TECHNICAL PROCEDURE

TRAILER SUSPENSION SYSTEMS

SUBJECT: System Maintenance
LIT NO: L578
DATE: December 1999

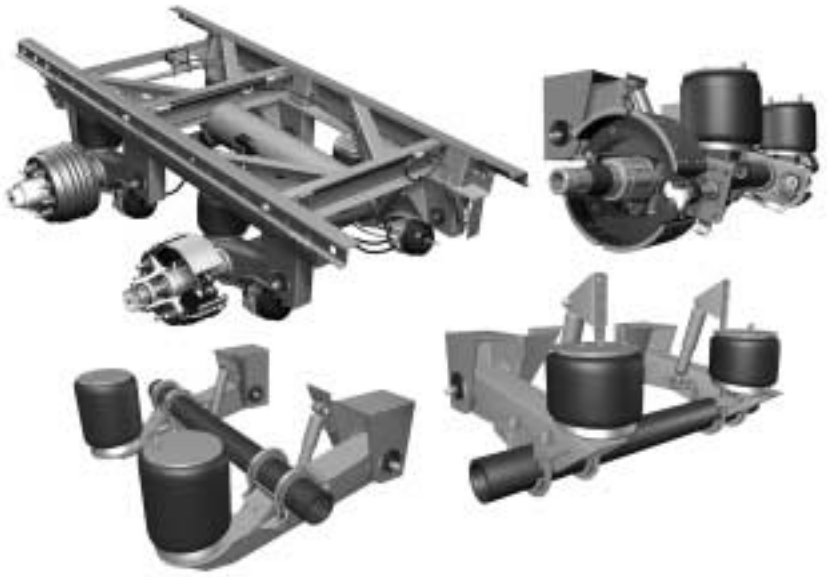


TABLE OF CONTENTS

For The Road Ahead

HENDRICKSON

INTRODUCTION

Hendrickson Trailer Suspension Systems (Hendrickson) designs its suspension systems to safely provide a long life and low-maintenance operation. The suspensions exhibit excellent ride characteristics under all legal load conditions. Your suspension was chosen to give your trailer the best ride, the correct load-carrying capability, and the required amount of roll control for your vehicle.

Hendrickson trailer air suspensions are manufactured in modern, quality-oriented facilities. Great care is taken to ensure that our customers receive the best product value for their purchasing dollar.

Hendrickson trailer air suspension systems deliver durability with a light-weight, simple, and trouble-free design. The suspensions will cushion the trailer, cargo and the driver with a quality ride not attainable without a Hendrickson air-suspension system.

Hendrickson supplies a wide variety of trailer suspension designs to meet your application needs. Each suspension system is intended for use in specific applications with maximum load capacities.

For a complete listing of Hendrickson products, contact your Hendrickson representative.

HENDRICKSON SUSPENSION FEATURES

TRI-FUNCTIONAL® BUSHING

The TRI-FUNCTIONAL BUSHING (located at the suspension pivot) controls vehicle roll- and axle-alignment, yet allows easy up-and-down travel. It also controls forces generated by braking, accelerating and irregular road surfaces. Cavities located at top and bottom absorb vertical movement. Solid rubber molded around steel center sleeve absorbs horizontal and lateral movement. The cavities elongate to absorb forces as the vehicle turns and increase roll stability. The bushing and suspension pivot are virtually maintenance free.

RIGID-AXLE CONNECTION

The trailer axle is welded directly to the suspension beam. This design has no flexible connections, which may lead to maintenance or replacement due to instability. The HT series axle connection is also U-bolted. The INTRAAX® axle connection is integrated to the suspension beams with a patented "axle wrap"; circular welded to neutral axis. The beam mounting surface is machined and is continuously welded to the axle wrap, eliminating axle seats and U-bolts. The INTRAAX rigid-axle connection provides outstanding roll stability, maintains axle alignment to beam, and contributes to a straighter axle tube and controlled toe alignment.

ROLL STABILITY

The TRI-FUNCTIONAL BUSHING and rigid-axle connection result in a roll-stable installation. The trailer floor remains level, even when offset loading occurs, while using only one height control valve per trailer.

SOFT RIDING

The air springs and TRI-FUNCTIONAL BUSHINGS support the trailer load, while absorbing road shocks. This softer ride protects the driver, cargo and vehicle; it also provides longer vehicle life and greater driver comfort.

LOAD CONTROL

The single height control valve assures an evenly distributed load across all air-ride axles when properly installed. With the exception of tire deflection, the trailer's ride height remains constant whether loaded or unloaded.

DURABILITY

Hendrickson air suspensions and their components have been thoroughly tested to provide a long life that is virtually maintenance free. The sturdy construction of the trailer air suspensions has a history of proven durability.

RIDE HEIGHT

Ride height is the measurement from the suspension mounting surface to the center of the axle. All Hendrickson air suspensions are designed to operate at a specific ride height. Care must be taken to ensure the correct loaded suspension ride height is maintained throughout the trailer's usage.

To determine the ride height of your Hendrickson trailer suspension, locate the suspension ID tag on the front of the HT frame bracket, the front crossmember of the HS slider box or on the inside of the suspension beam on an INTRAAX®. Check the indicated (bold) number in the following examples to find the designed ride height.

HT model: HT230-**14**-001
HS model: HS190T-**14**-4801A
INTRAAX model (early): AA230TBA..1 **14**A1A01...
INTRAAX description (current): B**15**U71.5...

Changes in ride height affect the air spring height, which in turn, changes the suspension's load carrying capabilities. To provide an equal loading of the axles, Hendrickson trailer suspensions are intended to be used at ride heights which maintain equal air spring heights throughout the application.

Operating a suspension at an incorrect ride height can result in improper loading and can shorten the service life of the suspension. Hendrickson is not responsible for components which fail due to incorrect ride height settings.

FACTORS AFFECTING RIDE HEIGHT

The following features need to be considered when determining ride height:

FRAME-TO-GROUND HEIGHT

The height from the bottom of the trailer frame (or suspension mounting surface) to the ground must be determined at each suspension location (Figure 1). This dimension provides the desired trailer deck height.

TRAILER DECK HEIGHT

The suspension ride height is calculated by subtracting the LOADED tire radius from the LOADED frame-to-ground height. The radius of the tire will decrease as the trailer is loaded due to tire deflection, which in turn, affects the trailer deck height (Figure 2).

