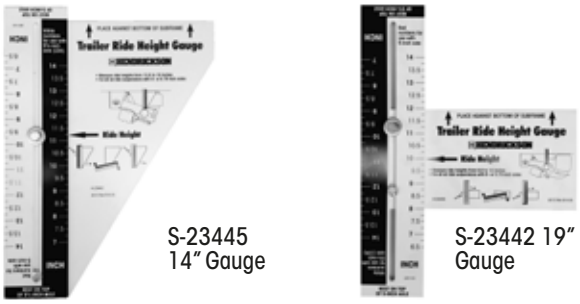


Figure 193: **Hendrickson Trailer Ride Height Gauges**

Measure the distance between the axle and the mounting surface of the suspension using the appropriate Hendrickson Ride Height Gauge.

Ride Height Adjustment

1. Compare the measured ride height with the recommended or designed ride height.

SERVICE HINT: The most accurate way to measure ride height is by dropping it down and allowing it to rise to the set height.

2. If necessary, adjust the ride height. The measured ride height must match the designed ride height.
   - If measured ride height is too low: – Disconnect the linkage and push the control arm up to add air to the air springs and raise the ride height to the correct measurement.
   - If measured ride height is too high: – Disconnect the linkage and pull control arm down to lower the ride height to below recommended height and then raise to the correct measurement.

IMPORTANT: A minimum of 550 kPa (80 psi) air pressure must be available to open the brake protection valve and allow air flow to the height control valve. A delay of five to 10 seconds may occur before the height control valve allows air flow to or from the air springs.

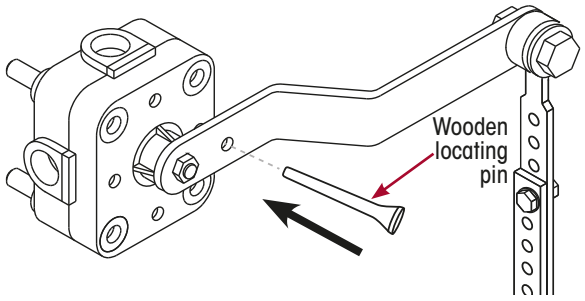


Figure 194: **Temporarily Hold HCV with Wooden Dowel**

3. When the suspension is at the designed ride height, insert a wooden (or plastic) locating pin into the adjusting block and bracket on the height control valve. This will lock the control arm in the neutral position, preventing inadvertent ride-height adjustments when attaching the linkage in the next step. Refer Figure 194.

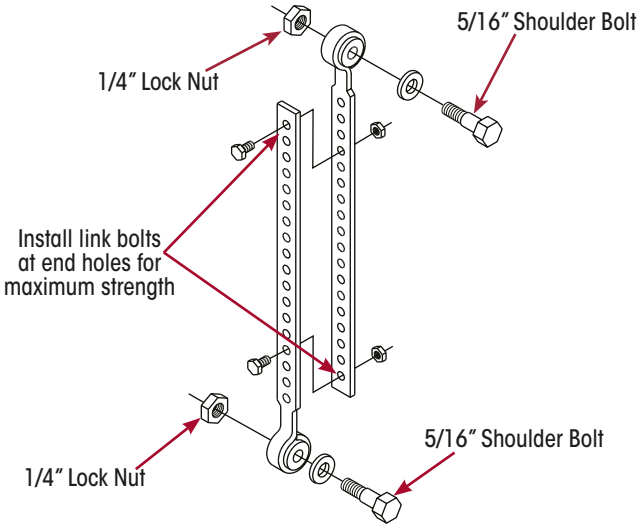


Figure 195: **Assembling HCV Linkage**

4. Attach the height control valve linkage. Fasten one end of the linkage to the height control valve control arm and the other end to the suspension beam. Tighten the 1/4-inch locking nut onto the 5/16-inch shoulder bolt until snug. Do not overtighten bolts. The washers and pivots must be able to rotate freely. Trim (if necessary) and bolt the two linkage halves together at the appropriate length to hold the height control valve arm in the neutral position when the suspension is at the designed ride height. Refer Figure 195:

5. If minor adjustment is necessary, loosen the height control valve locating nuts. This will allow the valve to be rotated in the slotted bracket mounting holes.

6. Remove the wooden locating pin.

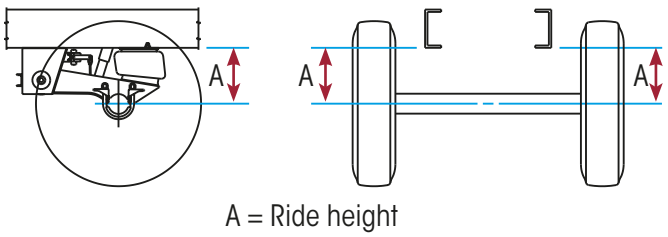


Figure 196: **Comparing Side to Side Ride Height**

7. Check that the ride height (***A***) is relatively equal from side to side (Figure 196) with the axle parallel to the trailer frame and the suspension beams parallel to each other.

8. Ensure that all fasteners are tight and that there are no air leaks before placing the trailer back into service.

AIR SPRING RESIDUAL PRESSURE

The suspension on some trailers should be dumped it times, such as a tipper when tipping. This action drops the air springs onto the bump stops and provides a more stable operation, especially considering the dynamic weight shift that occurs during tipping. However, it is quite likely that at least one of the suspension axles will be lifted by the same operation. If the air springs have no pressure at all, due to the dump function, then there is a possibility that the bellows will catch on the air spring piston.

To prevent this from occurring, a system of ensuring a minimum pressure at all times should be installed into the air circuit. This is not as simple as screwing a residual pressure valve into the exhaust port of the HCV. This is because the exhaust port on the Barksdale HCV is simply for the raise lower function. The air for the dump function comes out of another port in the side of the valve.

It is possible to speed up the dump function and ensure that there is always a suitable air pressure in the air bags to prevent damage if the axles are lifted when air is dumped. This is by installing a combined assembly of air valves and regulator, which is available from Hendrickson under the part number AK-136-1. The two quick exhaust valves are configured as shuttle valves, with the pressure regular setting the minimum air spring pressure when the suspension is in dump mode. Refer to Figure 197 and Figure 198.

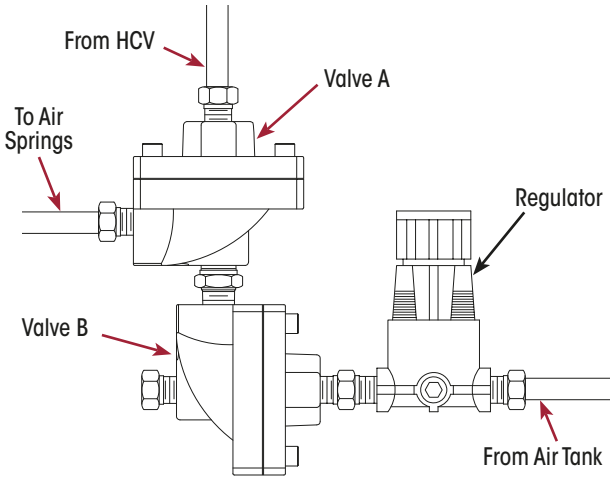


Figure 197: **AK-136-1 Pressure Retention System**

The AK-136-1 is installed so that air from the HCV travels through it to reach the air springs. Normal trailer height is controlled directly by the HCV. However, when the air spring pressure drops or is dumped the assembly rapidly releases air pressure. The pressure can continue to fall down to the minimum set pressure. Refer to Figure 199, Figure 200 and Figure 201 for descriptions of AK-136-1 operation.

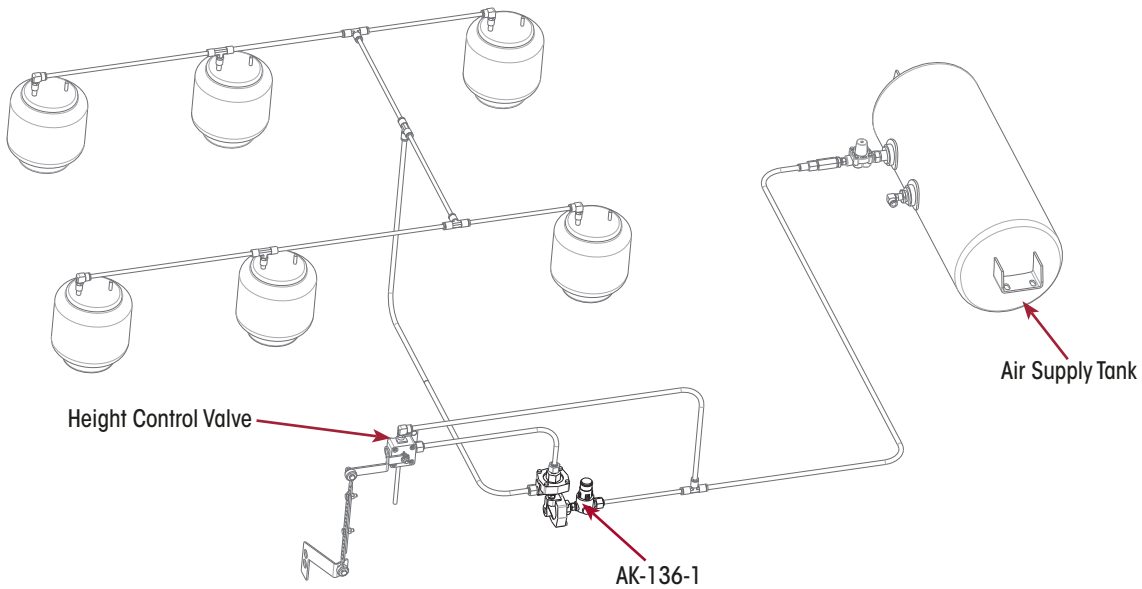


Figure 198: **AK-136-1 Pressure Retention System Layout**

Pressure Retention System Operation

NOTE: Only active parts of the AK-136-1 air control circuits have been highlighted.

Raise or Neutral

- Pressure from HCV is greater or equal to Air Spring pressure.
- Air pressure is able to flow from HCV to Air Springs.

Refer Figure 199.

