TECHNICAL PROCEDURE

TRAILER SUSPENSION SYSTEMS
HSDS™ SERIES

SUBJECT: Maintenance Procedures

LIT NO: T42001
DATE: July 2015 **REVISION:** A

HENDRICKSON
The World Rides On Us®

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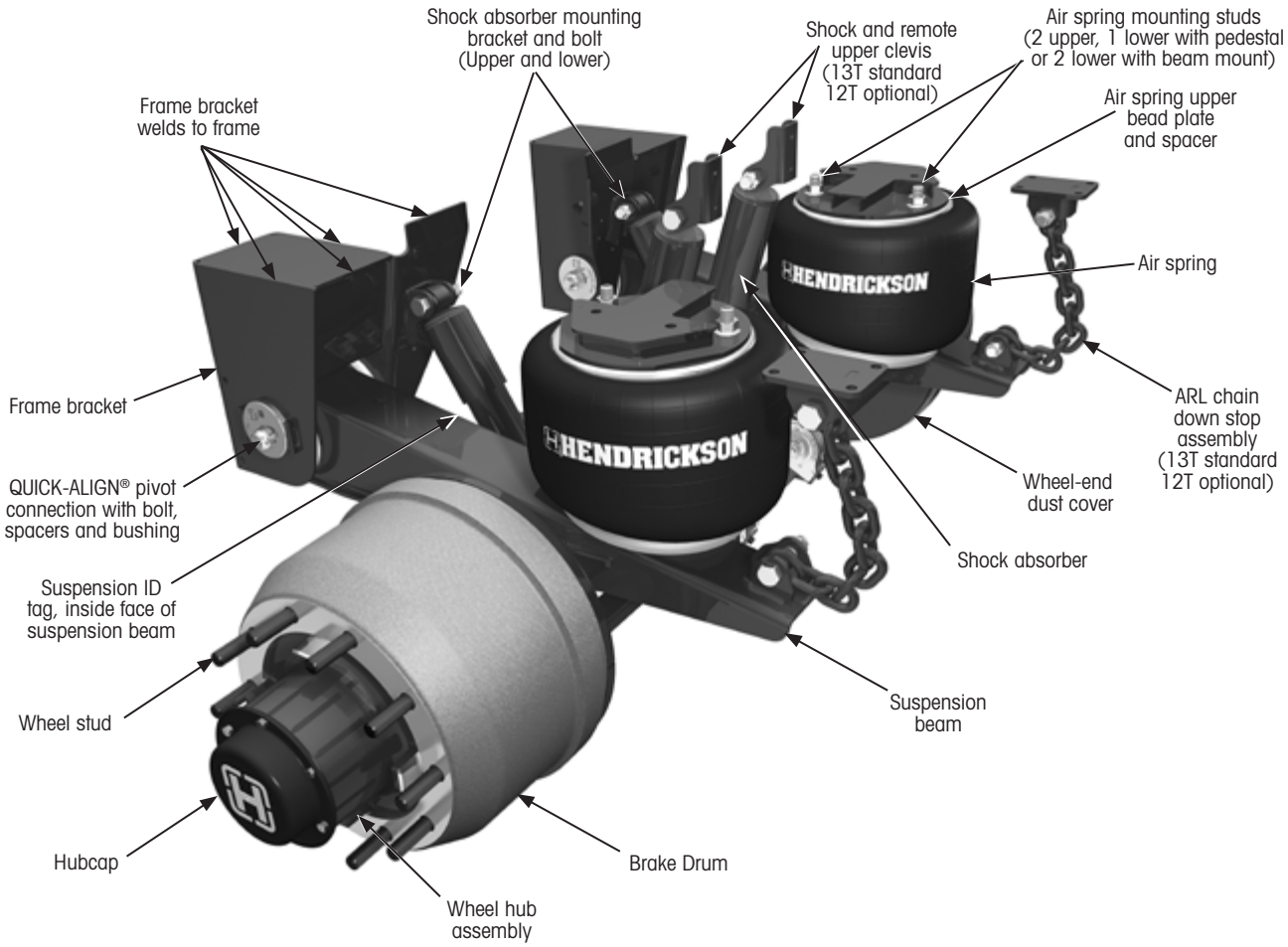


Figure 1: *HSDS™ suspension inspection and lubrication points (13T shown)*

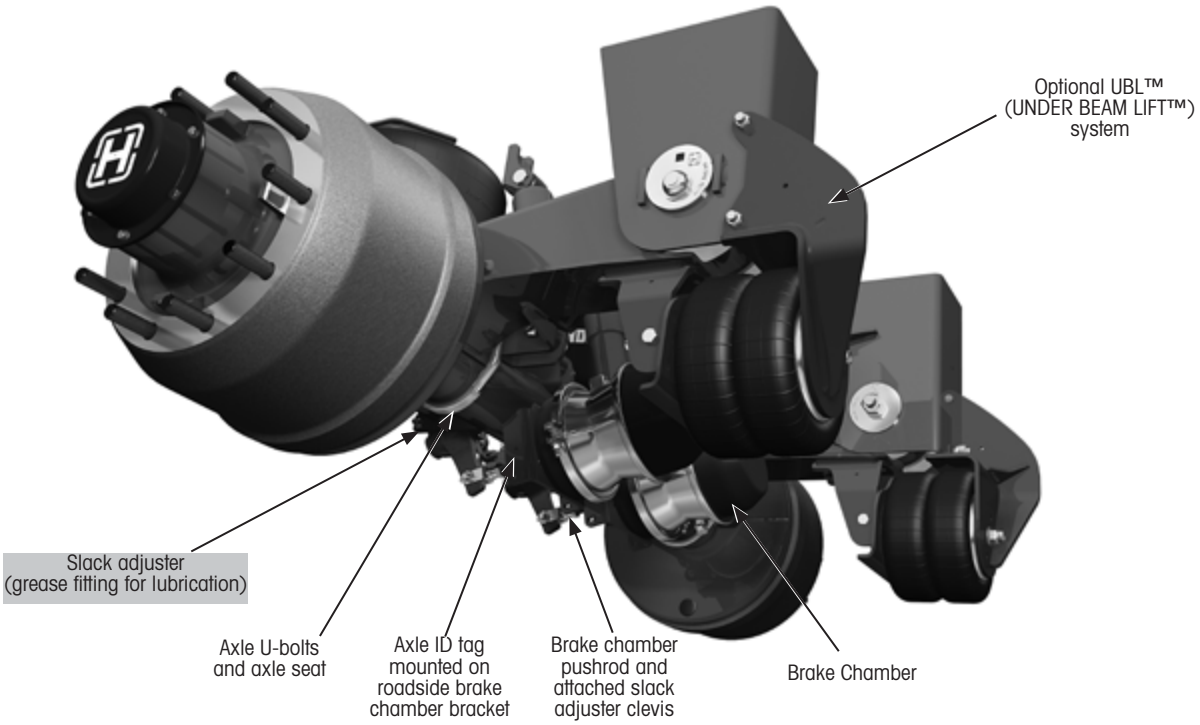


Figure 2: *HSDS™ bottom view with UNDER BEAM LIFT™ (UBL™) option (13T shown)*

INTRODUCTION

The purpose of this document is to provide general guidelines to maintain Hendrickson trailer HSDS™ suspension systems and their components. The information in this document applies to Hendrickson products only. For inspection and lubrication of products not manufactured by Hendrickson, refer to vendor documentation.

IMPORTANT: Regular inspection, lubrication and service according to Hendrickson specification is required to maintain warranty of Hendrickson products.

CONTACT HENDRICKSON

Inspection results or general questions may require contacting Hendrickson Trailer Technical Services for technical assistance. To do so, several options are available. However, some preparation is recommended, especially for warranty claims.

Prior to contacting Technical Services, it may be best to gather the following information (all that apply) about your Hendrickson suspension:

- Suspension ID Tag information (Refer to SUSPENSION IDENTIFICATION (ID) for tag location and details):
  - Suspension model number
  - Suspension serial number
  - Approximate number of suspension kilometers (miles) (optional).
- Vehicle VIN number. Refer to trailer OEM manual for VIN plate location.
  - Trailer Type (van, reefer, flat bed, etc…)
  - Manufacturer
  - VIN (vehicle identification number)
  - In-service date [1]
- If applicable, description of the system problem, part number and/or part description of the reported non-functioning part.
  - Date of failure
  - Where applicable: location of problem on suspension/trailer; e.g., road side, front axle, rear axle, curb side rear, etc
  - Symptoms-
    - » Systems, components or function effected by failure.
    - » When does failure occur?
    - » How often do they occur?
    - » Etc…
- What troubleshooting and/or measurements have been performed?
- What service data literature do you have or need?
- Digital photos of suspension and damaged areas.
- Special application approval documentation (if applicable).

EMAIL/PHONE

To contact the applicable Hendrickson Trailer Technical Services and Warranty department, use the following e-mail address or phone number:

TECHNICAL SERVICE BY REGION	
Australia	
Main Phone	+61.3.8792.3600
Email	TechnicalService@Hendrickson.com.au
China	
Main Phone	+86.400.666.9167
Email	HCTS@Hendrickson-intl.com (**H**endrickson **C**hina **T**echnical **S**ervices)
India	
Main Phone	+91.2135.662600
Mobile	+91.2135.662614
Email	HITS@Hendrickson-intl.com (**H**endrickson **I**ndia **T**echnical **S**ervices)
North America	
Main Phone	+1.330.456.7288
Email	HTTS@Hendrickson-intl.com (**H**endrickson **T**railer **T**echnical **S**ervices)

Table 1: *Contact information*

RELATIVE LITERATURE

Applicable references to relative literature is listed throughout this manual. Table 2 lists general literature that should be referenced, as needed, for maintenance purposes.

[1] If the in-service date is unknown or not available, the vehicle date of manufacture can be substituted.