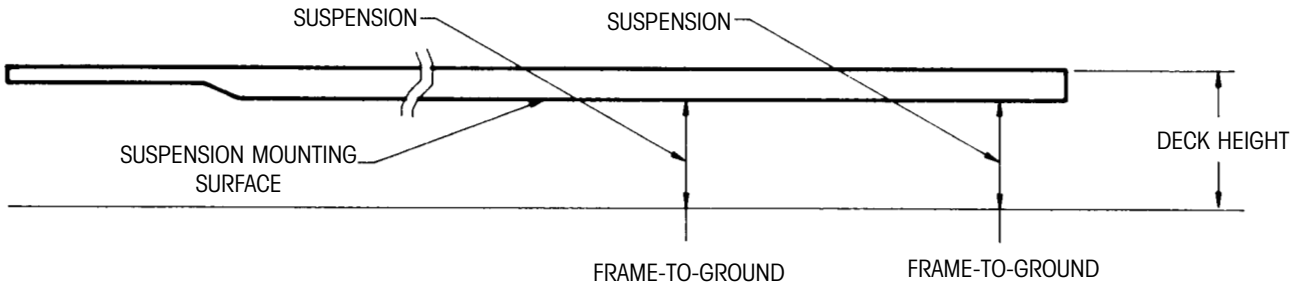


Figure 1. Frame-to-ground-height

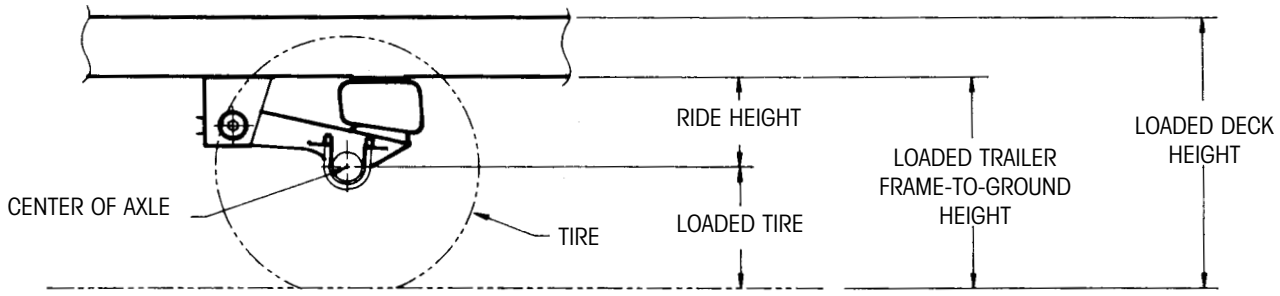


Figure 2. Trailer deck height

FIFTH WHEEL HEIGHT

The tractor fifth wheel affects the height of the trailer frame. (For example: a low fifth wheel height would cause the trailer frame to slope downward.) Variations in the fifth wheel height will result in variations of suspension ride heights.

The correct suspension ride height must be determined at each suspension location (Figure 3). When ride height variations are required, consult the Hendrickson Trailer Engineering Department to evaluate load equalization capabilities.

FRAME DEFLECTION

Deflection of the trailer frame when loaded must be considered. Frame deflection will result in a suspension ride height different from the installed ride height. The correct suspension ride height must be determined at each suspension location (Figure 4). When ride height variations are required, consult the Hendrickson Trailer Engineering Department to evaluate load equalization capabilities.

FRAME-TO-GROUND HEIGHT (CENTER LIFT AXLES)

The height of the bottom of the trailer frame (or suspension mounting surface) from the ground must be determined at each suspension location (Figure 5). This dimension must provide the desired LOADED deck height.

A leaf spring suspension's ride height will change under various loads. The auxiliary air suspension's ride height must be specified to match the loaded leaf spring suspension's ride height.

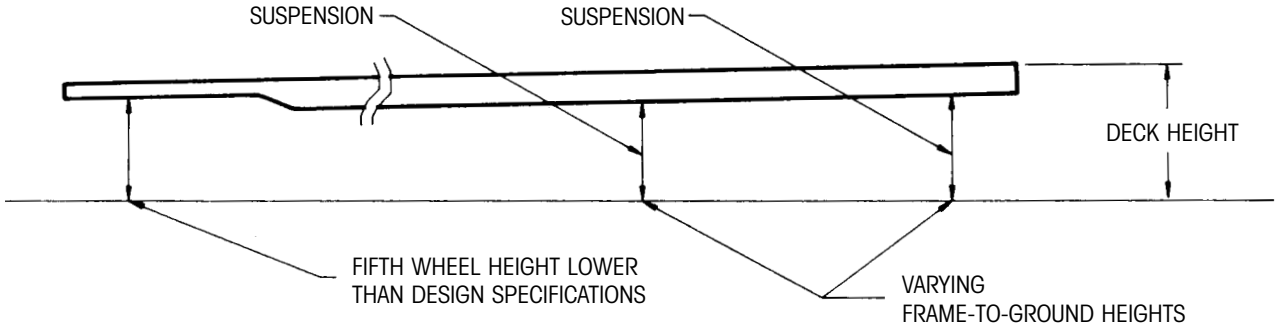


Figure 3. Fifth wheel height

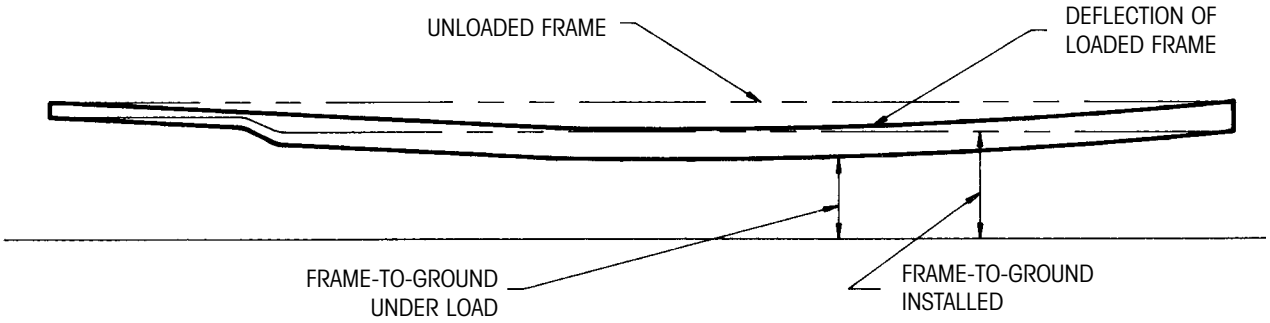


Figure 4. Frame deflection

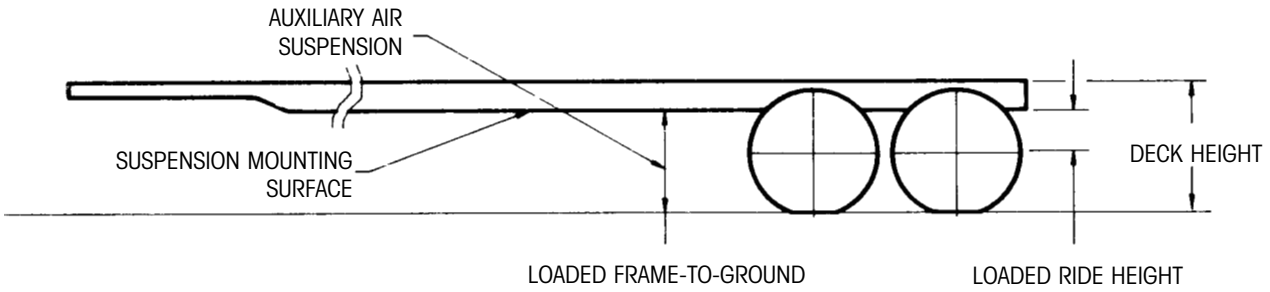


Figure 5. Frame-to-ground height (center lift axle)

SUSPENSION TRAVEL

Hendrickson Trailer Suspension Systems uses these terms to define the suspension travel:

Jounce — Maximum amount of upward axle movement allowed by the suspension (Figure 6).