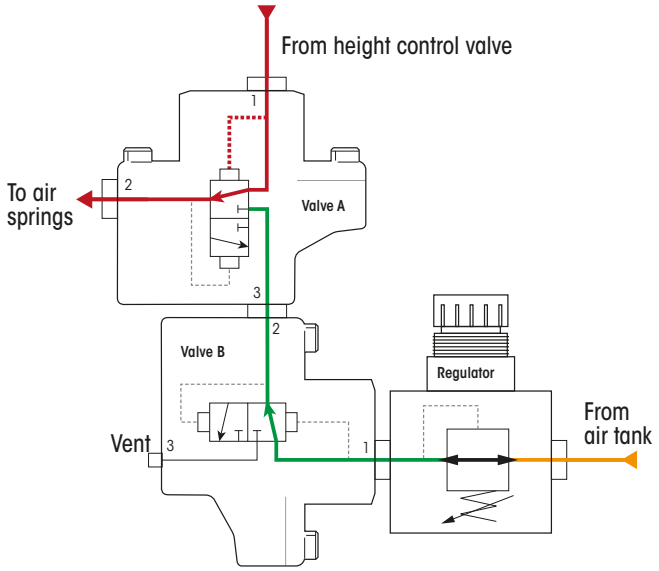


Figure 199: **AK-136-1 Operation – Raise or Neutral**

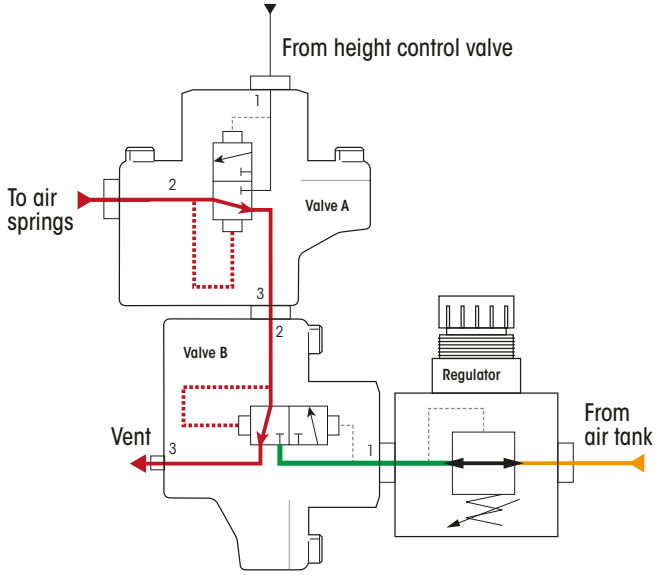


Figure 200: **AK-136-1 Operation – Lower**

Lower

- Pressure at HCV is now lower than Air Spring pressure. Air Spring pressure is greater than Regulator pressure.
- Air is able to pass through both valves and exit quickly. This allows suspension to lower rapidly.

Refer Figure 200.

Dumped

- Pressure at Air Springs is greater than HCV pressure and is now equal to Regulator pressure.
- No air movement. This keeps sufficient pressure in Air Springs to prevent them from collapsing when dumped.

Refer Figure 201.

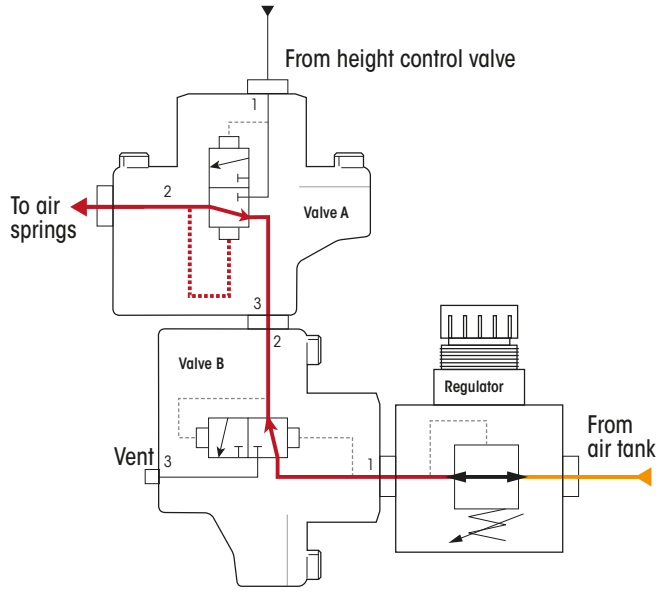


Figure 201: **AK-136-1 Operation – Dumped**

LIFT AXLE CONTROL VALVES

Lift axle control valves (LACV) work in conjunction with Hendrickson UNDER BEAM LIFT™ (UBL™) kits. They allow for one or more axles to be lifted to reduce fuel costs and tyre wear, as well as wear and tear of roadways. The lightweight nature of Hendrickson UBL kits provides additional benefits.

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 discussed here due to it being the most common valve now fitted. Refer to Figure 202 or a typical representation of a Hendrickson Auto/Auto LACV layout.

- **Auto/Auto**: These systems will raise and lower the axle automatically depending on load.
- **Manual/Auto**: These systems rely on the driver to raise the lift axle when no longer needed, such as after a load has been removed. However, the axle will drop as soon as the axle load reaches the set mass.

All lift axle control valves should have a manual override 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).

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

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, then 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).

Refer to technical manual 97117-187 for details regarding LACV, calibration, inspection and diagnosis.

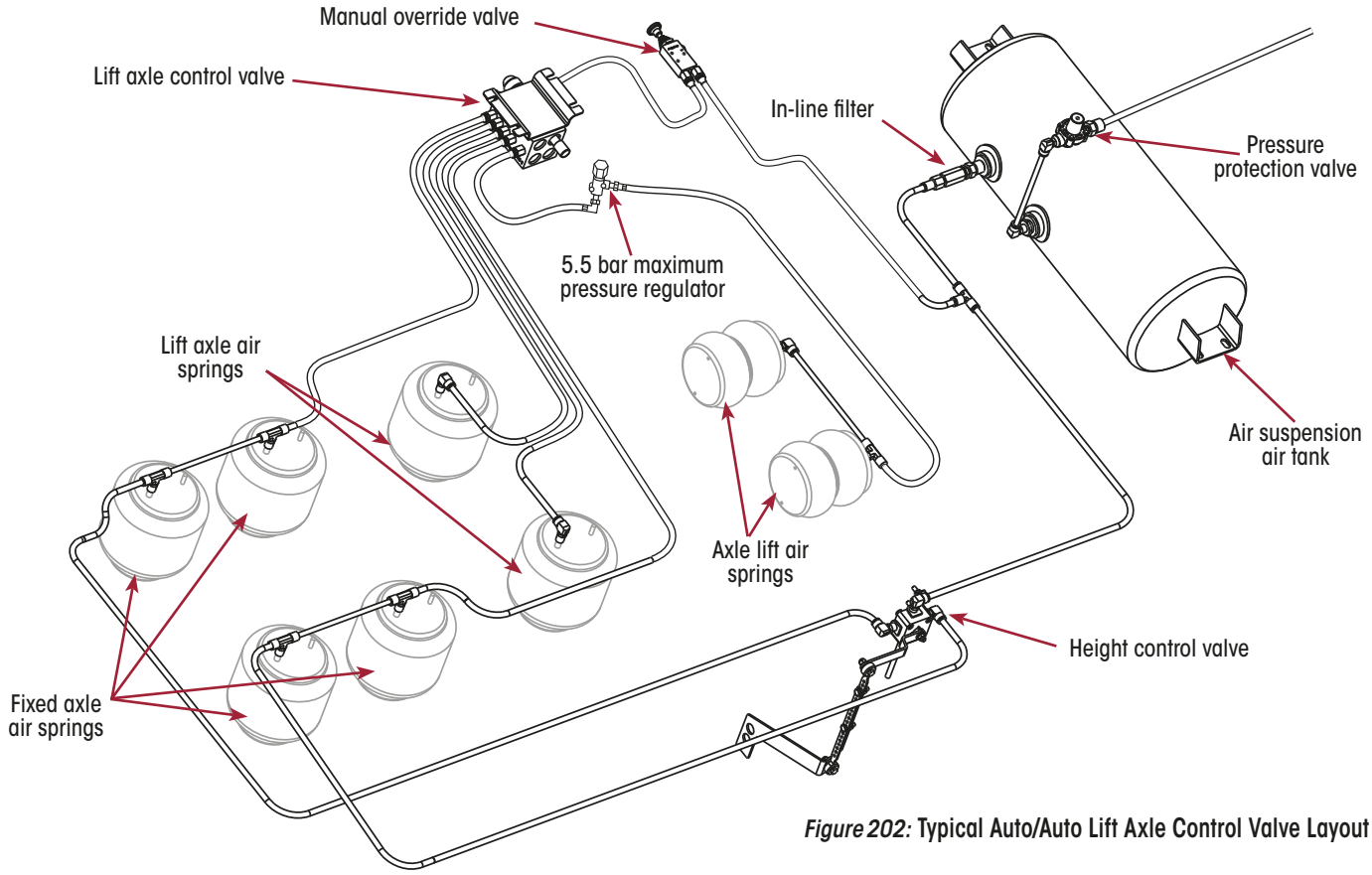


Figure 202: **Typical Auto/Auto Lift Axle Control Valve Layout**

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 relatively 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

Hendrickson 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 it is important the vehicle air supply dryer is inspected and replaced at regular recommended intervals. Refer "Pneumatic Supply" on page 80.

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

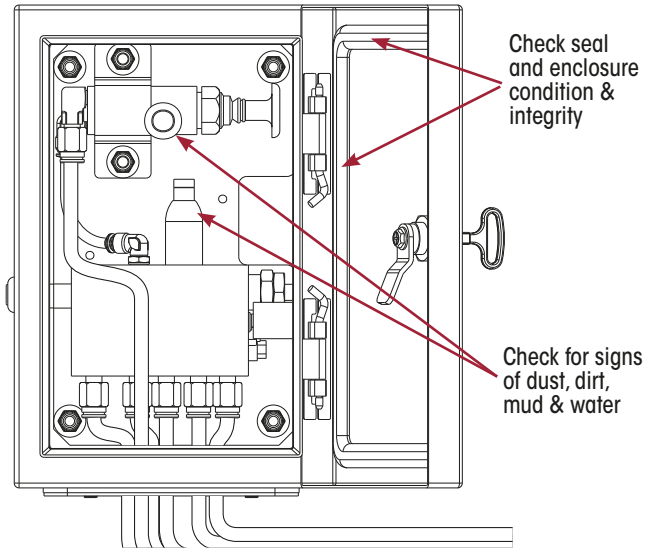


Figure 203: **Inspect LACV & Enclosure**

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 203.
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.

Contamination Check

The most common issue faced by LACV are contamination, either form internal or external sources.