NAME	DESCRIPTION
AKH0303	*HCV Installation & Plumbing for HSDS, Inch*
AKH0308	*HCV Installation & Plumbing for HSDS, Metric*
D-32592	*HSDS Suspension Components*
D-32593	*HSDS Brake Components*
D-32594	*HSDS wheel End Components*
E34227	*Air Installation Schematic*
L578	*Air Ride Suspension Preventive Maintenance Guide*
T15001	*Air-ride Concepts and Functions*

Table 2: *General suspension literature*

Sources for relative literature include Hendrickson, Vendor and TMC. Where duplication of information exists, Hendrickson literature is most applicable.

UNITS

Where applicable, units are presented in Metric then (Imperial).

WARRANTY STATEMENTS

Warranty coverage is dependant on current trailer location. Table 3 lists the applicable warranty by country with a link to each. These include warranty coverage and labor allowances.

COUNTRY	WARRANTY LIT #
Canada	L583
China	T48001
India	T48002
Mexico	L826SP
United States	L583

Table 3: *Warranty statements by country*

HENDRICKSON LITERATURE

Links to Hendrickson literature are underlined to identify a hyperlink to online resources at www.Hendrickson-intl.com. These documents are an extension to the information included in this manual. When viewed electronically, Hendrickson Trailer literature is opened by clicking on the underlined hyperlink. For more information CONTACT HENDRICKSON.

VENDOR LITERATURE

References to vendor literature can be found online, starting at the vendor's home page. Some vendor literature is listed and linked from the above Hendrickson Trailer literature web site.

TECHNOLOGY & MAINTENANCE COUNCIL (TMC)

TMC is a branch of the American Trucking Associations (ATA) that, for the past 30+ years, has been producing literature defining recommended practices (RP) for commercial vehicles and equipment. References specified within this document refer to number sections from TMC *Recommended Maintenance Practices Manual*. More information can be found at www.trucking.org.

ABOUT HSDS™ SUSPENSIONS

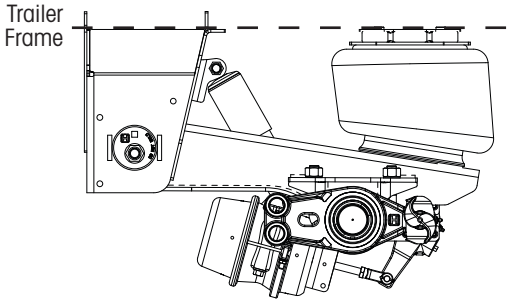


Figure 3: *HSDS™ fixed suspension system*

HSDS™ suspensions are a fixed type suspension that is positioned and mounted to the trailer frame (Figure 3). Trailer frame attachments are made at the top of the frame bracket (with bolts or welds) and mounting studs at the top of the AIR SPRINGS. Various configurations of the HSDS™ suspension can be identified by the coding on the metal SUSPENSION IDENTIFICATION (ID) tag located on the inside of the left suspension beam.

SUSPENSION IDENTIFICATION (ID)

The suspension ID tag (Figure 4) can be found as shown in Figure 1. This information is required for part inquiries and warranty processing.

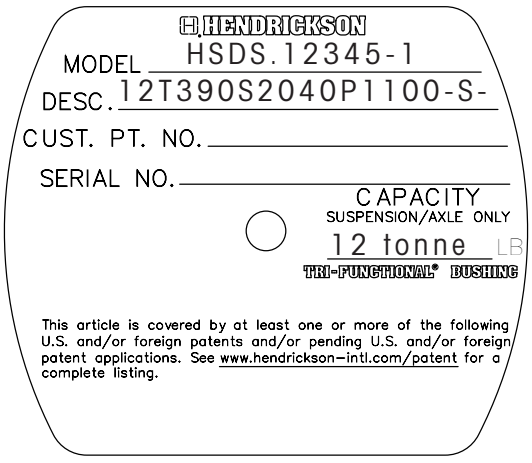


Figure 4: *Sample suspension identification tag*

SUSPENSION DESCRIPTION KEY

As shown in Figure 4, the suspension description is listed on the second line of the suspension ID tag. Decoding the description is as follows:

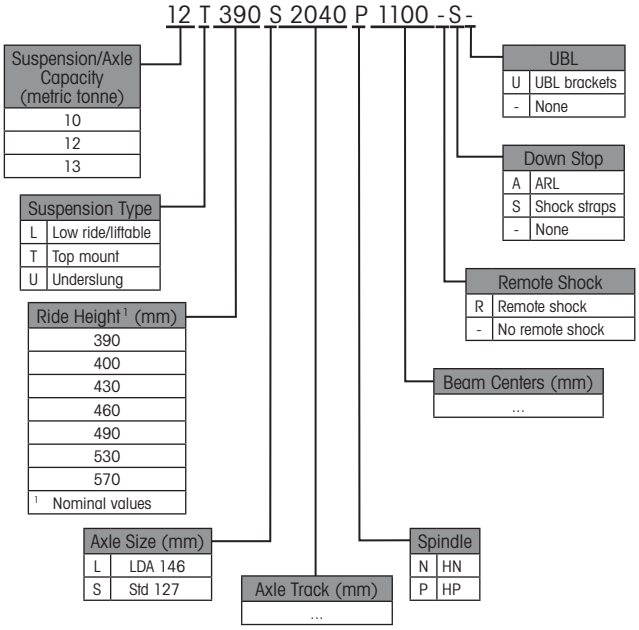


Figure 5: *Suspension description key code*

AXLE ID TAG

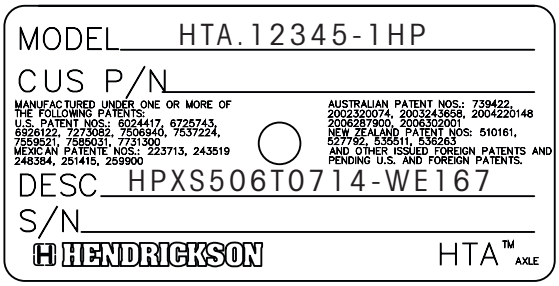


Figure 6: *Sample axle ID tag*

The axle ID tag (Figure 6) can be found as shown in Figure 2. This tag is located on the brake chamber mounting bracket. It includes Model number, Description and Serial number. The model number, with matching suspension configuration number, (Figure 4), is required for part inquiries. Both model and serial numbers are required for warranty processing.

PREPARATION FOR SERVICE

Before inspecting trailer components the following steps help to ensure conditions are safe.

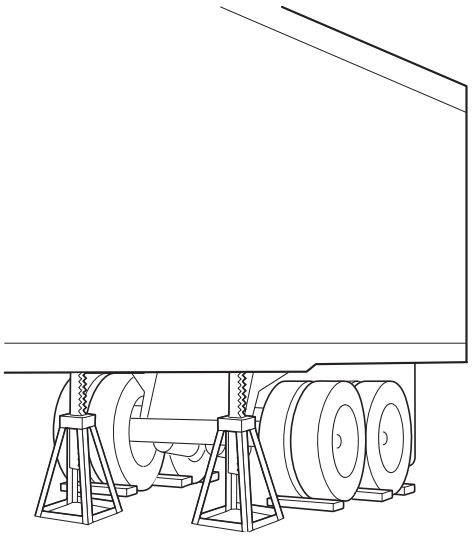


Figure 7: *Use of chocks and trailer stands*

Immobilize trailer:

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 (Figure 7).
4. **Exhaust** the air from the trailer suspension.

If required during service:

5. **Release** the trailer parking brakes.
6. Using a jack, **raise** trailer until trailer wheels clear the work surface.
7. **Support** the raised trailer with trailer stands.

⚠CAUTION: If not on trailer stands, one axle must remain down and chocked at all times to prevent trailer motion.

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

SUSPENSION

This section covers maintenance applicable to general suspension components.

INSPECTION

Refer to L578 *Air Ride Suspension Preventive Maintenance Guide* for recommended inspection and lubrication scheduling. This section covers general inspection of the suspension. Details of various component inspection and lubrication is discussed with each component later in this manual. Figure 1 and Figure 2 point to areas of inspection for the suspension and its components. An exploded view can be found on drawing D-32592.

IMPORTANT: Hendrickson trailer air ride suspension design requires the use of specific air springs, shock absorbers, etc… Hendrickson recommends only Hendrickson genuine parts be used. Replacement with other components may affect suspension performance, cause premature failures and void the warranty.

While performing inspection of the suspension and its components, look for obvious signs of damage or wear which could include:

- Damage to any metal parts or trailer components.
- Corrosion or rust.
- All mechanical joints and moving parts for excessive wear.
- Evidence of road debris, ice or other object(s) causing interference with moving parts.
- Ensure proper weld integrity
- Check for cracks or any separation of welded components.
- Bolts are secure and tight.
- Bolt integrity has not been deteriorated by corrosion or damage.

IMPORTANT: Any bolt or weld issue requires immediate attention by a qualified mechanic.

AIR LINE HOSES, TUBING, FITTINGS, VALVES, ETC.

This applies to air systems for brakes, lift kits, slider boxes, TIREMAAX®, etc… Check to ensure components:

- Show no signs of exterior wear caused by close proximity to moving parts or not properly constrained
- Are free of leaks
- Have fittings free of leaks or damage

WIRES

Some Hendrickson features (ABS, TIREMAAX® TIS and possibly UNDER BEAM LIFT™) use electrical components. If included, it is important to assure the integrity of the associated wiring is maintained for proper functionality.

NOTICE: Sparks from damaged electrical systems and wiring can cause system failures. Seek service if sparks are detected.

Check to ensure wires:

- Are properly restrained to restrict movement.
- Show no signs of exterior wear caused by close proximity to moving parts which will wear insulation and cause grounding and arching.
- Show no signs of corrosion which will effect functionality.
- Are not damaged or broken.

If any of the above conditions exist, contact a repair facility for immediate attention by a qualified mechanic or service representative.

AIR SPRINGS

Air spring components are shown in Figure 8, not all of which are visible, but are necessary to understand its operation.