Rebound — Maximum amount of downward axle travel allowed by the suspension (Figure 6).

When selecting a suspension, the amount of axle travel must be considered in both the loaded and unloaded conditions. Unloaded, the suspension rebound must not be less than 2″.

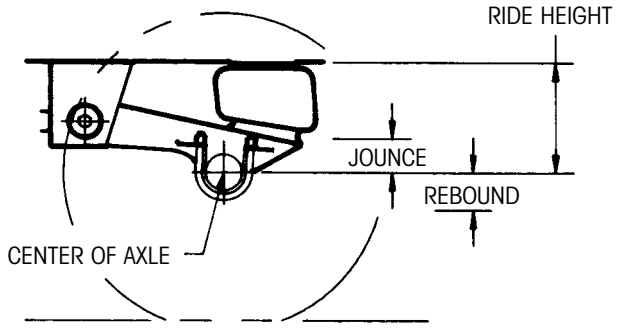


Figure 6. Suspension travel

TIRE CLEARANCE

In selecting a suspension, the trailer's tire clearance must be used to determine the maximum suspension jounce permitted by the trailer design. Hendrickson specifies that the tire clearance above the jounce requirement must include one inch for the "HT" series and INTRAAX models (Figure 7). "T" series models require two inches of tire clearance above the specified jounce requirement. A two inch clearance is specified between the trailer frame and inside tire inboard sidewall. This will provide sufficient clearance to allow for tire distortion and axle walk.

Example: 3″ Jounce
+1″ Clearance for the "HT" Series and INTRAAX model
4″ of space required above the tire at ride height.

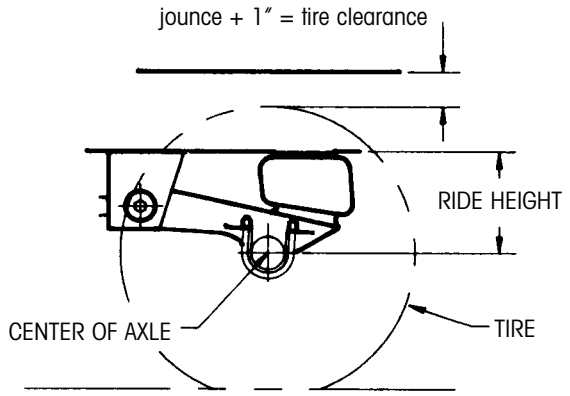


Figure 7. Tire clearance

The top dimensions in Figure 8 are for 35-inch suspension beam centers. The bottom dimensions (in parentheses) are for 41-inch suspension beam centers.

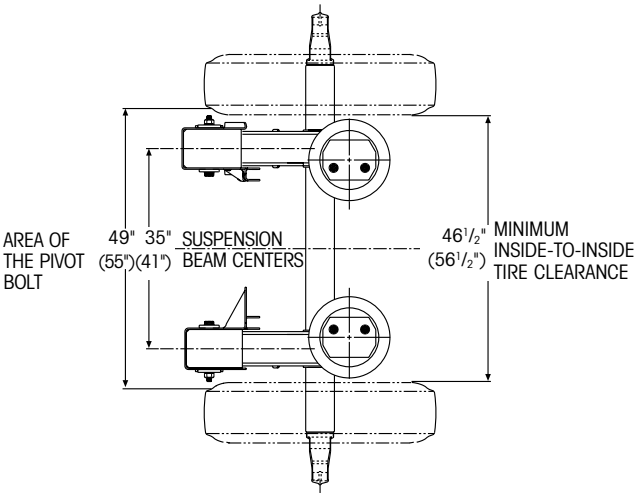


Figure 8. Inside-to-inside tire measurements

If the potential exists for tire interference, install the QUIK-ALIGN shear-type pivot bolt from the outboard side of the frame bracket.

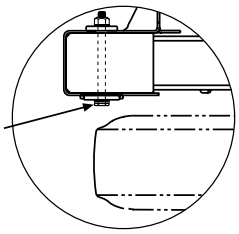


Figure 9. Alternative installation of the QUIK-ALIGN pivot bolt

CENTER LIFT SUSPENSIONS

Hendrickson offers center lift kits, which when added during a trailer suspension installation, provide a lifting capability (Figure 10). Only those suspensions with a minimum of 4″ of jounce are approved for use with a center lift kit.

Hendrickson's suspension jounce dimension includes an allowance for air spring bumper compression. As a result, the amount of lifted up travel will be less than the jounce.

The suspension lift distance indicates the amount of axle up travel. The resulting clearance under the tire will vary depending on both frame and tire deflection.

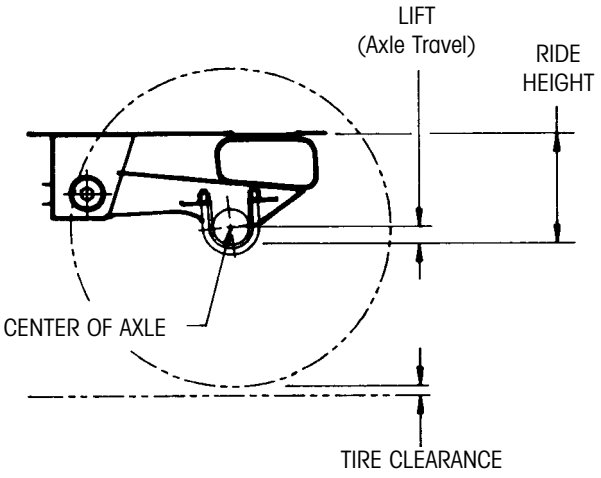


Figure 10. Center lift suspension

AIR CONTROL SYSTEM

Many types of air controls are available for Hendrickson trailer air suspensions. The most common system automatically regulates the designed ride height by controlling the air pressure supplied to air springs. When used in conjunction with other types of suspensions, such as a leaf-spring suspension, an operator-controlled pressure regulator is often employed. If using axle lifts or other special features, other air control circuits and components are added. All systems operate from the compressed air supply of the vehicle. The air pressure in springs controls the height or load on the axle.

The diagram (Figure 11) illustrates a typical air control arrangement in use with a Hendrickson trailer air suspension. One height control valve controls any number of primary air suspensions. Contact the trailer manufacturer for specific information about your trailer air control system.