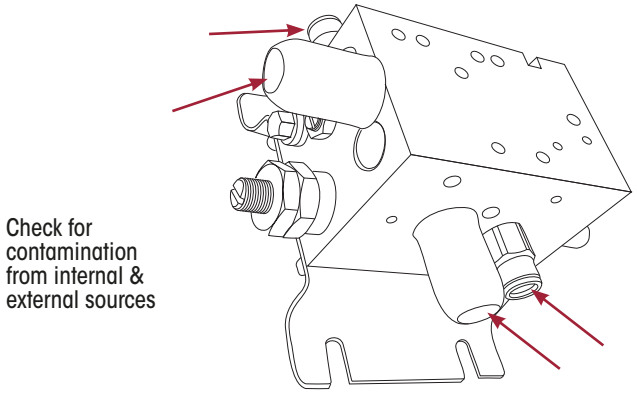


Figure 204: **Check for Signs of Contamination**

Check for signs of fine dust, dirt, mud or moisture build up in and around the LACV. Damage caused by contamination through the breather vents is irreparable. If in doubt, 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 204.

Refer to LACV Installation & Calibration manual 97117-187 for further inspection, diagnosis and servicing details.

RAISE LOWER VALVES

Raise Lower (Docking) valves are used to bring the trailer deck height in line with loading bays. They are very useful when dealing with various height loading bays. However, the valves can also cause considerable damage if not installed or used correctly.

The valves work by bypassing the height control valve to set trailer height. This means that the operator could inadvertently put full system air pressure into the air springs. So, an air spring that may usually see a maximum of around 70 psi, could be pressurised up to 140 psi, if left in the raise position. This excess pressure could damage air springs, shock absorbers and mountings if left in this state.

To prevent this kind of damage, all genuine Hendrickson Raise Lower valve kits contain a pre-set protective pressure regulator. However, if installing an aftermarket Raise Lower valve, then you should supply and install a pressure regulator set to a maximum of 80 psi. It is vital that these regulators be installed in the air supply line to the Raise Lower valve, which will minimise accidental component damage from over-pressurisation. Refer Figure 205

Some trucks have an option called RtR (Reset to Ride Height), which resets the ride height on account of a speed related signal from the EBS (or ABS) systems. This built in override is a great addition and is usually set to operate when vehicle speed reaches around 6 to 15 kmh. Even with an RtR, it is still important for the operator to manually set the Raise Lower valve back to standard before driving off. This is because RtR will not operate if the EBS is not operating properly. This could be due to an electrical wiring fault, malfunctioning EBS unit or a disconnected wiring harness.

NOTICE: Considerable pressure is required to raise the trailer height when fully loaded. If this pressure is not available, due to low system pressure, operation of air brake, leaks or for any other reason, then the trailer will not be able to reach the desired height.

IMPORTANT: If trailer is driven in a fully raised condition, even for short distances, it may damage the shock absorbers and/or their mountings.

NOTICE: Air supply to the Raise Lower valve should be via a pressure limiting regulator. The pressure regulator should be set to a maximum of 80 psi (550 kPa). This will prevent the air springs from over pressurising, which could damage shock absorbers and their mountings or air springs and their mountings. Refer Figure 205.

Raise Lower valves generally have five positions:

Raise Position: Air pressure from port #11 is delivered to port #22, which goes to the air springs and raises the trailer. Once the desired trailer height is achieved the operator moves the lever to raise stop.

Raise Stop: In this position the air supply to and from the air springs, port #22, completely closed.

Neutral: This position connects the air springs (port #22) to the height control valve (port #12). This reverts full control of suspension height back to the HCV.

Lower Stop: In this position the air supply to and from the air springs, port #22, completely closed.

Lower Position: Air pressure from the air springs at port #22 is directed to port #3, which is the vent port and drops the suspension. Once the desired trailer height is achieved the operator moves the lever to lower stop. If held in this position, the suspension will drop until it rests on the internal air spring bump stops.

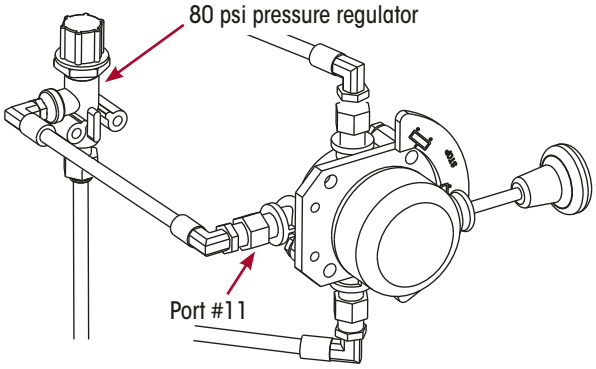


Figure 205: **Protective Pressure Regulator Installation**

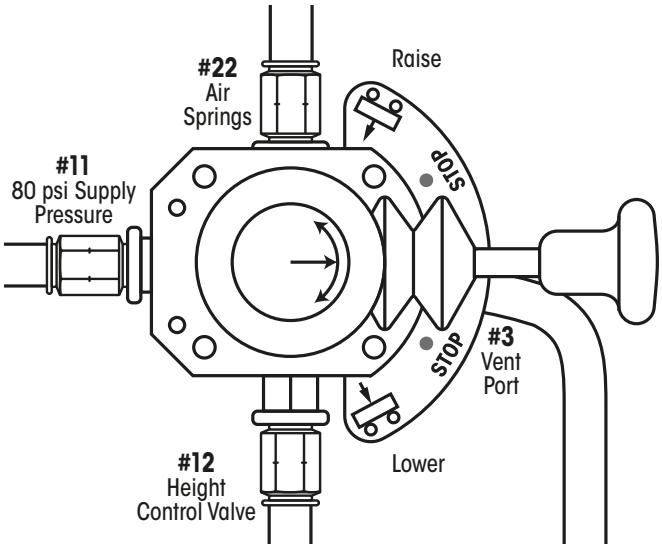


Figure 206: **Raise Lower Valve Port Location & Numbers**

TIREMAAX PRO

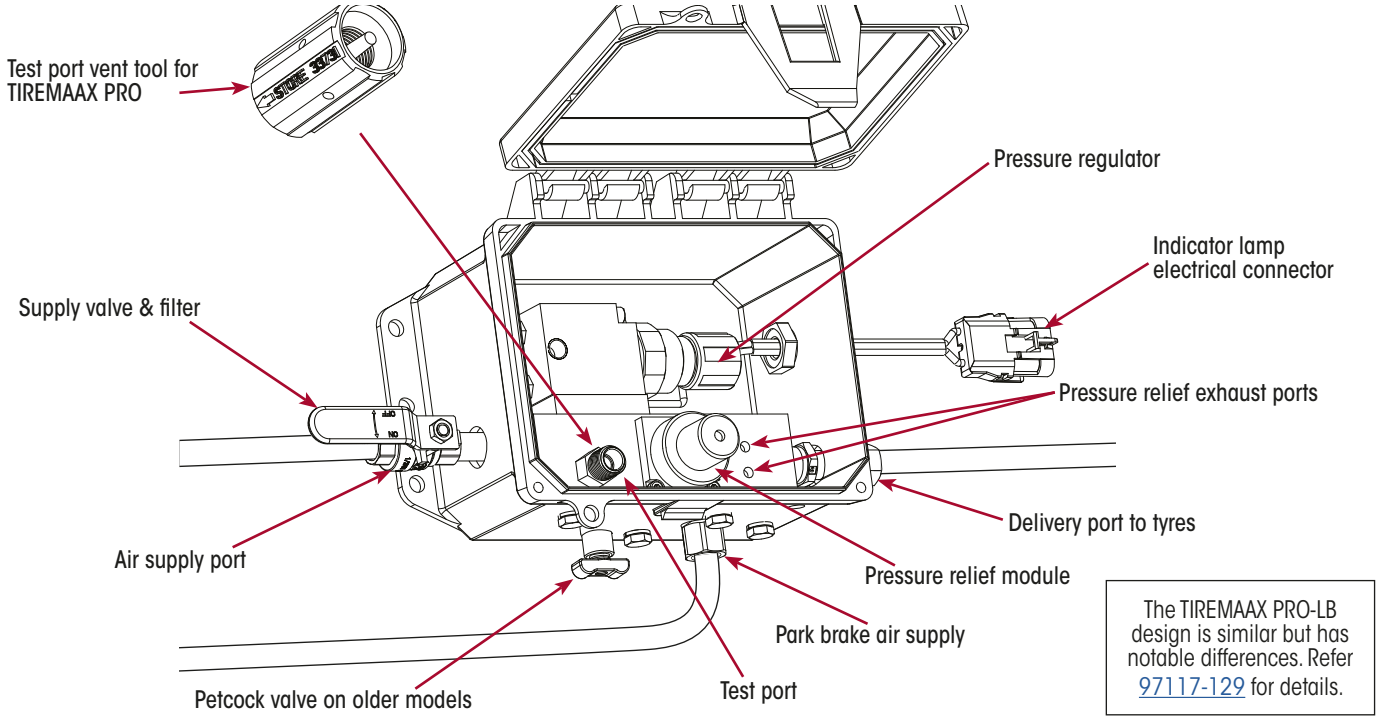


Figure 207: **TIREMAAX PRO Controller Components**

NOTE: This section contains basic TIREMAAX™ PRO inspection procedures. Comprehensive service and maintenance procedures for TIREMAAX PRO are detailed in T51002 or for TIREMAAX PRO-LB refer to 97117-129.

Inspections and Inspection Intervals

- Tyres be inspected for wear and damage at regular intervals.
- Check tyre pressures at regular intervals, referring to the tyre manufacturers' guidelines for acceptable inspection intervals.
- At regular intervals, check TIREMAAX components for air leaks and indicator lamp operation.

Every Three Months

To assess system integrity, perform the following:

1. Check indicator lamp operation. Refer to "Indicator Lamp Test" on page 94.
2. Manually check all tyres for a low-pressure condition by removing the tyre hoses at the hubcap and manually check tyre pressure. Refer to "Manually Checking Tyre Pressure" on page 95.
3. Inspect all tyre hoses to ensure that they are secure.
4. Check TIREMAAX controller enclosure to ensure it is in good condition and clear of dirt and moisture.