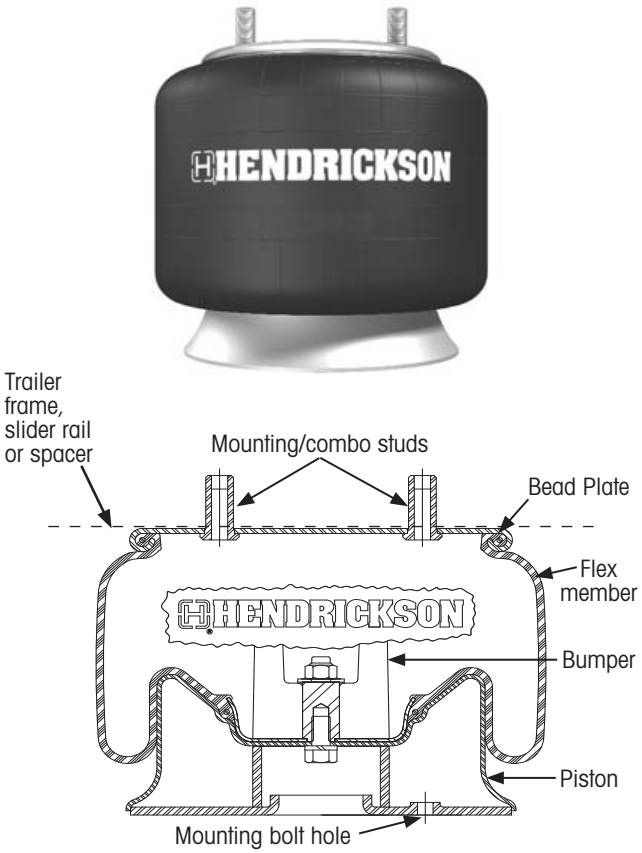


Figure 8: *Air spring components*

Air springs may not operate if rubbed, scuffed, punctured, over-extended or operated without air. If there is no or insufficient air pressure in the flex member, the axle weight of the trailer and its load will be supported by the internal bumpers. Smudging of bumper material on the underside of the upper bead plate is evidence of a trailer moving while at bumper contact.

Problems can also be due to issues with AIR LINE HOSES, TUBING, FITTINGS, VALVES, ETC. and vehicle operation without air while trailer is not at ride height. Determine the cause and take corrective action for any air spring failure to avoid a costly and permanent damage to suspension components and/or cargo.

To replace an air spring:

1. **Exhaust** all air from the suspension system.
2. **Raise and support** the vehicle in a safe manner (Figure 7 on page 7).
3. **Unbolt** the air spring.
4. **Disconnect** air-supply lines.
5. **Replace** the air spring.
6. **Bolt** the air spring in place.

   NOTE: Refer to APPENDIX A on page 25 for torque values.

7. **Connect** the air-supply lines.
8. **Lower** the trailer to the ground.
9. **Supply** air to the trailer and suspension system.

PIVOT CONNECTION

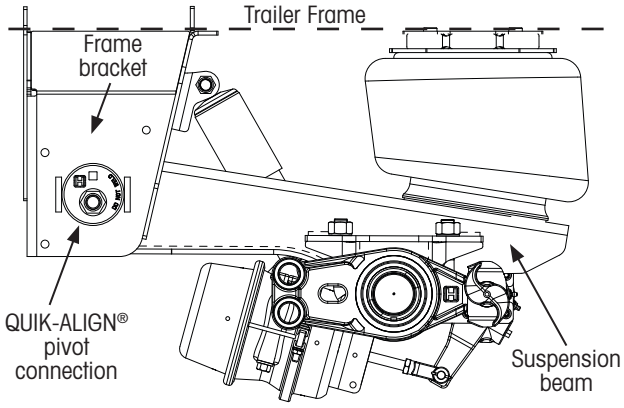


Figure 9: *HSDS™ QUIK-ALIGN® pivot connection*

This very important connection connects the suspension beam to the frame bracket (Figure 9). An improper pivot connection assembly can effect trailer alignment and performance.

PIVOT HARDWARE

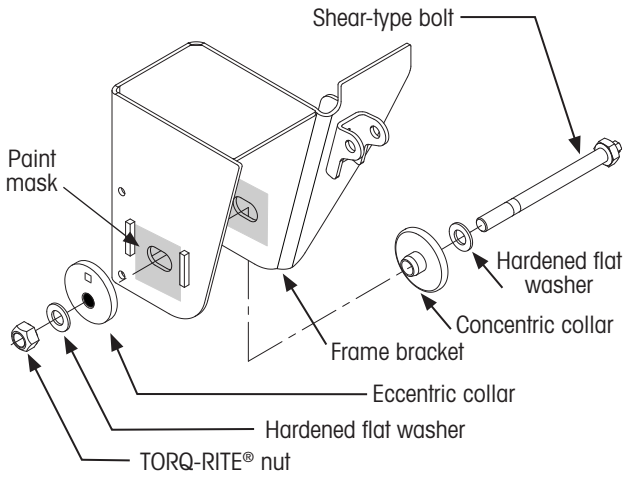


Figure 10: *QUIK-ALIGN® pivot Connection Hardware*

Figure 10 shows is an exploded view of QUIK-ALIGN® hardware used for the pivot connection. In this case, the bushing and wear pads are not shown.

NOTE: If adding surface coat to the frame bracket prior to assembly (Figure 10), areas where alignment collars and bushing inner metal contact the frame bracket must be masked.

If damage is assessed during inspection of any pivot connection components, determine cause and replace as soon as possible.

IMPORTANT: Failure to follow PIVOT CONNECTION HARDWARE inspection procedures will void warranty coverage. If necessary, refer to Hendrickson publication L427, *Bushing Replacement Procedures*, for pivot connection disassembly instructions. With the suspension beam assembly lowered, Hendrickson recommends inspecting the pivot bushings, bushing tube spacers, bushing tube and interior surfaces of the frame bracket. Refer to Hendrickson publication L750 *Bushing Tube Spacer Inspection/Replacement Procedure* for more inspection instructions.

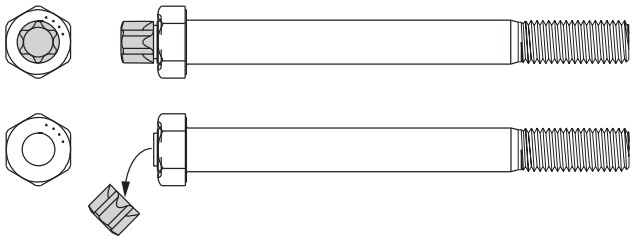


Figure 11: *QUIK-ALIGN hex-head shear-type pivot connection bolts*

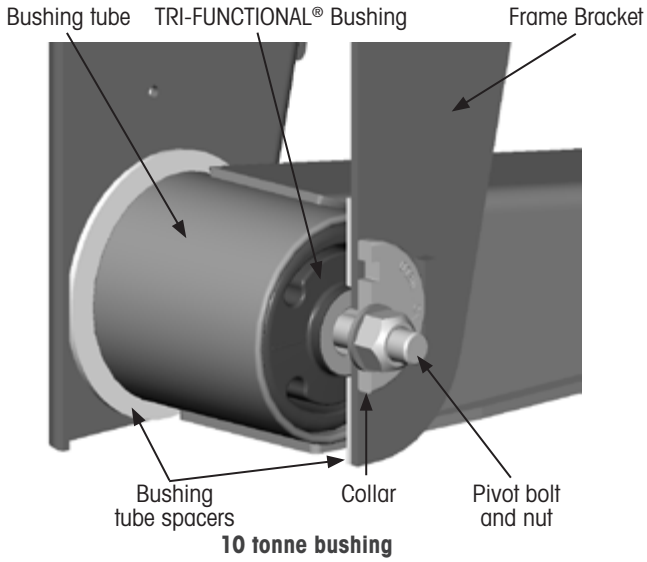


Figure 12: *Typical pivot connection inspection points*

Inspect to ensure the pivot connection hardware (Figure 10 and Figure 12) is properly assembled.

A properly installed pivot connection is crucial to the life of the suspension. The pivot fastener must continually provide a sufficient clamp load through the bushing to prevent premature suspension failure.

See T15001 *Trailer Air Suspension Systems Concepts and Functions* for bushing and pivot connections functionality.

⚠CAUTION: DO NOT APPLY anti-sieze compound or additional lubricant to pivot connection hardware. A dry lubricant coating has been applied to the threads of pivot connection bolt and nut. Do not allow undercoating, paint, surface coatings, or any other commonly used compounds to contact the threads of the pivot connection fasteners. These compounds can act like a lubricant, reducing the friction between the threads of the nut and bolt. This can lead to overtightened fasteners, unpredictable pivot connection clamp loads and unreliable axle alignments. Threads should be clean, dry and free of contamination, as supplied by Hendrickson.

Bushing Tube Spacers

Bushing tube spacers (Figure 12) are made of self-lubricating UHMW polyethylene. Periodic inspections are an important part of your air suspension maintenance routine. Of particular importance are the bushing tube spacers, which are located inside the frame brackets on each side of the PIVOT CONNECTION.

A typical inspection should include an evaluation of all bushing tube spacers on the trailer. Visually verify that the bushing tube spacers are:

- Intact
- Not missing, cut or worn-through

Due to the pivoting motion inherent with this connection, some bushing tube spacer wear is expected. Bushing tube spacer "cupping", where the bushing tube spacer forms around the bushing tube and resembles a shallow dish, is also normal. If you see these conditions, then no further inspection is required at this time. Your bushing tube spacers are in serviceable condition.

Bushing tube spacer wear is expected and normal, however "wear through", where the bushing 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.

TRI-FUNCTIONAL® Bushing

Hendrickson's TRI-FUNCTIONAL® bushing (Figure 12) has unique properties that will provide years of maintenance-free service. The TRI-FUNCTIONAL® bushing (located at the suspension pivot connection) provides a resilient connection that allows an axle to articulate without excessive flexing. The TRI-FUNCTIONAL® bushing, in conjunction with the rigid axle connection, results in a roll-stable suspension design that resists trailer lean independent of the air spring loading.

Periodic inspections are an important part of your air suspension maintenance routine. Of particular importance is the pivot bushing, which is housed within the suspension beam assembly bushing tube. All such inspections should include an evaluation of all pivot bushings on the trailer.

Measuring Bushing Placement

Hendrickson does not recommend disassembling the pivot connection for initial inspection of the pivot bushing. The recommended procedure is to make a measurement as follows.

NOTE: Trailer must be unloaded to perform measurement in Figure 13.