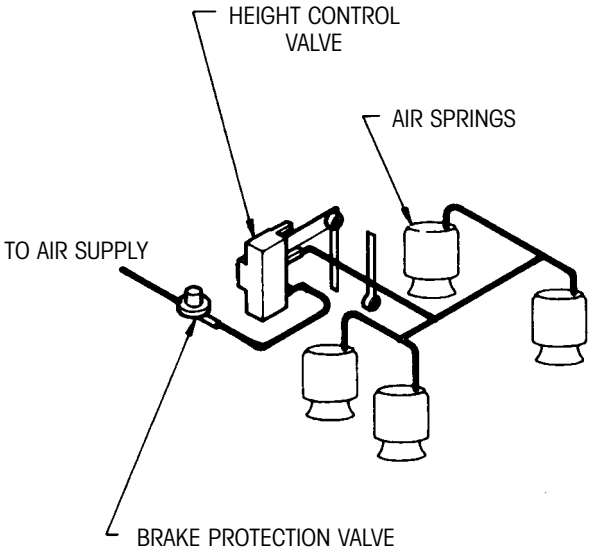


Figure 11. Height Control Valve

HEIGHT CONTROL VALVE

The height control valve on the Hendrickson trailer air suspension automatically responds to the relative position of the axle and vehicle frame. It meters air into or out of the air springs. Variations in load or temperature only affect the adding or exhausting of air. Since the Hendrickson trailer model air suspension is a mechanically stable suspension, only one height control valve is necessary. This system is less complex, less expensive and less troublesome than competitive systems.

In addition, it provides a safer system should an air spring blowout occur. Notice that only one height control valve is used per trailer or dolly; this grouping can include two, three, four or more axles. Hendrickson generally recommends that the height control valve be positioned on the rear axle on tandem axle arrangements and on the center axle of tri-axle arrangements. For trailers equipped with SURELOK®, it is important to place the height control valve on the same axle as the SURELOK locking legs.

When the actuating lever of the height control valve moves up, the valve opens and connects the air supply to the air spring. When the actuating lever moves down, the valve shuts off the air supply and opens the exhaust port to vent excess air from the air springs. A check valve prevents the loss of air spring pressure if the air supply fails. In the central position, air does not flow in or out of the air springs.

AIR DUMP VALVES

Air dump (or exhaust) valves increase stability during the loading and unloading of the trailer, as well as prolong component life. The valves can be controlled automatically, manually or by the use of an air-pilot valve.

When suspension air is exhausted, Hendrickson trailer air suspensions limit the suspension up travel (jounce) by a rubber bumper located inside the air spring. The air-spring bumpers adequately support the rated suspension capacity with the suspension air exhausted.

Hendrickson approves using air dump valves only when the control exhausts all the trailer air springs. Also, use of the air dump control is approved for the following situations:

- A trailer parked for any length of time, loaded or unloaded, either when connected to the tractor or supported by the landing gear legs.
- A trailer being loaded or unloaded, particularly when fork lift trucks are used.
- A dump trailer during the dump mode only.
- A trailer experiencing a sudden off loading of cargo, such as steel removed with a crane.

Any variation beyond these conditions must be approved in writing by Hendrickson Applications Engineering Department.

⚠ 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. When supported by the trailer's landing gear, this movement may damage or collapse the legs. Always exhaust the suspension air before locking the brakes. (Automatic air-dump systems are available.)

Variations in trailer deck height and, therefore, the suspension ride height will cause the longitudinal movement of the trailer. When loading and unloading the trailer, the changes in the load supported by the suspension will cause the deck height to change; this change results in the trailer moving away from the loading dock. Unless the air is properly exhausted from the air suspension, the above movement can damage or collapse the trailer landing gear, as well as result in a potentially dangerous gap between the trailer and the loading dock.

PERIODIC INSPECTION SCHEDULE

The Hendrickson trailer air suspension requires very little attention. Your air suspension may well last the life of the vehicle by using the information in this publication and other Hendrickson technical publications.

ORIGINAL-INSTALLATION INSPECTIONS

The vehicle manufacturer is responsible for completing the installation to Hendrickson specifications. In your review of the vehicle for the first time, check the following:

- trailer is level
- all welds are of acceptable quality
- all bolts are in place and secure
- pivot-connection nut tack-welded to bolt threads (not required with a "Huck" fastener)
- no component interferences exist

DAILY INSPECTIONS

A quick look to verify a level trailer that is riding at the correct ride height is suggested. This inspection will help you find any obvious problems. A closer inspection can detect broken or loose parts before any serious problems appear.

30-DAY INSPECTION

At 30 days, inspect clearances around air springs, tires, shock absorbers and all other moving parts. Evidence of part interference requires immediate attention by a qualified mechanic. The 30-day inspection includes the following checks:

- bolts are secure
- axle connections are tight
- any sign of wear

If you have any questions about the suspension area, call the trailer manufacturer or Hendrickson Technical Service Department at (330) 456-7288.

90-DAY INSPECTION

At 90 days, thoroughly check all items that were inspected at 30 days. The 90-day inspection also includes these items:

- all welded connections for signs of deterioration
- frame attachment joints, crossmember structures and all pivoting and clamping connections for problems

Early detection and correction of problems can save expenses and prolong the life of your trailer.

It is unlikely that you will find any problems with your Hendrickson air suspension during these inspections. However, your careful attention to these periodic inspections can save a great deal of time and expenses by avoiding unexpected difficulties in remote locations. Contact your Hendrickson representative or the Hendrickson Applications Engineering Department at (330) 456-7288 to discuss any questions about the construction and/or operation of your Hendrickson trailer air suspension.

QUIK-ALIGN® INSPECTION

Inspection of the QUIK-ALIGN occurs at 3,000 miles and at every lining change.

WHEEL END MAINTENANCE

7,500 MILES

Visually inspect seal and hub cap for leakages and hub oil level (if oil bath type).

12 MONTHS OR 100,000 MILES

At 12 months or 100,000 miles, which ever occurs first, visually inspect seal and R&I hub cap. Visually inspect for contaminants, check wheel bearing adjustment, install new oil, if oil filled, and replace hub cap gasket-retorque. Repair if necessary.

SUSPENSION SYSTEMS MAINTENANCE

By correcting minor problems when found, your Hendrickson air suspension will provide excellent service throughout your trailer's life. This section will help you to determine what to expect from your suspension components and the proper maintenance procedures.

RIDE HEIGHT ADJUSTMENT

1. Connect the vehicle to a compressed air supply with approximately the pressure of the normal supply system.
2. Ensure the inflation of the air springs.
3. Measure the ride height by using this method:

   a. Measure from the underside of the trailer frame to the top of the axle

   b. Add $2^1/_2$″ (half the diameter of the axle) to the measurement

   Example: $11^1/_2$″ to the top of the axle with the $2^1/_2$″ equals a 14″ ride height
4. Raise or lower the trailer as necessary, so it is at the designed ride height.
5. Once the trailer is set at the correct designed ride height, set the HCV lever to the neutral (central) position.
6. Adjust the HCV linkage to fit between HCV lever and lower linkage attachment.

IMPORTANT: When adjusting the height control valve, block the tire and release the trailer brakes. The axle must rotate freely to avoid a false reading.

Some height control valves have very small openings and a time delay of as much as 15 seconds. Allow sufficient time for the system to react to the adjustment. The response time will appear to be lengthy, but be patient.