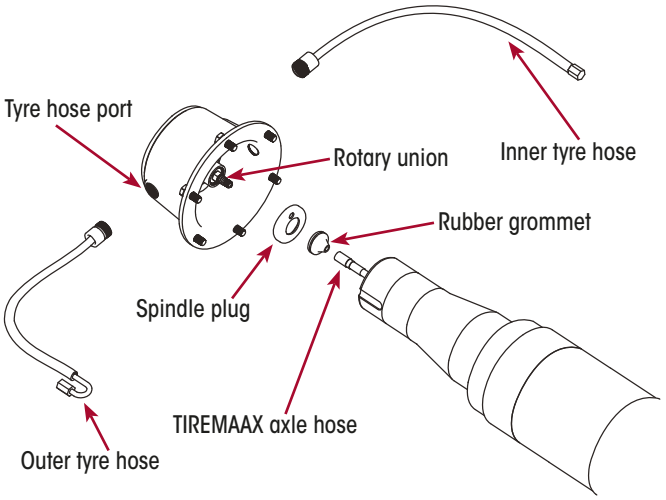


Figure 208: **TIREMAAX PRO Wheel End Components**

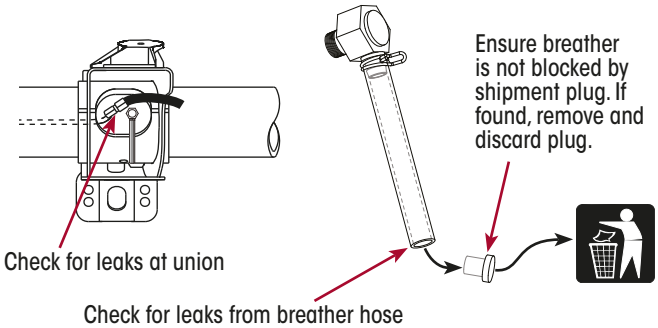


Figure 209: **Check for Leaks With Soapy Water**

Every 12 Months

In addition to the above three-month check, perform the following:

- Inspect all system connections for leaks. These checks need to be carried out with air pressure to the controller, the wheels chocked, and the park brake released. This is because the TIREMAAX PRO system is inactive with the park brake applied.

  Apply a foaming agent to all air fitting connections, including the axle vent. Air leaking from the axle vent indicates is an internal leak, possibly from the rotary union or hose connection. Bubbles formed in the foaming agent will provide a visual indication of an air leak. All connections must be airtight. Refer to Figure 209, "Axle Vent" on page 96 and to "Leak Detection Foaming Agents" on page 103.

NOTICE: New axles are fitted with a plug in the axle vent for transport purposes only. These plugs must be removed and discarded after the axle is fitted. Refer Figure 216.

INDICATOR LAMP TEST

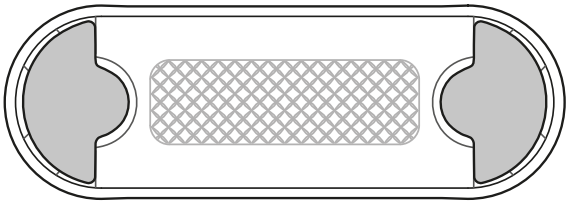


Figure 210: **TIREMAAX LED Indicator Lamp**

The indicator lamp is designed to illuminate if there is a major loss of air pressure, such as that caused by a tyre puncture, to warn the driver of such a failure. Correct operation of the lamp can be checked by artificially creating an air leak in the air circuit to the tyres. Refer Figure 210.

This procedure is easy to carry out due to a conveniently located test port on the TIREMAAX PRO controller. The type and location of the test port will vary depending on the type and age of the TIREMAAX system. For further details refer to Hendrickson Technical Manual T51002.

NOTICE: The indicator lamp may flash momentarily when the trailer parking brakes are released. If this occurs, the light is operational, and the following steps are not required.

1. Ensure that the correct supply voltage is available, that there is sufficient air pressure to the controller, that the park brake is off, and the wheels are chocked before commencing.

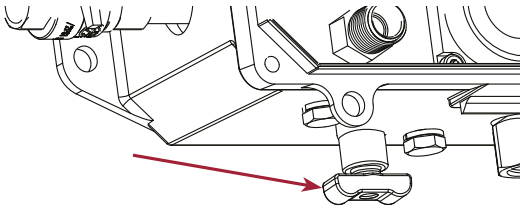


Figure 211: **Early TIREMAAX Petcock**

2a. Early TIREMAAX systems have a petcock either underneath the controller box or at the outlet going to the tyres. Refer Figure 211.

Quickly open the petcock until air rushes out of the valve. A sufficient stream of air should trigger the warning switch and illuminate the indicator lamp.

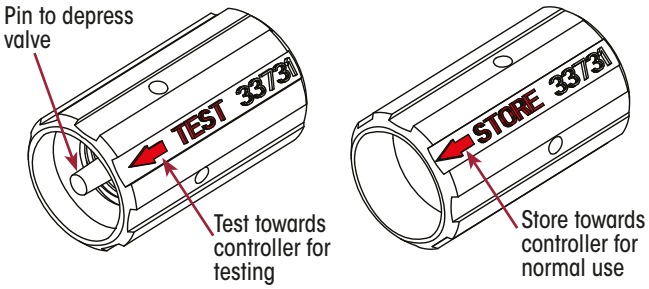


Figure 212: **Later TIREMAAX PRO Test Port Vent Tool**

2b. Later TIREMAAX PRO systems have a test port that covered by a test port vent tool. To enable the test port, remove the tool from the test port and turn it around so that the pin on the tool presses on the test port valve. If in doubt, refer to the inherent marking on the side of the test port tool. Refer Figure 207 and Figure 212.

Screw the tool onto the test port so that ample air flows from the valve. Check that the lamp illuminates. If it does, unscrew the tool and refit with the STORE arrow pointing toward the controller.

NOTICE: The TIREMAAX PRO test port vent tool is designed to prevent the controller lid from closing properly if it is installed the wrong way around. If the lid will not close properly, it may be that the vent tool is not installed the right way around.

MANUALLY CHECKING TYRE PRESSURE

⚠ **WARNING**: To prevent injury, always follow recommended safety procedures when maintaining or servicing vehicles.

NOTICE: Check valves in the tyre hoses help prevent tyre pressure loss when a tyre hose is removed. However, a slight burst of air may occur when the hose is first disconnected.

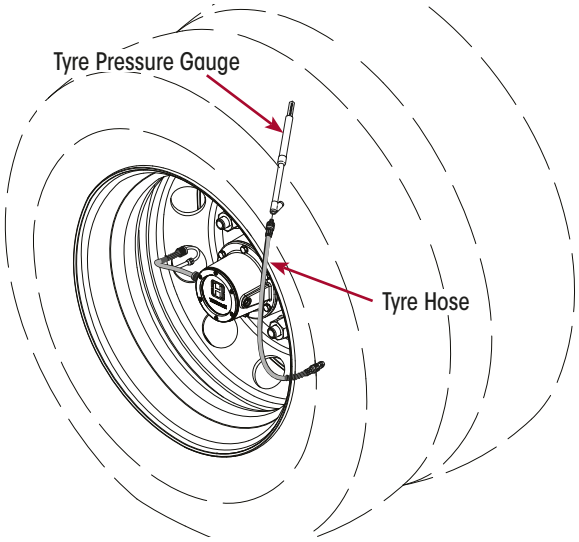


Figure 213: **Manually Checking Tyre Pressure**

1. Ensure vehicle is turned off and park brake is applied.
2. Unscrew tyre hose from hubcap.
3. Use a conventional gauge to measure tyre pressure at hose end. Refer Figure 213.
4. Inspect tyre hose O-rings for nicks or cuts. Replace as needed.
5. Reattach and firmly hand-tighten tyre hose. Ensure the hoses do not protrude past the wheel. A small smear of anti-seize on the fitting thread will help prevent it from seizing and galling.

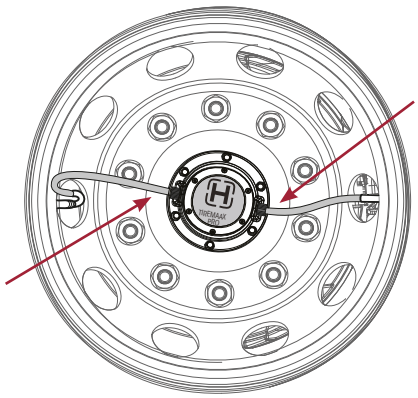


Figure 214: **Check Tyre Hose Position**

NOTICE: Do not overtighten the tyre hose at the tyre valve stem, which could damage the internal tyre hose seal. Ensure tyre hose is not stretched tightly or are so loose that it flops around and contacts the wheel. Check to ensure no part of the tyre hose extends out past the wheel. Refer Figure 214.

NOTICE: If a hose is removed, the system will:

- Isolate disconnected tyre.
- Continuously maintain inflation pressure for all connected tyres.

NOTICE: When the trailer parking brakes are engaged, delivery air exhausts to zero pressure in the delivery air lines only. The hub cap wheel valves then close and isolate the wheels from the system. This allows for minor tyre air leaks to become evident as the defective tyre deflates.

AXLE VENT

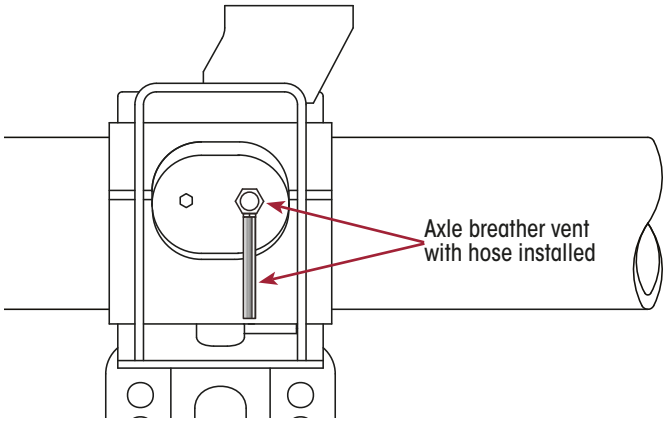


Figure 215: **Axle Breather Vent & Hose**

Hendrickson axles fitted with HXL7® extended long life wheel ends or TIREMAAX™ PRO tyre pressure control systems have a pressure relief breather valve installed. The valve is installed on the left hand side of the axle. These valves are normally maintenance free, however they still need to be checked to ensure the hoses are intact and are not blocked. Refer Figure 215.

If fitted with TIREMAAX PRO, they should also be checked for air leakage, which may occur if there is an air pressure leak within the axle. TIREMAAX is inactive when the park brakes are applied, so checking for escaping air should be carried out after chocking the wheels and releasing the park brakes. For more details refer to "TIREMAAX PRO" on page 93.