On an unloaded trailer, measure from the bottom of the suspension beam assembly to the bottom of the frame bracket as shown in Figure 13.

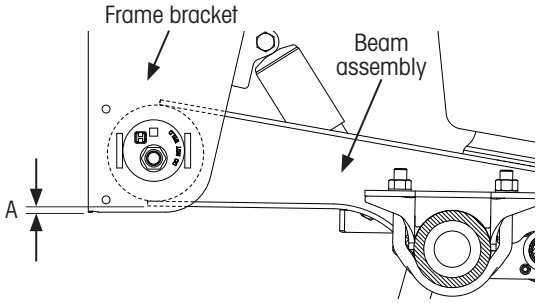


Figure 13: *Bushing position measurement (sample suspension, not HSDS™)*

A. If the measured dimension (A) is less than or equal to 19 mm (¾ of an inch), the pivot bushing is OK.

B. If the measured dimension (A) is greater than 19 mm (¾ of an inch), the pivot connection must be disassembled and the suspension

beam assembly lowered to more closely inspect the bushing.

NOTE: There are times when a problem, seemingly in the area of the suspension, is diagnosed as a failed bushing. Closer inspection typically reveals another component or a faulty installation is the problem. If a failed bushing is present, refer to PIVOT CONNECTION on page 9.

Bushing Inspection

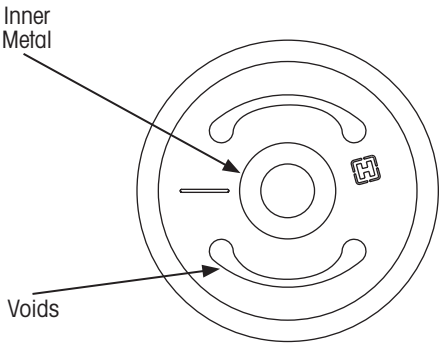
Pivot bushings (Figure 14) will typically "settle" in the vertical direction upon suspension installation. It is normal for the voids to have this "settled" appearance (Figure 14 B) due to cargo and the weight of the trailer loading the bushing.

However, cracks in the rubber extending between the void and the bushing's inner metal (Figure 14 C and D) are indications that the bushing needs to be replaced. If conditions similar to C and D are found, replace the bushing.

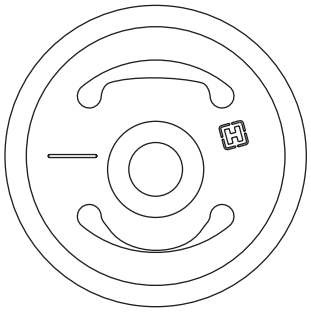
For warranty consideration, a digital photograph of the bushing in the bushing tube is required. Take the photograph before removing the bushing from the bushing tube. Also refer to PIVOT HARDWARE on page 10 and BUSHING TUBE SPACERS on page 11.

NOTE: The practice of using a long pry bar to determine if the bushing is defective is not recommended, because a normal (non-defective) bushing will move and provide a false indication of the bushing's condition if enough force is exerted with the pry bar.

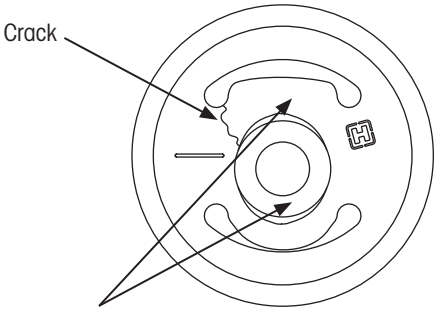
Re-bushing of a suspension requires the use of a bushing removal/installation tool (T82001 Pivot Bushing Tool Information) and a bushing kit. The kit will include required components for re-bushing. If replacing, both bushings should be replaced.



A. Newly installed bushing

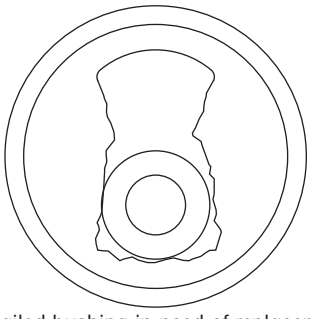


B. Normal appearance of an in-service bushing



Rubber completely separated from inner metal will eventually go through to other side.

C. Failing bushing



D. Failed bushing in need of replacement

Figure 14: *Bushing inspection*

BUSHING TUBE

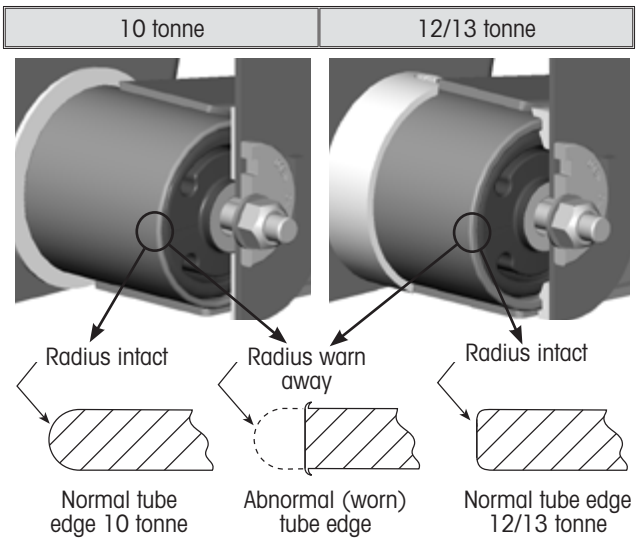


Figure 15: *Bushing tube edge inspection*

The bushing tube (Figure 15) is welded at the pivot end of the suspension beam. Periodic inspection should include a visual of the outer edges to ensure roundness as shown in Figure 15.

NOTE: Depending on depth of damage, warn edges of the bushing tube edges can be repaired. If the edge is warn, damage to bushing tube spacers and frame bracket should be visible.

QUIK-ALIGN® COLLAR

QUIK-ALIGN® component (Figure 10) inspection should occur annually, as stated in L578, and at every brake lining change. After alignment, the collar DOES NOT require welding because contact surfaces of the washer are designed to bite into the surface of the frame bracket during clamping of the pivot bolt. Inspection should include checking for physical damage and any indication of dislocation.

SHOCK ABSORBER

Shock absorbers absorb energy to prevent suspension oscillation. Shock absorbers are also used as rebound stops in all Hendrickson air suspensions and limit air spring extension, which prevents the air spring from being over extended and pulled apart. Use only Hendrickson shock absorbers for replacements. Hendrickson shock absorbers are designed to support the suspension beams and axle while trailer is lifted without air in air springs.

⚠CAUTION: Do not lift the 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.

In some severe service applications (Figure 1 on page 4), Auxiliary Rebound Limiter (ARL) shock straps or chain down stops are added to additionally aid in limiting the stroke of the axle during rebound. ARLs prevent air springs from over extending and support the suspension while a trailer is lifted.

To inspect shock absorbers:

- Check for signs of leaking.
- Check for damage to components.
- Ensure shock strap constraints, if installed, are not warn, damaged or broken.

NOTE: Misting is normal and a necessary function of the shock absorber. More details on inspection and service of shock absorbers can be found in L551 *Shock Absorber Inspection Procedure*.

To replace a shock absorber:

1. Remove the end fasteners.
2. Remove old shock absorber.
3. Insert the new shock absorber.
4. Secure with correct size locknut and bolts.
5. Torque fasteners to specification.

IMPORTANT: Hendrickson trailer air suspension design requires the use of specific air springs and shock absorbers. Only components purchased from Hendrickson or a Hendrickson-approved distributor can be used. Replacement with other components may cause premature failures and void the warranty.

SHOCK MOUNTING BRACKETS AND BOLTS

Each shock is mounted to the suspension by an upper (Figure 1) and lower (Figure 2 on page 4) connection. Shock absorber connections are assembled according to specifications.

Check to ensure:

- Mounting brackets are securely fastened.
- No excessive movement exists at upper and lower mounting bolts.

DOWN STOPS

Inspecting Down Stops:

- **Check** for damage to components.
- **Check** for twisting of stop.

To replace a down stop:

1. **Remove** the fasteners.
2. **Remove** the down stop.
3. **Insert** the new down stop. There should be no twists in the new stop. Chains used on ARL axles cannot be twisted.
4. **Secure** with correct size fasteners.
5. **Torque** fasteners to specification listed in Appendix A on page 25.

TRAILER LEVEL

A quick look can verify if a level trailer level. This inspection will help you find any obvious problems. A closer inspection can detect broken or loose parts before any serious problems appear.

If trailer lean is suspected, troubleshoot problem. If necessary, record height dimensions specified in T12003 *Trailer Lean Measurement Form* and submit to Hendrickson Technical Services for evaluation. Please refer to CONTACT HENDRICKSON on page 5 to request a copy of this form.

AXLE

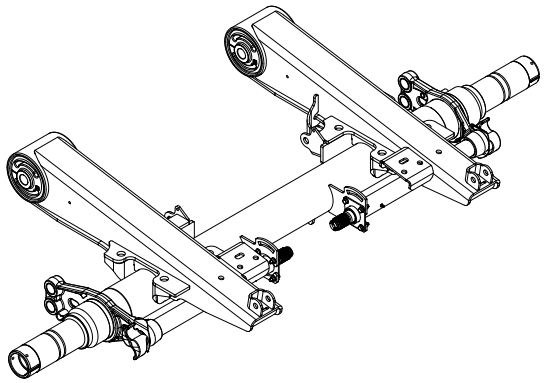


Figure 16: *HSDS™ 12/13T axle/beam weldment*

Axles for HSDS™ suspensions are attached during the suspension build by Hendrickson. Should any component of the axle/beam weldment fail or be damaged, the complete axle/beam weldment must be replaced. Welding to the axle is not allowed without prior approval by Hendrickson.

BRAKES

Brakes are standard equipment on Hendrickson trailer suspension systems and axles. Two styles of brakes are available on Hendrickson axles: DRUM BRAKES and AIR DISC BRAKES (ADB). **All brake components must be functioning properly to ensure safe braking.** For more complete information on brake systems, refer Table 4 to Table 6.