Once set to the designed ride height, test drive the trailer. After the test drive, check the ride height to assure an accurate adjustment.

Notice that the use of one height control valve removes the requirement for synchronization found with most other air suspension systems. This feature will save you time and expense in servicing your air system.

If you have any questions regarding the operation of your Hendrickson trailer air system, contact the Hendrickson Technical Service at (330) 456-7288.

AIR SPRING

Air springs will last almost indefinitely in most applications. However, air springs will fail quickly when rubbed, scuffed, or punctured. If an air spring fails, the trailer will settle on the internal rubber bumpers, so you can proceed to the nearest service facility at a lower speed. You should try to determine the cause of a failure, so you can avoid a costly repeat of the problem. If you have questions about the cause of a failure, contact Hendrickson Technical Service Department at (330) 456-7288.

To replace an air spring, follow these steps:

1. Exhaust all air from the suspension system
2. Raise and support the vehicle in a safe manner
3. Unbolt the air spring
4. Disconnect air-supply lines
5. Replace the air spring
6. Bolt the air spring in place
7. Connect the air-supply lines
8. Lower the trailer to the ground
9. Supply air to the suspension system

SHOCK ABSORBER

Shock absorbers do not absorb shock; they absorb energy to prevent suspension oscillation. Shock absorbers are also used as rebound stops in most air suspensions. The shock absorber limits the stroke of an air spring, which prevents the air spring from being pulled apart. In some severe service applications, a shock strap is added to additionally aid in limiting the stroke of an air spring.

To remove an air spring, follow these steps:

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

If your suspension has unique travel requirements, use only Hendrickson shock absorbers for replacements.

⚠ **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.**

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.

PIVOT CONNECTION

A correct 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.

Hendrickson trailer air suspension models come equipped with either a "Huck"-type fastener or a conventional nut-and-bolt arrangement at this location.

The factory installs the "Huck"-type fastener by using specialized hydraulic equipment. This fastener can only be removed by cutting the fastener apart.

Other factory-installed units are equipped with a nut and bolt at the pivot connection. This arrangement is also used when a field replacement is necessary. The pivot bolts are torqued to 800 ft-lbs. The nut is tack welded to the bolt threads to assure a permanent connection.

Hendrickson INTRAAX suspension systems come equipped with QUIK-ALIGN pivot connection hardware. The hardware consists of a specially plated shear bolt to ensure a proper clamp load, (550 ft-lbs, H-45 torque).

⚠ **CAUTION: Failure to properly torque the pivot bolt or tack weld the pivot nut to the bolt will result in loss of warranty coverage.**

TRI-FUNCTIONAL BUSHING

Hendrickson's TRI-FUNCTIONAL BUSHING has unique properties that will provide years of maintenance-free service. The TRI-FUNCTIONAL BUSHING (located at the suspension pivot) provides a resilient connection that allows an axle to walk 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.

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 problem is in the area of the suspension, refer to the TROUBLESHOOTING section on page 10. If a failed bushing is present, contact Hendrickson Technical Service Department at (330) 456-7288.

Rebushing of a suspension requires the use of a bushing removal/installation tool and bushing kit, containing the required components for rebushing. Contact Hendrickson for assistance. When rebushing the suspension, refer to *L427 Bushing Replacement Procedures.*

IMPORTANT: Literature is also available for installing the TRI-FUNCTIONAL BUSHING. Rebush using only the lubricant supplied in the bushing kit by Hendrickson Trailer Suspension Systems.

TROUBLESHOOTING: TRI-FUNCTIONAL BUSHING

COMMONLY MISDIAGNOSED BUSHING PROBLEMS

While the following problems can result from a failed bushing, most often they are the result of the items listed below.

PROBLEM	CAUSE(S)	SOLUTION(S)
TRAILER LEANS…		
Constantly in one direction.	Suspension beams installed out of parallel.	Determine which beam is out of parallel, cut from axle, reposition and reweld.
Varies from side to side.	Axle welds missing or broken.	**HT Models Only:** Clear away old welds, reposition the beams to be parallel and reweld to axle.
		INTRAAX Only: Replace the axle/beam weldment with a HALF-TRAAX unit.
Varies in one direction.	Pivot bushing failed.	Replace pivot bushing.

PROBLEM	CAUSE(S)	SOLUTION(S)
TRAILER "DOG TRACKS"…		
Constantly to one side.	Trailer frame not square, king pin excessively off center or high crown highways.	Realign suspension per Hendrickson Trailer Suspension Systems and bias the alignment of both axles equally in opposite direction of the dog tracking.
Varies from side to side.	**HT Models Only:** Loose pivot bolts.	Replace alignment collars, pivot bolts, nuts, TRI-FUNCTIONAL BUSHING and any worn suspension components.
	HT Models Only: Missing or broken alignment collar welds.	Clear away failed welds and realign — welded style pivot connection.
	All Models: Alignment collars loose (QUIK-ALIGN pivot connection).	Replace pivot bolt kit. Realign the trailer.
To one side under load.	Suspension not square to the axle.	Contact Hendrickson Technical Service Department at (330) 456-7288.
	Air springs misaligned.	Compare the installation to the suspension drawing and reposition as required; contact Hendrickson Technical Service Department at (330) 456-7288.
	Failed pivot bushing (rare).	Replace the pivot bushing and realign per instructions; contact Hendrickson Technical Service Department at (330) 456-7288.

IMPORTANT: Contact Hendrickson Technical Service Department at (330) 456-7288 for assistance.

COMMONLY MISDIAGNOSED BUSHING PROBLEMS (CONTINUED)

PROBLEM	CAUSE(S)	SOLUTION(S)
BUSHING WALK		
The suspension beams have shifted from the center of the pivot bushings.	Suspension beams are out of parallel (vertically or longitudinally).	**HT Models Only:** Determine which beams are out of position, cut the affected beams from the axle, reposition and reweld. Rebush both suspension pivots and realign per instructions. **INTRAAX Only:** Replace the axle/beam weldment with a HALF-TRAAX unit.
	Alignment collars loose from QUIK-ALIGN pivot connection.	Inspect the suspension hanger, replace if necessary, rebush the suspension and realign according to instructions.
	Frame bracket centers do not match the suspension beam centers.	Contact Hendrickson Technical Service Department at (330) 456-7288 for correct installation dimensions. Reposition the incorrect components and rebush both suspension pivots.
	Use of improper bushing lubricant.	Rebush using only the lubricant supplied in the bushing kit by Hendrickson Trailer Suspension Systems.
Pivot can be moved vertically.	Normal travel.	No action is required.
Bushing protrudes from the bushing tube.	Faulty or worn bushing.	If excessive rubber protrudes from one end, then it can indicate a bushing walk condition. Replace the bushing if this condition is present.
Grooving or deforming of wear pads.	Excessively dirty environment (i.e., farming, construction, on-off highway applications or sever service applications). Faulty or worn bushing	The wear pads act as filler pieces between the hanger and the bushing tube and bushing. The pads will show signs of wear due to the movement of the suspension beam during articulation. Replace pads if wear is excessive.