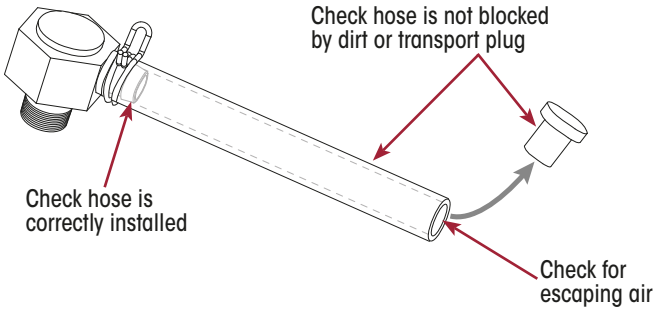


Figure 216: **Check Axle Breather & Hose**

Check for the following:

- Hose in place and intact.
  Correctly refit or replace the hose, as necessary.
- Hose not blocked by transport plug or by dirt.
  If fitted, remove and discard the transport plug. Remove the hose, clean out and refit, as necessary.
- Air escaping from hose.
  Check with wheels chocked and park brakes released on TIREMAAX PRO fitted suspensions. The valve will release pressure from the axle if there is a leak from either hoses or fittings within the axle. Remove the TIREMAAX hubcaps to diagnose further. Refer to "TIREMAAX PRO" on page 93 and to Hendrickson T51002 TIREMAAX PRO service manual for more information.

TYRES & AXLE ALIGNMENT

TYRE WEAR

There are quite a few potential causes of excessive tyre wear. This includes over loading, uneven loading, tyre balance, improper or faulty brake operation, inoperative shock absorbers, or a twisted chassis frame. The main ones are listed below in increasing order of impact:

1. Tyre pressures incorrect or uneven
2. Suspension components worn or damaged
3. Vehicle application
4. Axle out of alignment

Even if there are no faults and alignment and pressures are set correctly, wear will differ depending on where the tyre is operating, front truck tyres will wear at a reduced rate to the rear tyres due to tread pattern and the forces on them. Trailer tyres will wear differently again. Keeping that in mind, let's examine the causes of accelerated wear.

Tyre Pressures

Most people in the trucking industry know that incorrect tyre pressure leads to increased tyre wear. What is a surprise to many, is the degree that as little as 5-psi difference can make, especially on dual wheel sets.

Uneven or incorrect pressures are the most common preventable cause of excessive tyre wear. Insufficient pressure causes increased and uneven wear, higher fuel consumption and poor handling. Many operators run their fleets at higher than recommended pressures to avoid issues from low pressures. However, too high a pressure will cause uneven wear and has been associated with increased incidence of punctures and cuts.

How can we determine what pressure to run set the tyre to? Well, it is only by referring to the recommendations of the tyre manufacturer for the type, application, size, and expected load. Simply setting the pressure to a universal 95 or 100 psi will not provide the best ride, wear, and life expectancy. Quite often the required pressure may be closer to 85 psi.

A study by the U.S. FMCSA found that 41% of tyres surveyed were at least 5 psi underinflated and 31% of tyres were overinflated by 5 psi or more. Additionally, 72% of dual tyres were found to have mismatched pressures of 5 psi or greater, which is a cause of serious tyre wear issues.

You may wonder how much difference 5-psi can make. Well, in dual wheel sets it can make a huge difference. A 5-psi difference between commercial vehicle dual tyres can create a 6mm difference in tyre circumference. In general, a typical commercial trailer tyre makes about 310 revolutions per kilometre. This difference in diameter can cause the wheel with the lower pressure and smaller rolling diameter to skip to keep it moving at the same speed as the adjoining tyre.

Figure 217: **Patchy Wear Pattern**

Over 100,000 kilometres, the smaller tyre will drag that 6mm difference about 31 million times, which equates to 186 kilometres. The smaller tyre skipping across the roadway for those 186 kilometres will result in scrubbed tyres and create patchy wear patterns. (Refer Figure 217 and Cupped Pattern in Figure 219) At the same time, the larger tyre will suffer from internal damage due to the dragging force of the smaller tyre, which can also result in premature failure.

Therefore, on dual tyres, only a 5-psi variance between tyre pairs can make a huge difference. The answer to accelerated tyre wear is for truck owners and fleet operators to set up a frequent schedule of tyre inspection and pressure maintenance and/or install a tyre pressure inflation system, such as Hendrickson TIREMAAX PRO. Tyre pressure inflation systems have the added advantage in that there are no safety issues that occur when tyre inflation it is carried out by a technician. These systems can pay for themselves within a year or two, depending on application. The savings come from reduced tyre expenses, fuel savings from not driving with under-inflated tyres and reduced labour time needed to regularly check pressures.

The most important point is to regularly check your tires for damage, wear, and pressure. Tyre pressures should always be maintained at the recommended levels to reduce costs and downtime.

Suspension Components

Suspension pivot bushes, torque rods bushes, shock absorbers and mounting points fasteners all need to be in good condition to ensure maximum tyre life. Deteriorating with time and use, suspension components need regular inspection to ensure that they are in good working condition. Inspection intervals may need to be increased

if the vehicle is operating in harsh environments, such as high speed on corrugated dirt roads.

Axle Alignment

The alignment was set correctly when manufactured, it will rarely change significantly, unless the suspension has been subjected to considerable force. This is especially true for drive and trailer axles, which tend to be more substantial than the front axles, which need to be flexible enough to steer and are the first axles to run into potholes and objects.

Therefore, the main reason for alignment issues is because of loose or damaged components, such as alignment bolts. This is why regular inspection of suspension alignment bolt torque is a vital part of every regular service schedule.

Vehicle Application

Tyre wear increases with load, so an application where the vehicle is heavily loaded and/or at high speed will have reduced tyre life. Also, applications where there are a lot of tight turns will wear tyres quicker, especially with tri and quad group suspensions. The lateral forces in these group on tight turns can scrub the tread and cause chipping and chunking of the tread block.

There is often little that can be done to reduce wear due to application. However, long term it may be possible to replace axles in groups with steerable or liftable axles. It may also be possible to change the truck route slightly to avoid the tightest turns.

TYRE WEAR PATTERNS

Figure 218: **Centre Wear & Flat Spot Tyre Wear Patterns**

Minor flat spots, feathering, scalloping and divots in the tyre tread may be improved by rotating tyres on a trailer. However, if abnormal wear is significant then rotation will not help because the problem is already chronic. Severe flat spotting or balance issues will simply compound over time and may possibly create faults in other suspension components. Long-term, the cheapest option may be to address the cause of the original problem and replace the unevenly worn tyres.

Even a tyre in good condition can lose up to 10 psi in a month. Which is why installing TIREMAAX PRO tyre pressure control system, either from new or as a retrofit, will pay for itself in a relatively short time.

Figure 219: **Feathered, Edge Wear, Cupped Wear Patterns**

Irregular tyre wear pattern guides can be of some use in determining tyre wear faults. However, wear is seldom as simple as that depicted in the images in Figure 219. This is because rarely is there simply one issue at hand. A flat spotted tyre will be out of balance and may also have scalloping due to driving conditions. An under inflated tyre may also be overloaded and suffering from poor axle alignment. Cupped or uneven wear may be due to mismatched tyre pressures on dual wheels. Refer Figure 217.

A combination of problems that compound over time can make it difficult to pinpoint any wear problems down to a single fault simply by looking at the wear patterns. However, regular inspections by drivers and maintenance technicians can greatly improve tyre life by quickly acting on any unusual wear patterns.

WHEEL ALIGNMENT OVERVIEW

Due to their inherent design, camber and toe-in do not normally affect tyre wear on Hendrickson INTRAAX® axles. A small amount of positive camber is built into INTRAAX axles sold in Australia and toe-in is usually within a tolerance. Neither of these two specifications are adjustable and will generally only be out of specification if there is a problem with the axle.

⚠ **WARNING**: A small amount of positive camber is built into INTRAAX axles sold in Australia. Adding extra positive camber will not improve tyre wear and may cause subsequent axle failure. Failure caused by modifying the axle is not covered under Hendrickson warranty.

Thrust Angle

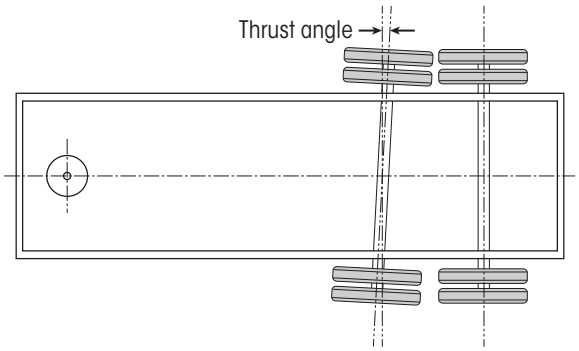


Figure 220: **Axle Thrust Angle**

The thrust angle of each axle is the most important wheel alignment angle for INTRAAX axles. Variations in thrust angle between axles on the same trailer form a scrub angle. Refer Figure 220.

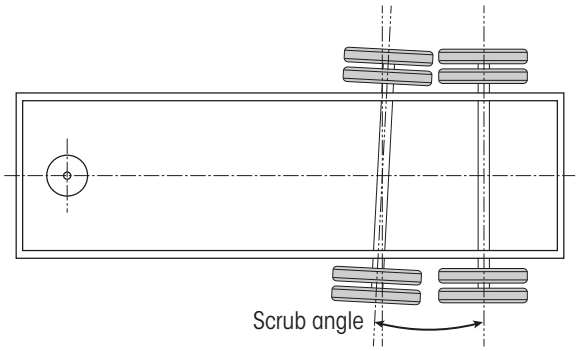


Figure 221: **Axle Scrub Angle**

Scrub Angle is the difference in thrust angles between axles. As the name suggests, scrub angles do cause tyres to scrub and wear due to each axle attempting to follow a different direction as they travel down the road. Refer Figure 221.

Alignment Check

There are several checks that need to be carried out before carrying out axle alignment checks.

1. Only check trailer alignment in an unladen state.
2. Check the wheels for runout and correct if necessary.
3. Settle suspension by moving trailer backward and forward in a straight line and leave parked on a hard level surface.
4. Block at least a couple of wheels.
5. Release the parking brake.
6. Set kingpin height to that specified by the trailer manufacturer.
7. Set trailer ride height to the designed ride height.