LIT #	DESCRIPTION
D-32593	*HSDS Brake Components*
L578	*Air Ride Suspension Preventive Maintenance Guide*
L974	*Drum Brake Maintenance Procedures*
L1009	*S-cam & Air Chamber Bracket Repair Procedure*
L1094	*Weld-on ABS Bracket Field Installation Procedure*
L1104	*Brake Kits and Components Parts List*
T71003	*Weld Mount Cam Tube Kit Installation*

Table 4: *Hendrickson brake related literature*

VENDOR	HYPERLINK
Bendix	www.Hendrickson-intl.com/Trailer/Bendix
Haldex	www.Hendrickson-intl.com/Trailer/Haldex
Wabco	www.Hendrickson-intl.com/Trailer/Wabco

Table 5: *Vendor brake related literature*

TMC RP	DESCRIPTION
RP 604	*Brake Chambers for Air-Braked Vehicles*
RP 607	*Service and Inspection of S-cam Brake Systems*
RP 608	*Brake Drums and Rotors*
RP 612	*Pneumatic Brake Balance*
RP 617	*Contaminant Elimination Procedure for Tractor, Trailer or Dolly Air Brake Systems*
RP 627	*Brake Lining Structural Defects*
RP 629	*Brake Lining Contamination*
RP 635	*Long Stroke Brake Chambers*
RP 652	*Service and Inspection of Air Disc Brakes*
RP 1503	*Brake Maintenance Guidelines for Severe Vocational Applications*

Table 6: *TMC brake related literature*

INSPECTION AND LUBRICATION

Regular checks (L578) of the brake system are required to ensure proper operation and performance of all components of the brake system. Refer to the discussion for each component for maintenance information.

IMPORTANT: Evidence of failures of any brake components requires immediate attention by a qualified mechanic.

DRUM BRAKES

Drum brakes (Figure 19 and D-32593) are standard on Hendrickson axles. The size of brake shoe and drum are dependant on braking needs for the trailer design, but maintenance procedures are similar. Information on drum brake and drum brake component service can be found in L974 *Drum Brake Maintenance Procedures*.

BRAKE SHOES

Because brake shoes may not be clearly visible for drum brake systems, ensure regular inspection and service intervals are scheduled as specified in L578.

BRAKE CHAMBER

Refer to vendor documentation (Table 5 on page 15) and TMC RPs (Table 6) for brake chamber recommended practices.

In general, check to ensure:

- Hoses and fittings are not leaking or damaged. Refer to AIR LINE HOSES, TUBING, FITTINGS, VALVES, ETC.
- Pushrod and other linkages are not bent or damaged.
- Brake chamber is functioning properly.

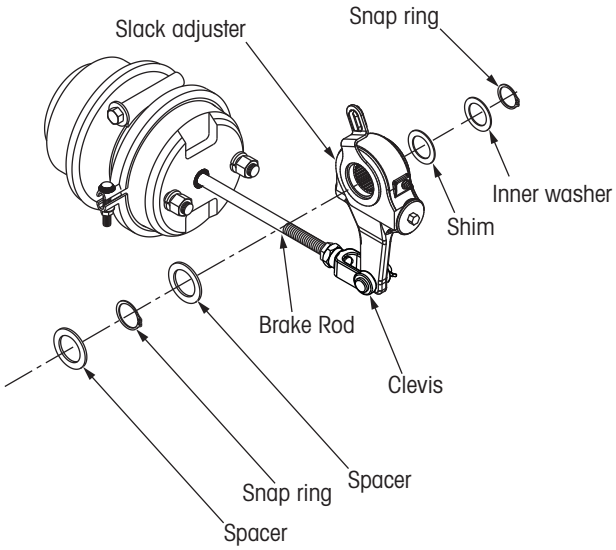


Figure 17: *Brake chamber mounting hardware*

S-CAM AND CAM TUBE

Along with checking for worn parts, S-cam bearings and cam tube are the only Hendrickson components

requiring lubrication. _(S-cam), Figure 18 and Figure 19. (S-cam with cam tube) show samples of lubrication points for each.

Replacing S-cam and/or Cam Tube
Refer to Table 4 for applicable literature provide with S-cam and cam tube kits.

SLACK ADJUSTER
The slack adjuster, also known as a brake adjuster, is used for drum braking systems (Figure 2 on page 4 and Figure 19) to provide a lever for the brake chamber to rotate the S-cam during braking. Manual or self-adjusting slack adjusters, also known as Automatic Brake Adjusters (ABA), take up slack in the link between the brake chamber push-rod and S-cam rotation. Because of the mechanical connection and motion within they need periodic inspection and lubrication.

For information on these vendor supplied products, refer to vendor documentation referenced in Table 5 or TMC Recommended Practices RP 609 *Manual and Automatic Brake adjuster Removal, Installation, and Maintenance.*

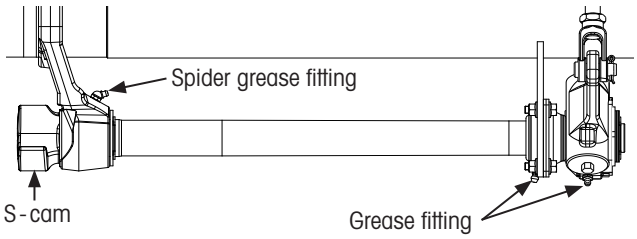
To inspect this component:

- Check for physical damage.
- Ensure moving parts are not corroded or frozen in position.
- Ensure ample grease is applied according to manufacturer's specifications or TMC RP 609.

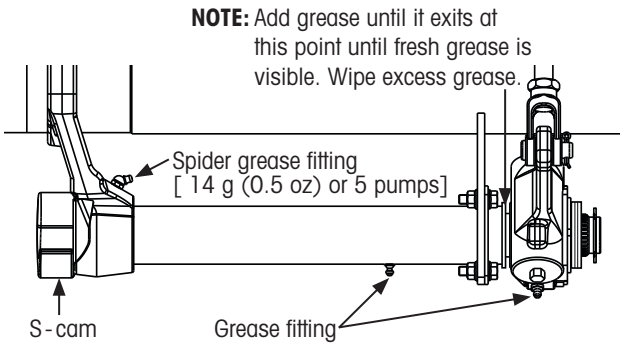
AIR DISC BRAKES (ADB)

Determining pad wear on most air disc brake systems is done by observing the position of indicators built into the caliper/carrier assemblies. Refer to Hendrickson and vendor literature listed in Table 5.

BRAKE PADS
Brake pad service and replacement procedures are dependant on the ADB system installed on the axle. Refer to the ADB vendor (Table 5) for details.



S-cam bearing mount assembly (no cam tube)



Cam tube weld mount assembly (top view)

Figure 18: *S-cam lubrication points*

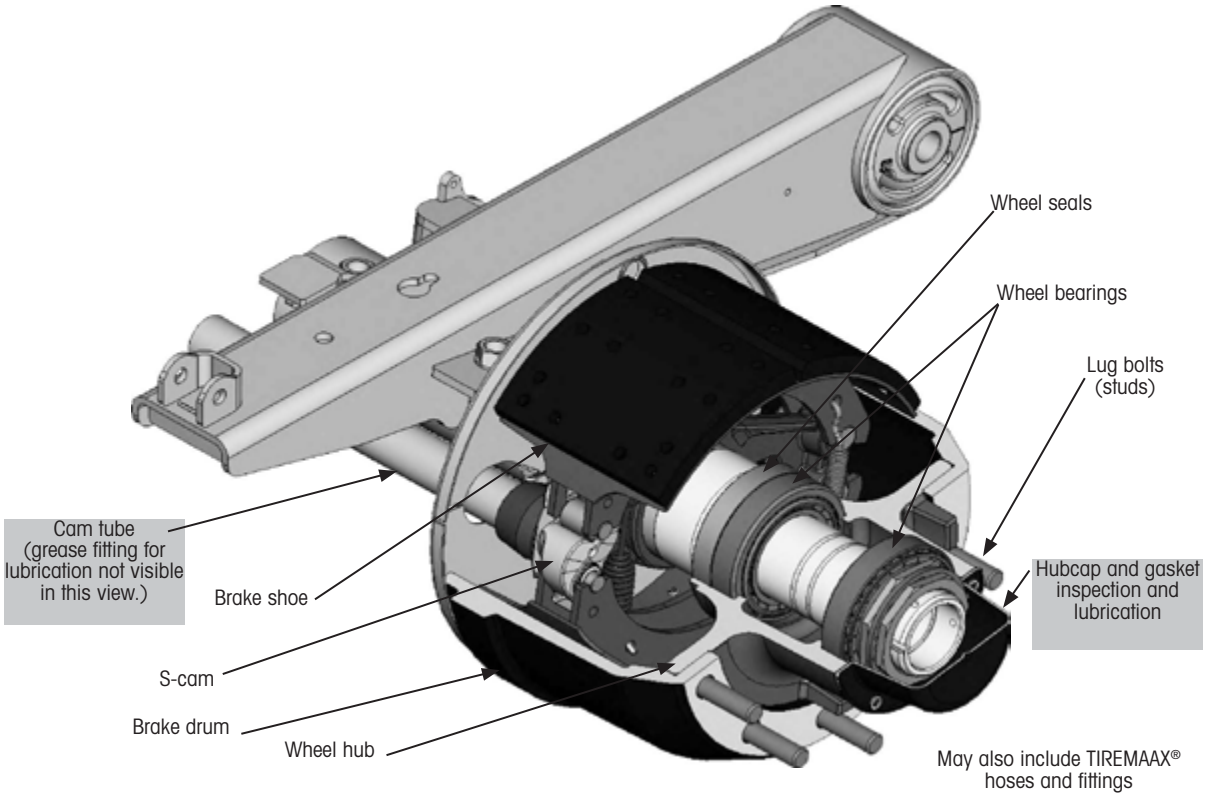


Figure 19: *Hendrickson wheel-end inspection points*

WHEEL END

Multiple styles of wheel ends are available with HSDS™ axles. TIREMAAX® TIS is optional for all wheel ends.

HUB TYPES

The following hub types may apply (refer to Table 10 on page 19).

Conventional

Standard hub, seal, lubricant and bearings are assembled. This non-precision wheel end has a standard warranty.