TORQUE SPECIFICATIONS

Use these torque specifications when installing the fasteners covered below.

COMPONENT DESCRIPTION	FT-LBS	N•m
QUIK-ALIGN Pivot Connection	505 to 595	685 to 807
Welded Pivot Connection (1 1/8 inches)	750 to 825	1017 to 1119
U-Bolts (HT Series)	475 to 525	644 to 712
Shock Bolts	210 to 235	285 to 319
Upper Air Spring Nuts	80 to 100	108 to 136
Lower Air Spring Nuts (HT Series)	40 to 50	54 to 68
Lower Air Spring Nuts (INTRAAX)	25 to 35	34 to 47
Brake Chamber Mounting Nut (INTRAAX)	100 to 110	136 to 149
S-Cam Support Bearing Mounting Nut (INTRAAX)	35 to 45	47 to 61

COMPONENT DESCRIPTION	IN-LBS	N•m
ABS Bracket Bolt and Nut (INTRAAX)	75 to 100	8 to 11
Dust Shield, Bolt-to-Spider (INTRAAX)	160 to 180	18 to 20
Dust Shield, Clamp-on (INTRAAX)	95 to 170	11 to 19

NOTE: Torque values are specified for the fasteners in the condition in which they are supplied by Hendrickson. **DO NOT APPLY ANY ADDITIONAL LUBRICANTS.**

⚠ **CAUTION: Overtorquing could result in fastener failure.**

Trailer Suspension Systems
2070 Industrial Place SE
Canton, OH 44707-2600 USA
330.456.7288
Fax 330.456.0105

HENDRICKSON

Trailer Suspension Systems
250 Chrysler Drive, Unit #3
Brampton, ON L6S 6B6 Canada
905.789.1030
Fax 905.789.1033

L578 5M 7-00 Printed in United States of America.

TECHNICAL PROCEDURE

TRAILER SUSPENSIONS SYSTEMS

SUBJECT: Alignment Procedure
LIT NO: L579
DATE: April 2003 **REVISION:** B
Supersedes previous versions of L579.

TABLE OF CONTENTS

TOOLS AND EQUIPMENT

The following tools and equipment are necessary to complete the procedure within this publication:

- 50-foot (minimum) steel tape measure with $^{1}/_{32}$-inch or millimeter increments
- 12-foot (minimum) steel tape measure with $^{1}/_{32}$-inch or millimeter increments, or a trammel bar
- Tape tensioning device; consisting of:
  - Fish (or engineering) scale
  - Clamp
  - String - used to fasten the clamp to the fish scale
- Kingpin adapter or kingpin extender (pogo stick)
- Level - used to plumb the kingpin extender
- Wheel-end (or spindle) extenders
- ½-inch breaker bar or ratchet
- E20 Torx socket; 1-inch drive recommended (refer to the section titled E20 TORX SOCKETS for more Torx socket details)
- Impact wrench with a minimum torque capability of 600 ft. lbs. (813 N•m)
- $1^{7}/_{16}$-inch shallow impact socket
- $1^{7}/_{16}$-inch combination wrench
- Tire changing equipment (as needed)

E20 TORX SOCKETS

Hendrickson offers three E20 Torx sockets that may be used on the shear-type bolt during alignment (refer to table 1). In addition to these tools, sockets from other vendors (Camcar TX-8120 or Strong Tools E-20 T.S.) are also available and may be used.

To avoid damaging the shear bolt's Torx head (regardless of the drive socket being used), the drive socket must fully engage the Torx head (figure 1).

DESCRIPTION	DRIVE SIZE	COMMENTS
Hendrickson E20 Torx Socket (part number A-24303)	¾ inch	Cost effective tool for occasional use (not recommended for use in high-volume trailer production environments)
Hendrickson E20 Torx Socket (part number A-24536)	1 inch	For medium-duty use (dealers, repair facilities, etc.)
Hendrickson E20 Torx Socket with sleeve (part number A-25119)	1 inch	For high-volume trailer production environments or manufacturing facilities. The sleeve provides greater operator control.

Table 1. Hendrickson E20 Torx socket summary

Hendrickson does not recommend the ¾-inch drive socket for use in high volume trailer production environments. The ¾-inch drive socket can back away from full Torx head engagement during the shearing process and strip the Torx-head splines. When damage occurs to the Torx-head splines, the proper torque and clamp load may not be achieved.

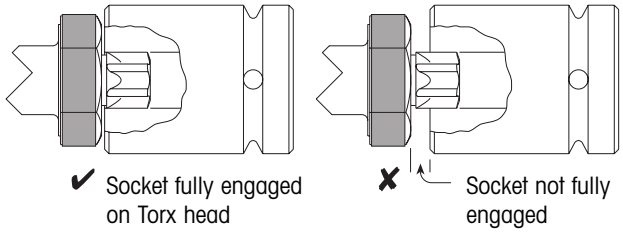


Figure 1. Socket engagement

For high volume trailer production and service facilities, Hendrickson recommends the one-inch drive E20 Torx socket with sleeve, part number A-25119 (figure 2). The sleeve helps support the tool by riding over the entire head of the shear bolt, including the heat shrink tubing. It also provides greater operator control at the moment of shear by preventing the heavy tool from veering. The operator can rest the tool on the bolt during the entire operation resulting in greater control of socket-to-bolt engagement, reduced fatigue and consistently torqued pivot connections. If you already own the one-inch drive E20 Torx socket without the sleeve (part number A-24536) and wish to add a sleeve to it, dimensions are included in figure 3. A local fabricating shop can make and assemble the sleeve for you using this information.

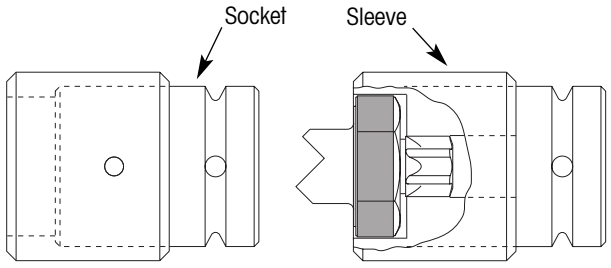
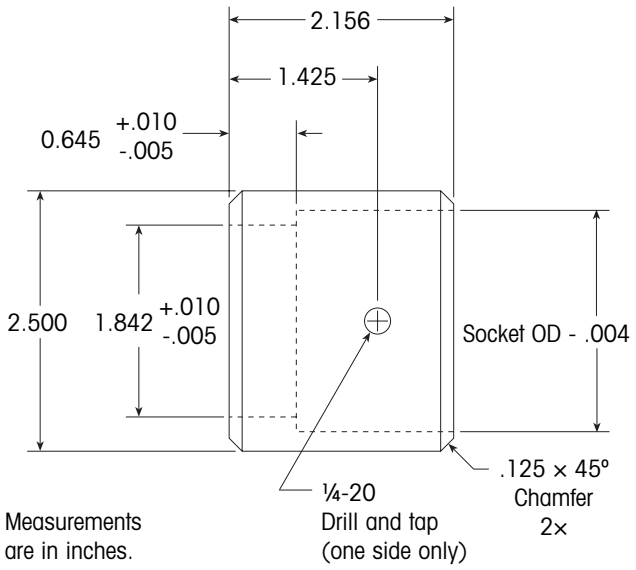


Figure 2. One-inch drive E20 Torx socket with sleeve



FABRICATION NOTES:

1. Sleeve undersized by .004; shrink fit socket into sleeve OD.
2. Drill and tap assembly for ¼-20 × .25 (oval point) standard hex socket set screw.
3. Material: Ø2.500 6150 H.R.S.
4. Heat treatment (sleeve):
   - oil drenched: 1550° F (538° C)
   - tempered: 1000° F (843° C)

Figure 3. Sleeve dimensions

PIVOT CONNECTION HARDWARE

Hendrickson suspensions are equipped with either QUIK-ALIGN® or welded collar style pivot connections.