Laser alignment equipment allows for greater repeatable alignment accuracy. However, it is also possible to carry out suitable alignments using simple equipment, such as with a kingpin extender and wheel end extenders and a suitable steel tape measure.

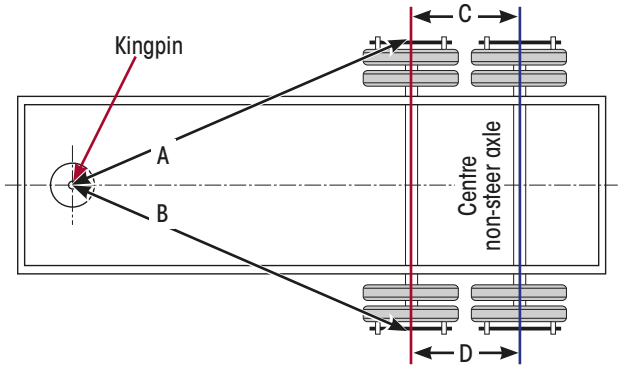


Figure 222: **Measuring Tandem Axle Alignment**

Compare measurements A and B to determine thrust angle. Measurements C and D will help to determine scrub angle. Ideally, the left and right wheel ends should both be precisely the same distance to the kingpin on the front axle of a dual axle. These measurements must be taken in the context of the accuracy of the measuring equipment and axle and suspension tolerances. Refer Figure 222.

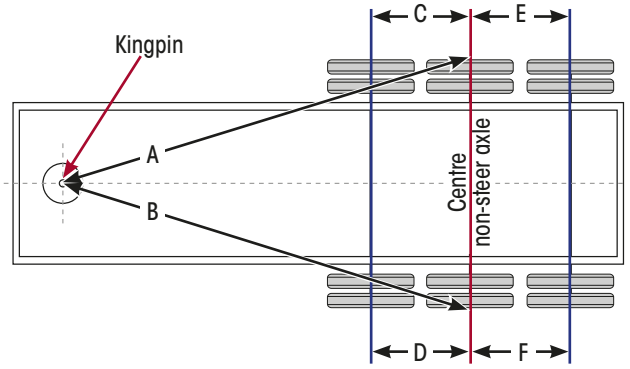


Figure 223: **Measuring Tri-Axle Alignment**

On a tri-axle, it is best to align the centre axle with the kingpin. On a tri-axle this prevents the margin of error compounding from the second to third axles. The other axle(s) should then be brought into line against this aligned axle. Refer Figure 223.

On axle group that include a steer axle the first aligned axle, which is used as reference for the remaining axles, will vary depending on application. On a tri-axle, first align the front (non-steer) axle thrust angle. On a quad-axle, align the centre of the non-steer axles. For more details refer to Hendrickson CONNEX™ ST Drum Brake Steerable Axle Maintenance 97117-273 or Disc Brake Steerable Axle Maintenance 97117-296.

The method employed measuring axle alignment will vary depending on which equipment is used. Refer to the equipment manufacturer's guidelines when conducting the alignment.

For a comprehensive examination of trailer axle alignments, refer to Hendrickson technical publication L579 Axle Alignment Procedures. Torque specifications are available in manual 97117-251.

Install a new QUIK-ALIGN® shear-type bolt, nut and hardened flat washers into the axle pivot connection to be adjusted, but do not fully tighten at this time. The pivot connection fasteners should be tight enough to hold the flanged eccentric collar in place between the alignment guides and flat against the frame bracket, but loose enough to permit the hardened flat washers to rotate freely.

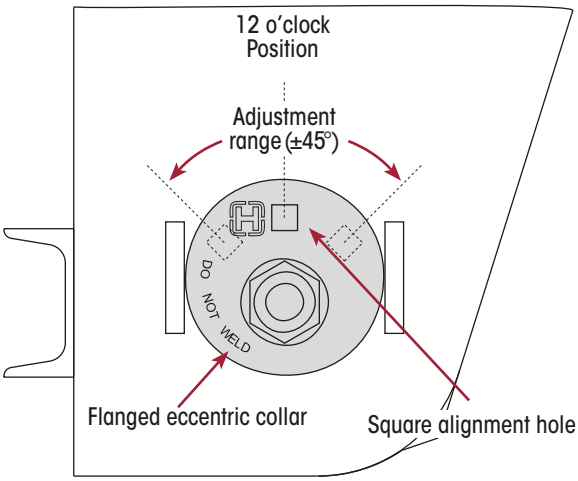


Figure 224: **QUIK-ALIGN Eccentric Collar Positions**

NOTICE: It is good practice to carry out axle alignment by rotating the eccentric QUIK-ALIGN® collars on both left and right sides (one forward and the other backwards). This ensures that the axle remains centred on the trailer. Simply moving the QUIK-ALIGN collar on one side may result in an axle that is excessively forward or rearward, which may result in further problems, such as a wheel rubbing on a mudguard. Refer Figure 224.

⚠ **CAUTION**: The QUIK-ALIGN® pivot bolt and nut are not reusable. Ensure new hardware is used when adjust axle alignment to ensure a reliable assembly.

After successfully conducting an axle alignment, tighten the QUIK-ALIGN pivot bolts at ride height until the Torx head shears off. This helps ensure the torque has been correctly set to *800 Nm*. The pivot bolt torque should be re-checked after 1,500 km to ensure correct clamping load on the pivot connection.

INTRAAX Alignment Guidelines

If recommended requirements are not available from the trailer manufacturer, Table 14 may be used as a guide to acceptable specifications.

Element	Range (From/To)		Tolerance
Camber (Positive)	10 minutes (0.17°)	30 minutes (0.5°)	±0°10′ (0.17°)
Thrust Angle	0.5 mm / metre to left	1 mm / metre to right	

Table 14: **General Trailer Alignment Guidelines**

QUIK-ALIGN® Installation Notes

- QUIK-ALIGN pivot bolts must be torqued immediately after wheel alignment. This will ensure the connection does not move out of alignment.
- The suspension must be at ride height when the bolts are tightened to ensure TFB™ reliability is not compromised.
- QUIK-ALIGN pivot bolts are single use only. They must be discarded after removal and replaced with new.
- Ensure the surface where the fastener sits is not cracked, gouged, or fatigued and that the through holes are not elongated.
- Do not apply anti-seize or any lubricant to QUIK-ALIGN pivot bolts as it will interfere with the thread coating.
- Settle QUIK-ALIGN concentric and eccentric pivot washers by tapping them with a hammer before final tightening.

Refer also to "QUIK-ALIGN Inspection" on page 68.

LUBRICANTS

Lubricating Greases

IMPORTANT: Greases should not be mixed because the thickeners, lubricating fluids and additives in different greases may be incompatible.

NLGI Consistency Number

NLGI consistency standard was developed by the USA based National Lubricating Grease Institute. It is an evaluation of the relative hardness of lubricating grease. Refer Table 15.

NLGI number	Appearance	ASTM Test Result*
000	Fluid	445-475
00	Semi-Fluid	400-430
0	Very Soft	355-385
1	Soft	310-340
2	Medium	265-295
3	Firm	220-250
4	Very Firm	175-205
5	Hard	130-160
6	Very Hard	85-115

Table 15: **NLGI Number Specifications**

* ASTM (American Section of the International Association for Testing Materials) specification test ASTM D217 is a two-part test that compares the hardness of a grease at 25 degrees Celsius.

The number does not refer to any other properties of the grease that would help you decide its suitability. Therefore, two greases could be identified as NLGI #2, one may be suitable for wheel ends and the other may be suitable for food manufacturing equipment. Just because it has the same NLGI number does not mean that it has the same properties or service life as the one you are replacing.

SDS – Safety Data Sheets

Safety Data Sheets (SDS) are available on the Hendrickson website by searching for SDS literature.

Grease Classification

The ASTM D4950 Standard is a standard classification and specification for automotive service greases. This specification defines the requirements used to describe the properties and performance characteristics of vehicle chassis greases and wheel bearing greases.

Group	Performance	Category
LA	Mild Duty	Chassis
LB	Severe Duty	Chassis
GA	Mild Duty	Wheel Bearing
GB	Moderate Duty	Wheel Bearing
GC	Severe Duty	Wheel Bearing
GC-LB	Severe Duty	Multi-purpose

Table 16: **Grease Classifications**

Chassis greases are grouped under the prefix letter L and wheel bearing lubricants are grouped under the prefix letter G. Higher suffix letters denote higher specifications. Refer Table 16.

Wheel bearing greases used with Hendrickson wheel ends should be rated either GB or GC.

Lithium Wheel Bearing Grease

Standard wheel end hubs generally use NLGI #2 wheel bearing grease with a mineral base oil and lithium complex thickener. National Lubricating Grease Institute (NLGI) grade 2 refers to a grease of medium consistency that is suitable for wheel end roller bearings.

Semi-Fluid Wheel Bearing Grease

However, synthetic semi-fluid bearing grease (NLGI #00) has several advantages over standard lithium-based grease. A few of these benefits are:

- Extended usable lubricant life
- Internal transfer of grease improves bearing reliability
- Increases seal life by lubricating moving parts of hub seal.

Hendrickson only recommend two semi-fluid grease specifications. Refer to Table 17 on page 103.

LUBRICANT SPECIFICATIONS

Listed below are lubricant specifications approved by Hendrickson for use in service maintenance.

Category	Application	Type	Specifications
Chassis Grease	Slack adjusters & S-cam bushes	Castrol Premium Heavy-Duty Chassis Grease or similar	NGLI #2, LB rated, chassis grease.
Wheel Bearing Grease	Conventional & HXL2 wheel bearings	Castrol Premium Heavy-Duty Wheel Bearing Grease, Shell Gadus® S3 V220C Wheel Bearing Grease or similar	NGLI #2, GB or GC rated, high-temperature wheel bearing grease.
Semi-Fluid Grease	Hendrickson extra long-life HXL5 & HXL7 wheel bearings and PreSet	Mobil Mobilith SHC™ 007 or Chevron Delo® Syn-Grease® SFE EP	Synthetic base NLGI #00 **IMPORTANT**: Only these two greases meet Hendrickson standards for high performance wheel bearing semi-fluid grease. Use of any other grease will require adopting annual clean and repack service procedures.
Hub Oil	Oil filled wheel hubs	Mobilube® HD Plus 85W-140, Castrol Syndrive 50E or similar	API MT-1 lubricant.
Anti-Seize	Slack adjuster clevis pin, S-cam splines, brake anchor bushes, brake shoe pivots and brake shoe roller ends.	Jet-Lube Kopr-Kote® copper/ graphite high-temperature anti-seize compound or similar.	MIL-A-907E (MIL-PRF-907E)

Table 17: **General Lubricant Specifications**

NOTICE: Refer to Hendrickson Wheel End Maintenance technical publication 97117-250 for more details regarding Hendrickson hubs and wheel ends.