Hendrickson Extended-Life

These precision, factory assembled, installed and lubricated hub assemblies are designed for 3, 5 or 7-year limited warranty. All components are field serviceable, however, CONTACT HENDRICKSON before disturbing spindle nut or attempting repairs. To maintain warranty, all repairs must use genuine Hendrickson parts.

IMPORTANT: Disturbing the spindle nut without first contacting Hendrickson and following inspection procedures in the relative wheel-end maintenance manuals can void warranty.

INSPECTION

Wheel-end component inspection must be performed as stated in L578. Inspection and maintenance procedures are summarized in this document. For more complete wheel-end inspection and troubleshooting practices, refer Table 7 or TMC recommended practices listed in Table 8.

LIT #	DESCRIPTION
L496	*Standard Wheel-End Maintenance Procedures*
L579	*Trailer Suspensions Systems Alignment Procedure*
T72002	*HXL7® Wheel End Maintenance Procedures*
T72006	*HXL3™ Wheel End Maintenance Procedures*
T72007	*HXL5® Wheel End Maintenance Procedures*

Table 7: *Hendrickson relative wheel-end literature*

TMC RP	DESCRIPTION
RP 622A	*Wheel Seal and Bearing Removal, Installation, and Maintenance*
RP 644	*Wheel End Conditions Analysis Guide*

Table 8: *TMC recommended wheel-end inspection*

During inspection, check for unwanted dirt and debris caught inside drum, behind wheels and around any moving parts.

NOTE: Hendrickson only supports Hendrickson dressed wheel end components.

CONTAMINATION

Contamination occurs when foreign particles and fluids are allowed to enter and mix with the lubricant. If contamination is able to enter the lubrication cavity, lubricant can also escape. The result is:

- Degraded performance of the lubricant
- Corroded and/or damaged bearing surfaces
- Increased end-play
- Rough and/or noisy wheel rotation
- Dry, non-lubricated bearing surfaces

NOTICE: Pressure or steam washing should be avoided in around wheel ends as water and cleaning chemicals could be forced past seals, degrade lubricant performance and corrode bearing surfaces. Wiping area clean is the preferred method.

Grease Contamination

Hendrickson dressed hubs are typically factory assembled, lubricated and pre-torqued to Hendrickson specifications. Any non-approved hub disassembly risks warranty violations. The most likely evidence of contamination is LUBRICANT LEAKS.

HUBCAP INTEGRITY

As an important wheel-end component, hubcaps protect the end of the spindle by preventing contaminants from entering bearings and they contain lubricant. The hubcap assembly consists of:

- Hubcap
- Hubcap gasket or O-ring
- Fasteners (except for screw-on type)

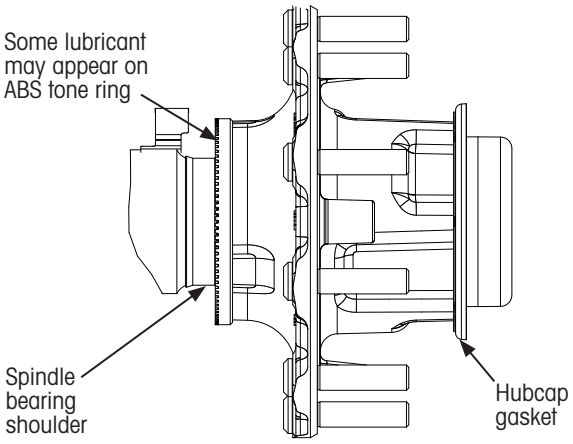
IMPORTANT: For extended-life wheel-end systems, unauthorized hubcap removal can discontinue warranty coverage.

Inspection includes:

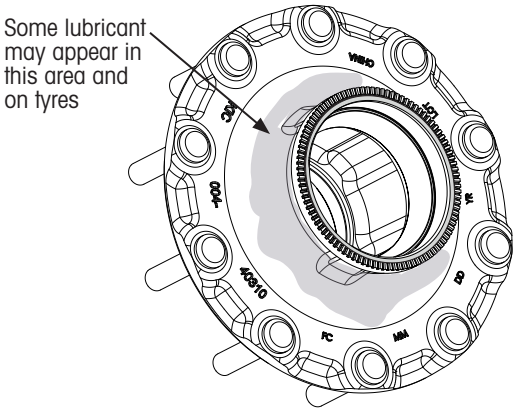
- Signs of leaking lubricant.
- Dents, cracks, broken tabs or other physical damage.
- Loose or missing fasteners.

TMC RP 644 (Table 8 on page 17) offers more complete inspection criteria for hubcaps and wheel-end components.

LUBRICANT LEAKS



A. Side view



B. Back side of hub (shaded area)

Figure 20: *Evidence of lubricant leakage*

Hubs are lubricated with grease. They are not interchangeable with hubs lubricated with oil.

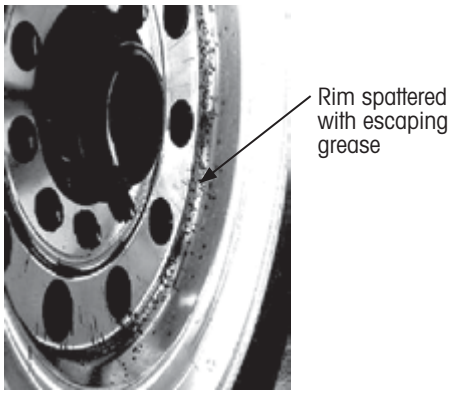


Figure 21: *Wicking hubcap gasket example*

Leaking Grease
During assembly, grease is injected between inner and outer bearing. After assembly excess grease can exist in the area of the seal and spindle bearing shoulder (Figure 20 A). **This is a normal occurrence and does not indicate a seal leak.** It offers some surface protection during suspension storage prior to installation and should be wiped clean during service.

At any time, if a small amount exists, wipe clean and schedule a follow-up inspection to confirm no leak.

Grease flows throughout the wheel-end between the hubcap and seal. Evidence of leaking include:

- Streaks of grease on inner seal and inside surface of tyre (Figure 20 B).
- Streaks of grease on outer rim and outside surface of tyre (Figure 21). Most likely grease leaking past hubcap gasket.

Grease is semi-solid (Table 10 on page 19).
During trailer motion, grease migrates throughout bearing rollers and surfaces to be distributed. Worn or damaged components (seal, bearing surfaces, gasket, etc.) can allow grease to pass. If a significant amount of grease exists outside the seal (Figure 20 B) and on tyres, the seal should be replaced. Refer to Table 4 on page 15 for relative service literature.

HUB LUBRICATION
This section discusses lubrication of Hendrickson wheel ends. For information on vendor products refer to vendor documentation and TMC Recommended Practices (Table 9).

TMC RP	DESCRIPTION
RP 624	*Lubricant Fundamentals.*
RP 631	*Recommendations for Wheel End Lubrication*
RP 644	*Wheel End Conditions Analysis Guide, Section F — Lubrication issues.*

Table 9: *TMC recommended lubrication practices*

Table 10, includes a list of lubricants applied during factory assembly of Hendrickson wheel ends. In most cases, this lubrication should last throughout the life of the trailer and/or suspension.

IMPORTANT: CONTACT HENDRICKSON before disassembly of a Hendrickson dressed wheel end. Not doing so will violate warranty coverage.

Table 10 includes lubricants applied to Hendrickson dressed wheel ends during assembly.

HENDRICKSON DRESSED WHEEL END TYPE	LUBRICANT [1]				
	Synthetic Gear Lube 75W - 90W	SAE 80 OR 90W gear oil	Semi-fluid grease		NLGI (SHC 220)
			Chevron Delo SF	Mobilith SHC007	
Conventional Hub	✔	✔	✔	✔	✔
ConMet PreSet™	✔		✔	✔	
HXL3™	✔	✔			
HXL5™			✔		
HXL7®			✔		

[1] If more than one is checked, see trailer OEM manual for type used or CONTACT HENDRICKSON.

Table 10: *Wheel-end lubricant types*

Table 11 and Table 12 list hub lubrication capacities based on various combinations of brake, hub, spindle and lubrication type.

SPINDLE	HUB TYPE	LUBRICANT CAPACITY (LITERS/KILOGRAMS)		
		SF Grease	NLGI #2	Oil
HN	ConMet Preset	0.52/0.45	—	0.35/0.30
	KIC 11.25" Lt. Wt	0.59/0.51	0.59/0.54	0.41/0.36
HP	ConMet Preset	1.23/1.60	—	0.80/0.70
	KIC 11.25" Lt. Wt	1.33/1.15	0.81/0.74	1.01/0.88
	KIC 335MM13t	0.88/0.76	0.81/.074	0.71/0.62
	KIC 335 MM10t	0.99/0.86	0.89/0.81	0.75/0.65

Table 11: *Hub lubricant capacity - Drum brake*

SPINDLE	HUB TYPE		LUBRICANT CAPACITY (LITERS/KILOGRAMS)	
			SF Grease	Oil
HN	ConMet Aluminum		0.52/1.18	0.35/0.30
HP	ConMet	Aluminum	1.23/2.60	0.80/0.70
		Ductile iron	1.61/ 3.4	0.95/0.831

Table 12: *Hub lubricant capacity - Disc brake*

Applying No.2 Grease
When using No. 2 grease, apply as shown in Figure 22 and HSDS™ drawing D-32594.