QUIK-ALIGN® STYLE PIVOT CONNECTION

The QUIK-ALIGN style pivot connection uses two flanged collars inserted into slots on each side of the frame bracket (figure 4). The eccentric collar on the outboard side of the frame bracket is used to adjust the position of the axle during an alignment. The alignment guides on the side of the frame bracket limit the eccentric collar to rotational movement in the frame bracket slot. Rotating the eccentric collar clockwise causes the axle to move forward. Rotating the eccentric collar counterclockwise causes the axle to move rearward (figure 5). The maximum range of adjustment is ±45 degrees from the 12 o'clock position.

Along with hardened flat washers, a shear-type bolt and a TORQ-RITE® nut are also part of the QUIK-ALIGN style pivot connection. Use of this shear-type bolt and TORQ-RITE nut ensures proper clamping force without the use of a torque wrench.

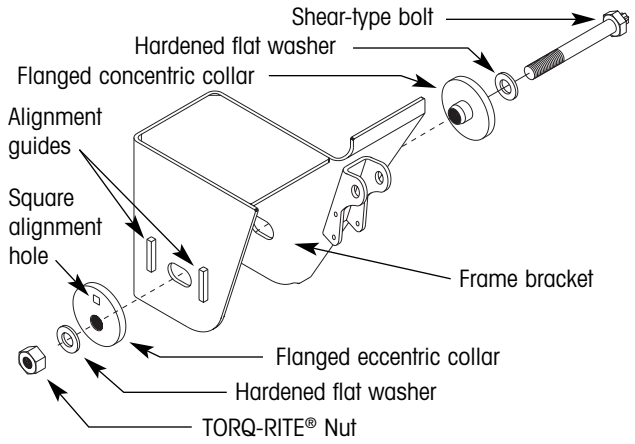


Figure 4. QUIK-ALIGN style pivot connection

⚠CAUTION: DO NOT apply an anti-sieze compound to the pivot connection hardware or allow undercoating, paint, 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

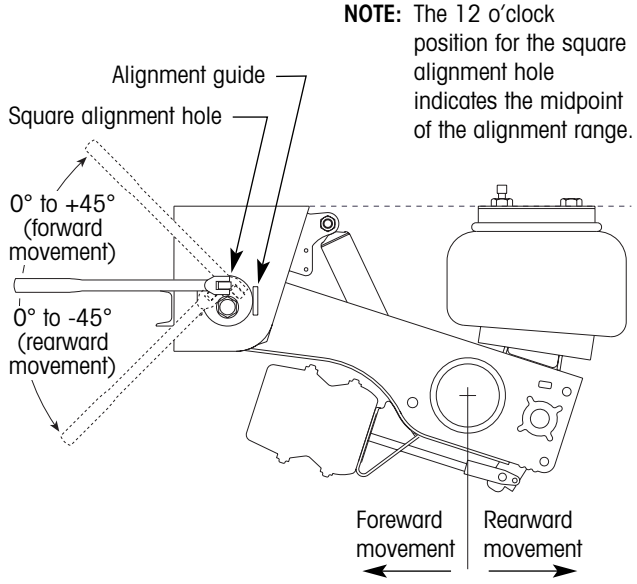


Figure 5. Rotating the flanged eccentric collar on the QUIK-ALIGN style pivot connection

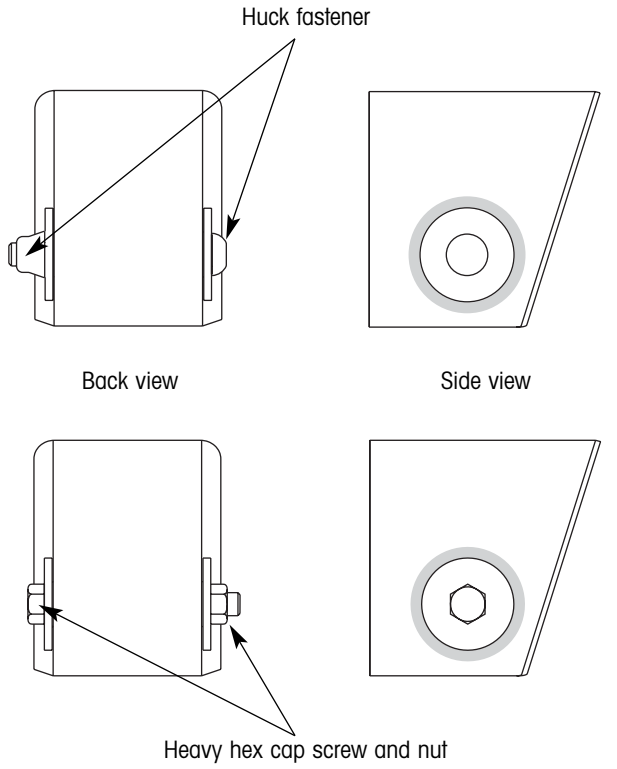


Figure 6. Welded collar style pivot connection

fasteners, unpredictable pivot connection clamp loads and unreliable axle alignments.

⚠**CAUTION: DO NOT apply undercoating to the suspension and frame brackets until after completing the alignment.**

WELDED COLLAR STYLE PIVOT CONNECTION

The welded collar style pivot connection is clamped together by either a huck fastener or a $1^1/_8$-inch heavy hex cap screw and nut (figure 6). After the alignment is completed, the entire circumference of both inboard and outboard collars is welded to the frame bracket, and the nut is welded to the $1^1/_8$-inch heavy hex cap screw (if used instead of the huck fastener).

To realign this style of pivot connection, the collar welds must be removed so the pivot joint can be repositioned.