Storing Grease

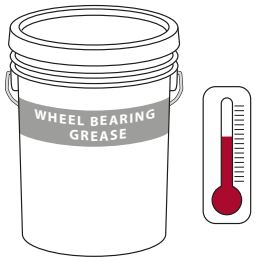


Figure 225: **Store Grease in a cool area away from direct sunlight**

To minimise the separation of oil from the grease during storage, smooth the grease surface and then gently tap container on a hard surface, to remove any trapped bubbles of air.

Securely refit the lid and store out of direct sunlight and away from any heat sources. Replace any grease that is contaminated, past its use-by date or has been poorly stored. Refer to the grease manufacturer for more details and information regarding grease care and storage requirements.

Leak Detection Foaming Agents

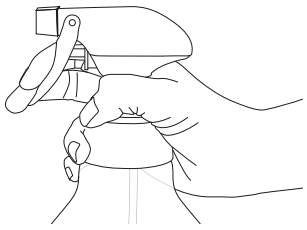
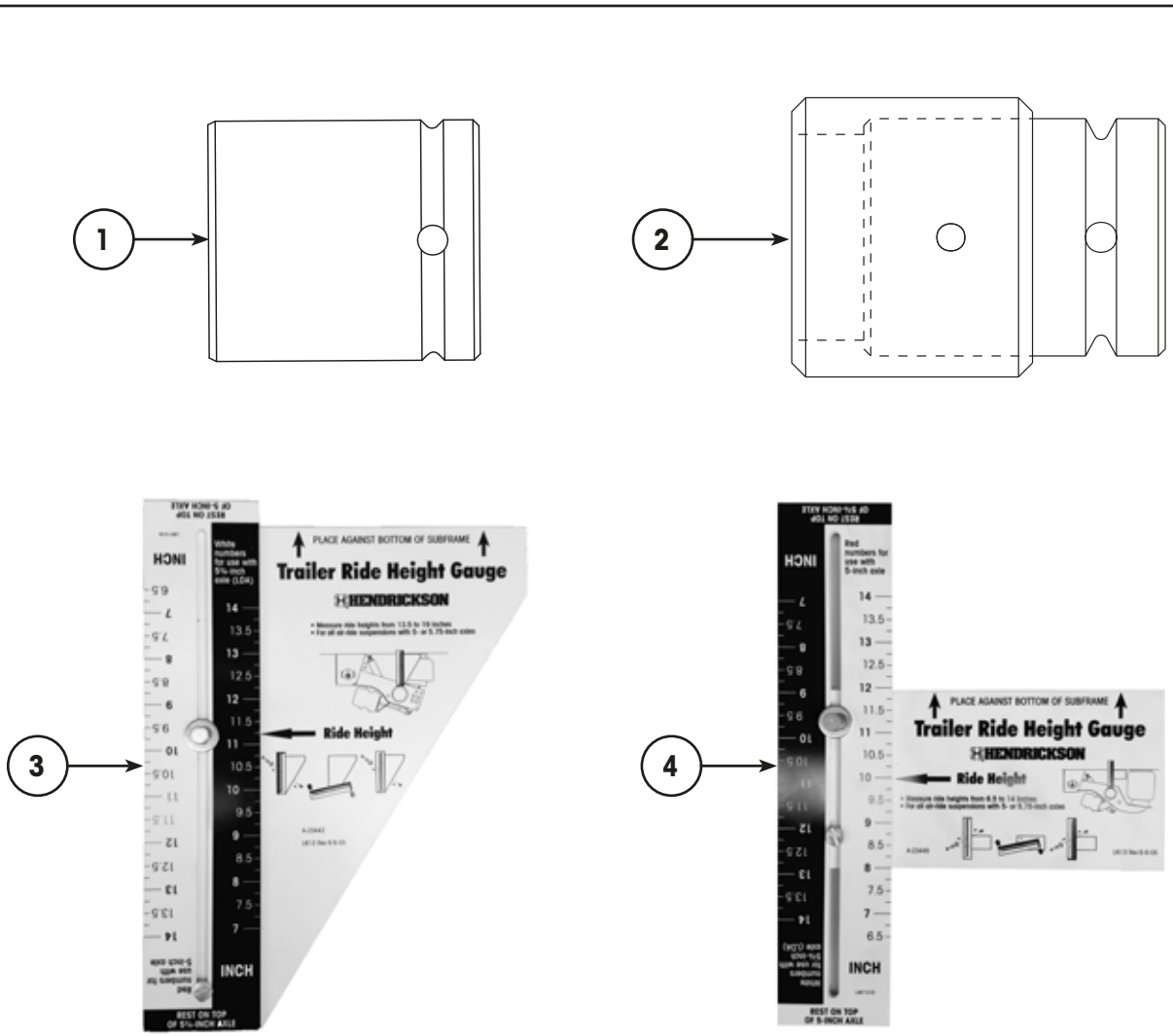


Figure 226: **Check for Leaks with a Suitable Foaming Agent**

Foaming agents used for air leak detection must not contain any ammonia. Over time ammonia causes embrittlement of the brass fittings used for pneumatic connections. This will eventually cause the fittings to crack and fail. Likewise, any compound used should be low in chlorine, which can damage some plastics.

Therefore, the only recommended solutions are those designated as leak detecting solutions (such as those meeting BS EN14291:2004) or general-purpose detergents that are specified as ammonia free and low chlorine, such as Viva Energy Detergent Dobatex Gold.

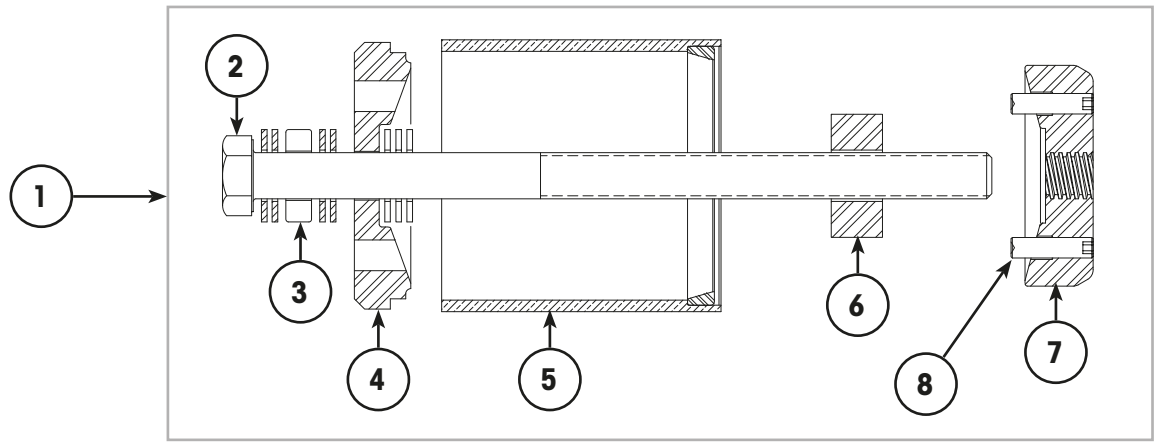
SPECIAL TOOLS

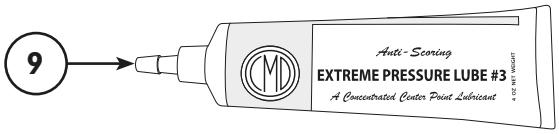


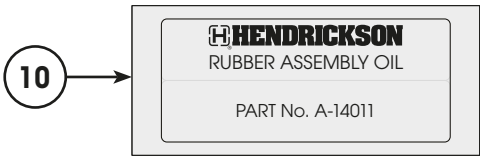
Item	Part Number	Description	Drive	Comments
1	S-24303	Hendrickson E20 Torx™ Socket	3/4 inch	Cost effective tool for occasional use (not recommended for use in high-volume production).
	S-24536	Hendrickson E20 Torx Socket	1 inch	For medium-duty use (dealers, repair facilities, etc.) or for those with one-inch drive air tools.
2	S-25119	Hendrickson E20 Torx Socket with Sleeve	1 inch	**[1]** Recommended in all circumstances and ideal for high-volume trailer production environments or manufacturing facilities.
3	S-23445	Gauge, Ride Height – 6.5 to 14 Inch		Handy, easy to use gauges that suit both standard 5-inch and LDA 5¾-inch axles.
4	S-23442	Gauge, Ride Height – 13.5 to 19 Inch		

[1] NOTE: One-inch drive socket, S-25119, has a sleeve that helps support the tool by sitting over the entire head of the shear bolt. The operator can rest the tool against the collar during the entire tightening procedure. This assists in getting full socket-to-bolt engagement, it reduces fatigue and helps to achieve consistent, properly torqued pivot connections.