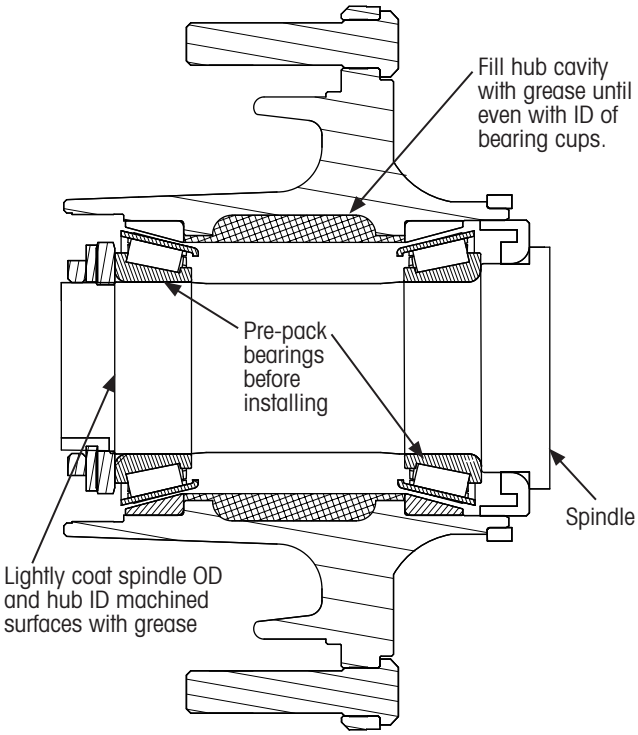


Figure 22: *No.2 grease packing (Hub cross sectional view)*

For more details, refer to:

- Hendrickson wheel-end literature listed in Table 7.
- Trailer OEM specifications.
- TABLE 9: TMC RECOMMENDED LUBRICATION PRACTICES on page 19

SMOOTH WHEEL BEARING ROTATION

There are many factors that can effect smoothness of rotation. Primary causes include:

- Bearing surface conditions
- Damaged hub seal
- Moisture
- Unwanted debris

NOTE: A reasonable assessment can be performed without removing tyres and rims. However, this procedure is best performed with wheels removed.

1. While maintaining physical contact, **slowly rotate wheel-end hub** in both directions at least five revolutions.
2. During rotation, ensure smooth and quiet rotation. The bearings should move smoothly. **Feel for any resistance in movement**. Any debris in bearings should be felt or heard.

IMPORTANT: If bearings feel rough, sound noisy or do not rotate freely, do not place the suspension back in service. CONTACT HENDRICKSON Technical Services for guidance.

WHEEL BEARING ADJUSTMENT
Details for performing this procedure can be found in Hendrickson wheel-end literature listed in Table 7.

IMPORTANT: Most Hendrickson dressed axles include low maintenance hub assemblies. Wheel bearing adjustment should only be necessary if:

- Replacing a leaking seal.
- Evidence of failed bearings during SMOOTH WHEEL BEARING ROTATION on page 20.
- Instructed to do so by Hendrickson.

WHEEL SEAL
The wheel seal contains lubricant at the inner end of the hub. Refer to CONTAMINATION and LUBRICANT LEAKS on page 18 for inspection details.

NOTE: Hendrickson Extended-life wheel ends include specific seals that must be replaced with Hendrickson approved seals.

OPTIONS

Refer to the SUSPENSION IDENTIFICATION (ID) to identify applicable options for the suspension. This might include:

- TIREMAAX® TIS
- UNDER BEAM LIFT™

TIREMAAX® TIS

The function of a TIREMAAX® Tyre Inflation System (TIS) is to ensure constant and steady tyre pressure. For more details on this system, including troubleshooting and maintenance, refer to T51002.

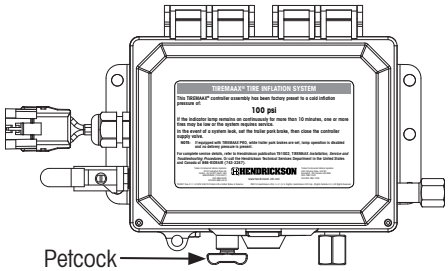
INSPECTION
To inspect the TIREMAAX® system, refer to the section on inspecting AIR LINE HOSES, TUBING, FITTINGS, VALVES, ETC. on page 8. The system includes check valves which isolate damaged tyres in case of blowout or punctures. Refer to T51002 *TIREMAAX CP & PRO Installation Manual* for troubleshooting and

instructions on how to temporarily disable the system, if needed.

⚠CAUTION: Before moving about and under trailer for inspection, safely immobilize trailer according to PREPARATION FOR SERVICE on page 7.

INDICATOR LAMP TEST

If the indicator lamp appears to be not working, fully open petcock on the controller (Figure 23). The air flow will cause the indicator lamp to illuminate. If not, check WIRES on page 8 and/or replace indicator lamp.



NOTE: The controller is attached to the trailer frame in the area of the suspension. For CP, the petcock is located at the supply line output.

Figure 23: *TIREMAAX® PRO controller*

TYRES AND TYRE PRESSURES

Tyres are a very important component affecting trailer ride and performance. For tyre related inspection and selection recommended practices, refer to Table 13.

TMC RP	DESCRIPTION
RP 214	*Tire/Wheel End Balance and Runout*
RP 216	*Radial Tire Conditions Analysis Guide*
RP 218	*DOT Tire Identification Codes*
RP 219	*Radial Tire Wear Conditions and Causes (A Guide to Wear Pattern Analysis)*
RP 220	*Tire Tread Design Selection*
RP 223	*Tire Selection Process*
RP 232	*Zipper Rupture Inspection Procedures*
RP 235	*Guidelines for Tire Inflation Pressure Maintenance*
RP 1402	*Tire Selection for Commercial Light Trucks*

Table 13: *TMC recommended tyre inspection*

TYRE HOSES AT WHEEL

Figure 24: *Sample tyre hose **improper** installation*

Figure 24 shows a tyre hose improperly installed on a wide based wheel. Tyre hoses must be installed in a manner which minimizes the possibility of catching on objects during trailer motion, yet does not stretch or otherwise strain the hose. For information on wheel clocking, refer to T51002 *TIREMAAX CP & PRO Installation Manual*.

UNDER BEAM LIFT™

Some suspensions include an UNDER BEAM LIFT™ (UBL™) kit. This kit includes bolt-on hardware for the purpose of making an HSDS™ suspension liftable. For part information and installation instructions, CONTACT HENDRICKSON for the applicable installation drawing.

RIDE HEIGHT

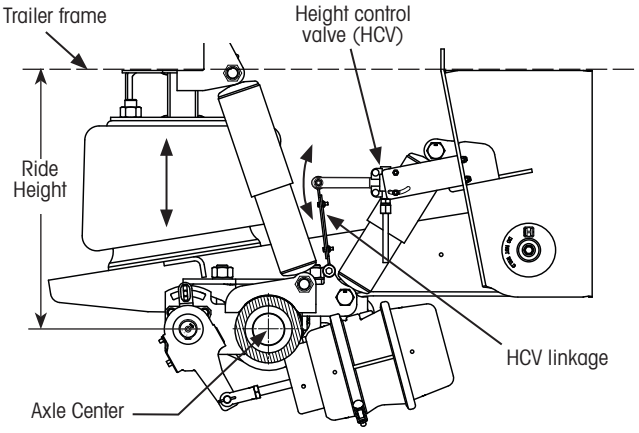


Figure 25: *Ride Height & Height Control Valve (HCV)*

Ride Height (RH) is defined as the distance from the frame bracket mounting to the trailer frame to the center of the axle (Figure 25). It is controlled by the Height Control Valve (HCV) and, once set, should not be modified. Air spring, shock and frame brackets sizes are selected and assembled to the suspension beam based on the desired ride height.

CHECKING RIDE HEIGHT

The following procedure is for checking and if necessary adjusting your Hendrickson trailer suspension ride height. The suspension's designed ride height helps optimize suspension performance and helps maintain load equalization among the axles.

Operating an air suspension outside its specified ride height can reduce ride quality, damage cargo and increase suspension wear. To take full advantage of the benefits an air-ride suspension has to offer, each suspension on the trailer must be operated at its designed ride height.

BEFORE YOU BEGIN

Gather the information listed in the below table.

VALUE	SOURCE
Kingpin height	Trailer OE
Suspension designed RH	SUSPENSION IDENTIFICATION (ID) on page 6
Allowable RH range	APPENDIX B: RIDE HEIGHT SETTINGS on page 27

Table 14: *Information to measure ride height*

PREPARATION

To ensure safety and a consistent measurement prepare the trailer as follows:

1. Place the trailer on a flat, level, debris-free surface.

Figure 26: *Chock trailer wheel*

2. Chock the trailer wheels (Figure 26) and release the trailer parking brakes.

Figure 27: *Checking tyre pressure*

3. Check the air pressure in the trailer tyres (Figure 27).

   The tyres must be at the manufacturer's recommended pressure when checking trailer ride height. If necessary, inflate or deflate the tyres to match this recommended pressure.

4. Maintain air pressure in the trailer air suspension system.

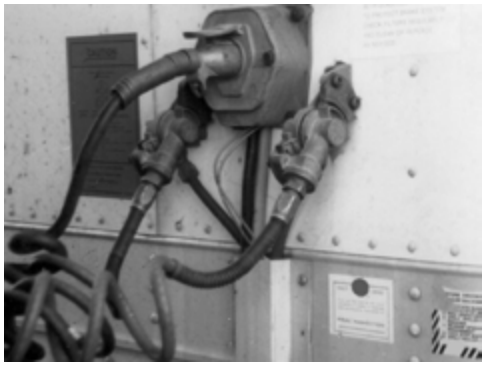


Figure 28: *Trailer connections*

NOTE: Trailer ride height can be checked with the trailer coupled to or uncoupled from the tractor. If the trailer is uncoupled from the tractor, maintain pressure in the trailer air suspension system by applying shop air to the trailer emergency glad hand (Figure 28). This ensures that the trailer parking brakes remain released.

VERIFYING DESIGNED KINGPIN HEIGHT

Figure 29: *Measuring kingpin height from ground*

1. Determine what the designed kingpin height should be. Check the trailer ID tag on the trailer front bulkhead or contact the trailer manufacturer for the designed kingpin height.
2. Measure the trailer kingpin height. The trailer can be coupled to or uncoupled from the tractor for the kingpin measurement.

NOTE: If the measurement is being made with the trailer coupled to the tractor, the fifth wheel height of the tractor must be the same as the designed kingpin height of the trailer. If the tractor fifth wheel height is not the same as the trailer kingpin height, then uncouple the trailer from the tractor and make the measurement uncoupled.

With the trailer uncoupled from the tractor, measure from the ground to the kingpin mounting plate (Figure 29).

3. If necessary, adjust the landing legs to place the trailer at the designed kingpin height.
4. Verify the kingpin height by measuring from the ground to the kingpin mounting plate on both sides of the kingpin.