SPECIAL TOOLS



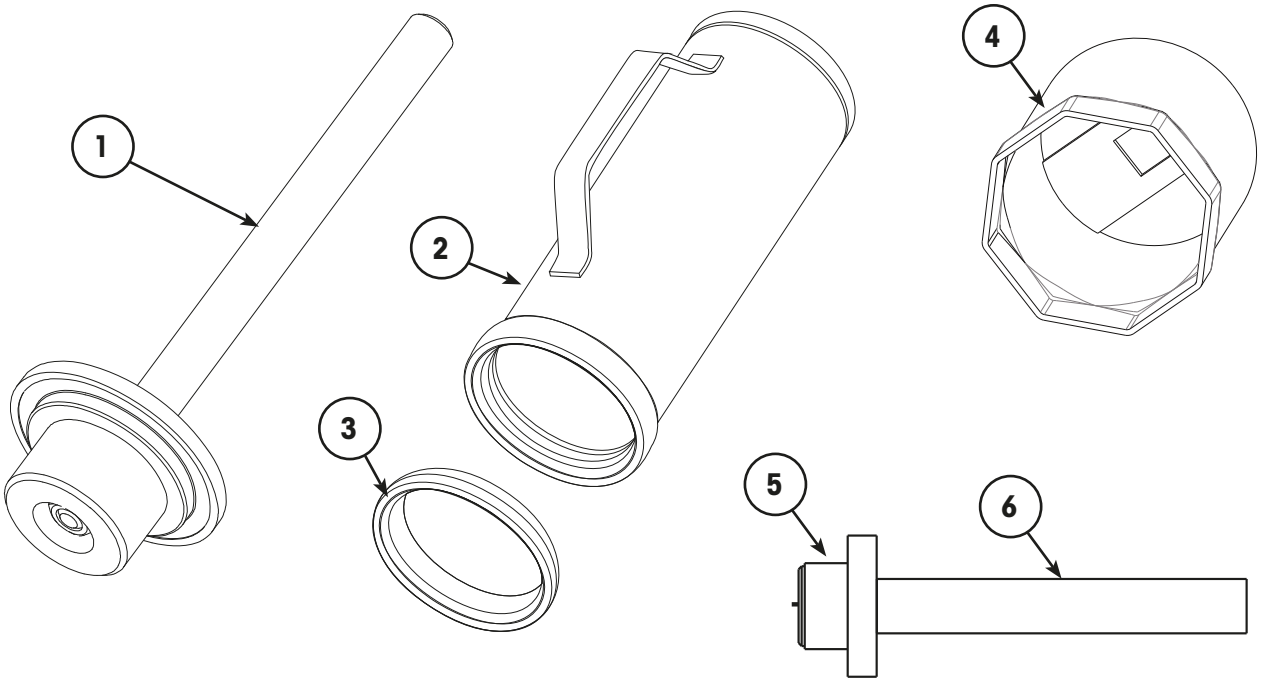




Item	Part Number	Description	Qty	Notes
1	S-24736	Tool Kit – Narrow 3" TRI-FUNCTIONAL™ Bush	1	**[1]** Refer note.
	S-21307A	Tool Kit - Wide 6" TRI-FUNCTIONAL Bush	1	
2	S-24215	Bolt, Acme Thread – 14 Inch for Narrow 3"	1	Included in item 1.
	S-21308	Bolt, Acme Thread – 18 Inch for Wide 6"	1	
3	98762-001	Bearing, Thrust – TFB™ Tool All	1	Included in item 1.
4	S-26986	Plate, Front – TFB Tool Narrow 3"	1	Included in item 1.
	S-21312	Plate, Front – TFB Tool Wide 6"	1	
5	S-24216	Tube, Transition – TFB Tool Narrow 3"	1	Included in item 1.
	S-21313	Tube, Transition – TFB Tool Wide 6"	1	
6	S-21314	Spacer, Removal – TFB Tool All	1	Included in item 1.
7	S-26985	Plate, Rear Drive – TFB Tool Narrow 3"	1	Included in item 1.
	S-21309	Plate, Rear Drive – TFB Tool Wide 6"	1	
8	SA-2800-4	Set Screw – 1/2-13 x 4 inch – Wide 6" Only	2	Removal only. Included in item 1.
	SA-2800-7	Set Screw – 1/2-13 x 2 inch – Wide 6" Only	2	Installation only. Included in item 1.
9	S-21337	Grease, Extreme Pressure	1	**[1]** Essential for use with tool on installation. Included in item 1.
10	A-14011	Lube Pack - TRI-FUNCTIONAL Bush	1	To lubricate bushes on installation.

[1] NOTE: The TRI-FUNCTIONAL™ tool kits are supplied with one tube of extreme pressure grease. It is essential to use this grease on the tool thread to avoid thread form damage. Do not apply this grease to the bushes.

SPECIAL TOOLS



Item	Part Number	Description	Qty	Notes
1	S-32121-1	Hub Mounted Seal Insertion Tool – HN	1	Suits hub mounted HN seal.
	S-32121-2	Hub Mounted Seal Insertion Tool – HP	1	Suits hub mounted HP seal.
2	97781-003	Universal Spindle Mounted Seal Insertion Tool Tube	1	Use with adapter ring – item 3.
3	97781-002	Spindle Mounted Seal Insertion Tool Adapter Ring	1	Suits spindle mounted HP seal. Use with universal tool tube – item 2.
4	S-32120-1	Socket, HN Spindle Nut – 3-13/16 Inch	1	Suits HXL5 & HN 3-piece inner nut.
	S-32120-2	Socket, HN Spindle Nut – 3-1/4 Inch	1	Suits HN 3-piece outer nut.
	S-32120-4	Socket, HP Spindle Nut – 4-3/8 Inch	1	Suits HP 3-piece outer nut.
	S-32120-3	Socket, HP Spindle Nut – 4-7/8 Inch	1	Suits HXL7 & HP 3-piece inner nut.
5	S-28146-1	Plug Driver – HN Tapered Spindle	1	Use with plug driver handle, item 6.
	S-28146-3	Plug Driver – HP Parallel Spindle	1	Use with plug driver handle, item 6.
6	S-27399	Plug Driver Handle	1	Use with plug driver, item 5.

TERMS AND ABBREVIATIONS

Terms and abbreviations that may be used in this document include:

230/250/300 ..... An indicator of suspension capacity. The actual suspension loading capacity may vary according to specific applications and to working regions.

ADB ..... Air Disc Brake, using pneumatic air pressure rather than hydraulic or electric systems to function.

ADI ..... Austempered Ductile Iron is a high strength specialty heat treated iron material.

ADR ..... Australian Design Rule, these are national standards for vehicle safety, anti-theft and emissions.

ARL ..... Auxiliary Rebound Limiter. These are optional kits which limit a suspension rebound by use of a chain system instead of just using the shock absorber.

Bumper Contact ..... The distance the suspension moves upward from the designed ride height until the internal air spring bumper is contacted. This is also the distance the suspension will lift.

CTA ..... Component Type Approval is the new Australian certification replacing the CRN (Component Registration Number) and SARN numbers.

Designed Ride Height . The ride height at which the suspension was originally specified when purchased.

HALFTRAAX™ ..... The bare INTRAAX® axle without brakes, hubs or ancillary equipment fitted.

HCV ..... Height Control Valve. Controls trailer ride height by regulating air supply to the air springs.

High Control ..... Indicates that the suspension may have a longer drop front hanger than standard. This condition provides optimum straight-line stability and is recommended for use on the lead axle of dog trailer suspensions as well as trailer and dolly suspensions used in multi-combination vehicles.

INTRAAX® ..... A fully integrated axle and suspension system that saves weight and improves reliability. The axle passes through and is welded to the suspension beams (trailing arms). U-bolts are not used, and the axle cannot be separated from the beams.

Jounce ..... The maximum distance the suspension can move upward from the designed ride height. This distance includes the compression of the air spring bumper and the pivot bush, and it is always more than the suspension lift distance. Also referred to as the suspension compression.

LDA ..... Large Diameter Axle, which is 5.75-inch compared to the 5-inch older standard.

Liftable ..... A liftable suspension has sufficient jounce to be lifted and still allow the non-lifted axles suspension to operate without the wheel of the lifted axle contacting the ground. A liftable suspension would normally have a minimum of 100 mm of jounce.

Low Ride ..... The beam drops down behind the axle and the air spring is mounted lower than the axle and further behind the axle (similar to underslung).

PCD ..... Pitch Circle Diameter, the diameter of the circle passing through the centre of all the wheel studs.

Rebound ..... Is the amount a suspension may drop down from designed ride height. It is the opposite of jounce and is also sometimes referred to as extension.

Ride Height ..... The dimension between the axle centre and the trailer chassis underside. This dimension is usually unique to a suspension model but may change dependent on the trailer application.

SARN ..... Sub Assembly Registration Number. This is a former Australian number that verified the brake sub-assemblies comply with ADR 38/xx. It has been replaced by CTA.

Suspension Lift ..... The distance the suspension can be lifted from designed ride height. This distance is the same as the bumper contact distance. The amount of suspension lift will change if the ride height is changed.

Suspension Travel ..... The total amount the suspension can move up or down. It is equal to jounce plus rebound and is measured at the axle.

TFB™ ..... TRI-FUNCTIONAL™ Bush is a unique large diameter bush designed to control the horizontal, vertical and roll forces of a trailer in motion.

Top Mount ..... The air spring is mounted on top of the beam, usually close to the axle (similar to overslung).

Vocation ..... The type of work performed by the truck or trailer.

CONTACTING HENDRICKSON & WARRANTY

Contact Hendrickson customer service before performing any warranty related repairs. Refer to the latest applicable warranty statements for more details regarding Hendrickson warranty, which are available www.hendrickson.com.au.

Contact Hendrickson customer service for technical assistance as needed. To do so, several options are available. Prior to contacting Hendrickson, it will be best to have the following information about your Hendrickson suspension available (all that apply):

- Suspension ID Tag information. Get the suspension model number, suspension serial number and approximate number of suspension kilometres.
- Vehicle VIN number. (Refer to trailer OEM manual for VIN plate location.) Get the trailer type (van, refrigerated, flat bed, etc...), manufacturer, VIN (vehicle identification number) and in-service or manufacture date.
- If applicable, description of the system problem, part number and/or part description of the reported non-functioning part.
- What troubleshooting and/or measurements have been performed?
- What service data literature do you have or need?
- Digital photos of suspension and damaged areas.

Detailed contacts for Hendrickson are available on the www.hendrickson.com.au website.
Hendrickson Customer Service may be contacted using the contact details shown below.

Revisions Table

DATE	REV	PAGE	DESCRIPTION
Nov-2023	E	23	Expand inspection of bush for brake adjuster control arm.
Nov-2023	E	10, 90, 91	Add LACV operational check at 12 months. Amend LACV inspection directions.
Nov-2023	E	92	Expand Raise Lower valves section.
Aug-2024	F	50, 51	Update brake chamber installation.
Aug-2024	F	55	Clarify wheel installation recommendations.
Aug-2024	F	58, 62-66	Expand brake calliper inspection checks and elements.
Aug-2024	F	81	Add dryer cartridge operation diagrams.
Aug-2024	F	77	Add left / right hanger identification.

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.

*Need Help? Australia Call **+61 3 8792 3600** or Email **customerservice@hendrickson.com.au***
*New Zealand Call **+64 9 570 4721** or Email **nz-customerservice@hendrickson.co.nz***

HENDRICKSON
www.hendrickson.com.au

HENDRICKSON ASIA PACIFIC PTY LTD
ABN 21 004 992 769
32- 44 Letcon Drive, P.O. Box 1063
Dandenong, Victoria, 3175
61.3.8792.3600 • Fax 61.3.8792.3699

HENDRICKSON NEW ZEALAND
Unit P, 24 Allright Place
Mt Wellington, Auckland, 1060
64.9.570.4721 • Fax 64.9.570.4816

97117-161 Rev F