MEASURING RIDE HEIGHT

A suspension's designed ride height is defined as the distance from the suspension mounting surface (the bottom of the trailer or slider box) to the center of the axle (Figure 25).

Suspension ride height should always be measured at the axle with the height control valve (Figure 30).

Figure 30: *Measuring ride height with tape measure*

1. Using a tape measure:
   A. Measure the distance from the top of the axle to the mounting surface of the suspension (Figure 30).
   B. Add half of the axle diameter to this measurement to determine your suspension's ride height.

   For example:

   i. On 127 mm (5 inch) axles — add 64 mm (2½ inches) to the measured distance.

   ii. 127 mm (5 inch) axle circumference is approximately 400 mm (15¾ inches).

COMPARING MEASURED RIDE HEIGHT TO DESIGNED RIDE HEIGHT

Now that the measured ride height has been established, it can be compared with the designed ride height, which can be found on the SUSPENSION IDENTIFICATION (ID) tag described on page 6 and Figure 5 on page 7.

Read the designed ride height from the model line or the description line of the ID tag. If you cannot determine the ride height from the information on the identification tag, measure as shown in Figure 25 and Figure 30 or CONTACT HENDRICKSON technical services.

NOTE: The tag displays nominal designed ride hight. The OE may have made adjustments within limits listed in Table 17 on page 27.

ADJUSTING SUSPENSION RIDE HEIGHT

For optimal suspension performance, the measured ride height must equal the designed ride height or be within the allowed ride height range listed in APPENDIX B: RIDE HEIGHT SETTINGS on page 27. To ensure optimal performance and avoid damage to suspension components, a ride height that measures outside the allowed range must be adjusted to be within the specified range. For all HSDS™ suspensions, the HCV linkage is the same length.

Adjustments are made using the adjustment slot shown in Figure 31. To adjust the suspension ride height:

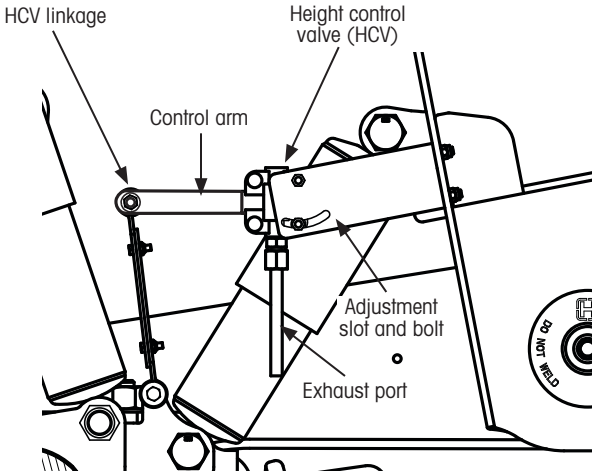


Figure 31: *Height Control Valve components*

1. Follow previous procedures to:
   A. Ensure trailer is safe and on level surface.
   B. Set kingpin to proper height at front of trailer.
   C. Obtain designed ride height value.

   NOTE: Refer to Appendix B for specifications on allowed ride heights.

2. Loosen HCV pivot and adjustment slot bolts to enable adjustment (Figure 31).

3. Pivot HCV body toward the air spring to raise the ride height (add air to the air springs) or toward the frame bracket to lower the ride height (remove air from the air springs) until the distance between the suspension mounting surface and the center of the axle equals the designed ride height.

   NOTE: There must be a minimum pressure of 5.5 bar (80 psi) in the air reservoir in order to open the brake protection valve and allow air to flow through 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.

4. With the suspension at the proper ride height, tighten the pivot and adjustment slot bolts.

APPENDIX A: TORQUE VALUES

METRIC

	COMPONENT DESCRIPTION	SIZE	N•m	FT. LBS.	SOCKET SIZE
Suspension	QUIK-ALIGN® Pivot Connection	7/8-9	746±60	550±45	7/8 inch
	U-bolts	M22x1.5	680±30	500±25	32mm
	Shock Absorber Bolts	3/4-10	300±10	225±10	3/4 inch
	Air Spring Nuts, Upper	M22x1.5	122±13	90±10	32mm
	Air Spring Bolts, Lower	M14x2	85±5	65±5	18mm
	Air Spring Plug	M12x1.5	15	10	8mm Hex
	ARL Bolts	M16x2	20±5	15±5	24mm
Brakes	Brake Chamber Bolts	M16x1.5	195±15	142.5±12.5	24mm
	Brake Chamber Jam Nut	M16x1.5	64±4	47.5±2.5	24mm
	Slack Adjuster Anchor Nut	7/16-14	56±2	45±5	7/16 inch
	S-Cam Bracket	5/16-18	36±3	26.5±2.5	5/16 inch
UBL	UBL Air Spring Bolts	M10x1.5	42.5±7.5	30±5	16mm
	UBL Air Spring Nuts	M18x2.5	67.5±7.5	50±5	27mm
	Beam Plate Assembly Bolts	M12x1.75	87.5±12.5	65±10	18mm
	Hanger Bracket-Side Ribbed Neck Bolts	1/2-13	135±7	100±5	3/4 inch
	Hanger Bracket-Front Carriage Bolts	5/8-11	270±14	200±10	15/16 inch
	Hub Cap Mounting Bolts	M8x1.25	21±3	15±3	13mm

	COMPONENT DESCRIPTION	SIZE	N•m	IN. LBS.	SOCKET SIZE
Brakes	Disc Brake Dust Shield Clamp	M12x1.25	10±1	90±10	13mm
	Drum Brake Dust Shield Clamp	M8x1.25	13±1	110±15	13mm
HCV	HCV Nuts	M6x1	8±1	70±10	10mm
	HCV Shoulder Bolts	M6x1	8±1	70±10	10mm
	UBL Self Tapping Screws	3/8-16	19±1	170±10	3/8
	[1] Torque values in these tables are for fasteners as supplied by Hendrickson Trailer Suspension Systems.				

Table 15: *Trailer Suspension Bolt Torque Values, Metric*

US CUSTOMARY

	COMPONENT DESCRIPTION	SIZE	N•m	FT. LBS.	SOCKET SIZE
Suspension	QUIK-ALIGN® Pivot Connection	7/8-9	746±61	550±45	7/8 inch
	U-bolts	7/8-9	680±30	500±25	7/8 inch
	Shock Absorber Bolts	3/4-10	300±10	225±10	3/4 inch
	Air Spring Nuts, Upper	3/4-416	122±13	90±10	3/4 inch
	Air Spring Bolt, Lower	1/2-13	85±5	65±5	1/2 inch
	Air Spring Plug	1/4-18 NPTF	15	10	1/4 inch
	ARL Bolts	M16x2	20±5	15±5	24mm
Brakes	Brake Chamber Bolts	5/8-11	195±15	142.5±12.5	5/8 inch
	Brake Chamber Jam Nut	5/8-11	64±4	47.5±2.5	5/8 inch
	Slack Adjuster Anchor Nut	7/16-14	56±2	45±5	7/16 inch
	S-Cam Bracket Bolt	5/16-18	36±3	26.5±2.5	5/16 inch
UBL	UBL Air Spring Bolts	3/8-16	42.5±7.5	30±5	3/8 inch
	UBL Air Spring Nuts	3/4-16	67.5±7.5	50±5	3/4 inch
	Beam Plate Assembly Bolts	1/2-13	87.5±12.5	65±10	1/2 inch
	Hanger Bracket-Side Ribbed Neck Bolts	1/2-13	135±7	100±5	3/4 inch
	Hanger Bracket-Front Carriage Bolts	5/8-11	270±14	200±10	15/16 inch
	Hub Cap Mounting Bolts	M8x1.25	21±3	15±3	13mm

	COMPONENT DESCRIPTION	SIZE	N•m	IN. LBS.	SOCKET SIZE
Brakes	Disc Brake Dust Shield Clamp	M12x1.25	10±1	90±10	13mm
	Drum Brake Dust Shield Clamp	M8x1.25	13±1	110±15	13mm
HCV	HCV Nuts	1/4-20	8±1	70±10	1/4 inch
	HCV Shoulder Bolts	1/4-20	8±1	70±10	1/4 inch
	UBL Self Tapping Screws	3/8-16	19±1	170±10	3/8 inch
	[1] Torque values in these tables are for fasteners as supplied by Hendrickson Trailer Suspension Systems.				

Table 16: *Trailer Suspension Bolt Torque Values, US Customary*

Unless specified in literature relative to a suspension component, torque values are the same for all Hendrickson suspension fasteners, where applicable. Torque fastener locations and other information is listed in HSDS™ drawings D-32592, D-32593 and D-32594. Table 15 lists all fastener torque values and should be referenced as needed.

IMPORTANT: Do not apply additional lubricant to fastener threads. Doing so will reduce the friction between fastener components, which can lead to overtightening, unpredictable clamp loads and unreliable fastener connections.

BOLTS

Standard machine bolts and nuts are used to assemble many components, however special torque bolts are used where applicable (see PIVOT CONNECTION on page 9. **All torqued bolts must be replaced if removed for any reason**.

Generally, **re-torquing of bolts on Hendrickson suspensions is not required**. If a bolt does not appear to be properly torqued, refer to the section in this manual for that component.

⚠CAUTION: Improper bolt torque can result in abnormal wear and/or damage to suspension components or result in separation of components.

APPENDIX B: RIDE HEIGHT SETTINGS

The below table lists the allowed ride height settings by suspension type.

RIDE HEIGHT SPECIFICATIONS (MM)		
Designed	**Minimum**	**Maximum**
HSDS™ 10T		
390	355	390
400	380	410
430	410	440
460	440	470
490	470	500
530	510	540
570	550	580
HSDS™ 12T, 13T		
390	370	390
400	380	410
430	410	440
460	440	470
490	470	500
530	510	540
570	550	580
HSDS™ 12T Bolt-on Hangers		
400	380	410
430	410	440
460	440	470
490	470	500
530	510	540
570	550	580

Table 17: *Ride Height allowed settings*

Call Hendrickson for additional information or visit ***www.hendrickson-intl.com***

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