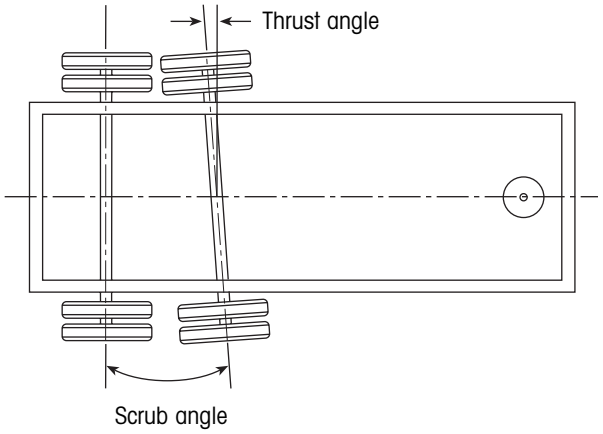


Figure 7. Tandem trailer axle angles

ALIGNMENT BACKGROUND

Properly aligned trailer axles optimize fuel economy and driveability, and help prevent excessive tire wear.

A perfect alignment scenario has all trailer wheels parallel to one another and perpendicular to the centerline of the trailer. However due to uncontrollable factors, this perfect scenario is often an unreasonable expectation. A more likely alignment scenario has the trailer wheels parallel *within a very small tolerance range* to one another and perpendicular *within a very small tolerance range* to the centerline of the trailer.

There are two important trailer axle angles that must be kept within recommended tolerance ranges: thrust angle and scrub angle (figure 7). These angles, when out of tolerance, can lead to increased rolling resistance, excessive tire wear and can contribute to trailer "dog tracking." Dog tracking is a condition where the trailer does not follow or track directly

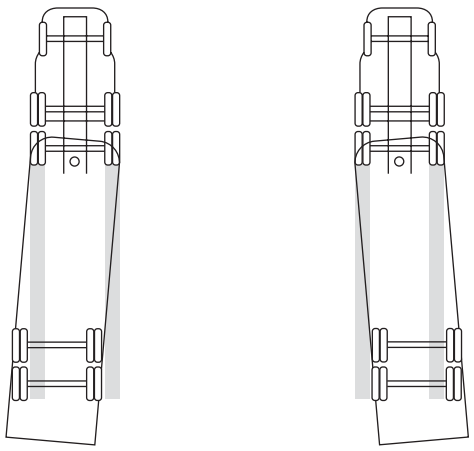


Figure 8. Examples of trailer dog tracking

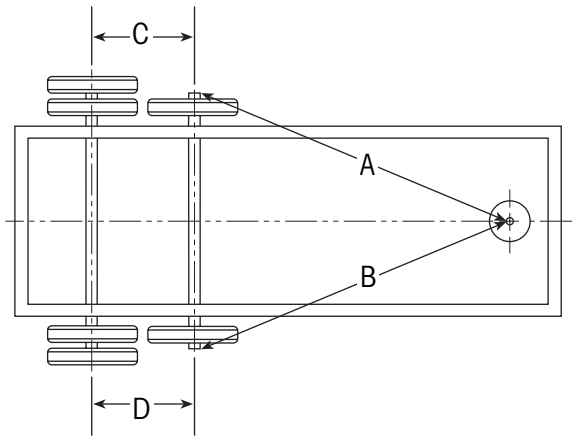


Figure 9. Measurements to check axle alignment

behind the truck as the vehicle is being operated in a straight line (figure 8) and is influenced by body rail alignment, king pin location, axle side-to-side location, and other things. The procedures presented in this publication detail how to check, and if necessary, bring these angles within the recommended tolerance range.

The front axle is used as a starting point to measure thrust angle. First, the measurement target value (or tolerance range) is determined. Then, the distance from the kingpin (used as the trailer centerline) to matching points on each end of the front axle is measured (distances "A" and "B" in figure 9). The difference between these two measurements is then compared to the measurement target value to determine the axle thrust angle. If the difference between the "A" and "B" measurements is larger than the target value, the axle must be adjusted to achieve an acceptable axle thrust angle. If the difference between the "A" and "B" measurements is smaller than or equal to the target value, axle thrust angle is within the tolerance range and no adjustment is necessary. The remaining axles are then measured with respect to the front axle and adjusted, if necessary, to an acceptable scrub angle.

Even though distances are being measured using measurement points on the ends of the axle, it is the axle thrust angle that is important. As shown in figure 10, the acceptable axle thrust angle remains constant over the length of the axle. However, the measurement target value that coincides with the acceptable axle thrust angle varies over the length of the axle. Because of a simple geometrical relationship, the measurement target value gets larger as you move farther away from the center of the axle. For example, measuring from the king pin to a point 18 inches beyond the end of the spindle might produce a measurement target value of ±0.218 ($^{7}/_{32}$) inches (figure 10). But a measurement from the king pin to the brake drum might only produce a measurement target value of ±0.094 ($^{3}/_{32}$) inches. Both of these measurements are within the acceptable axle thrust angle, but one is more than

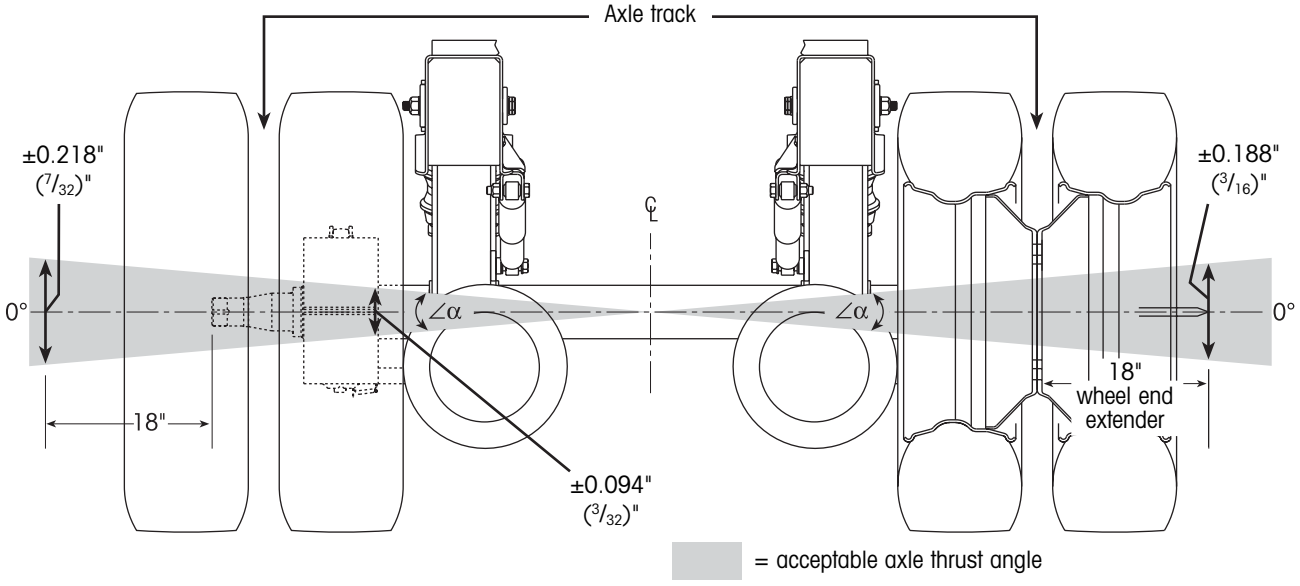


Figure 10. Thrust angle geometry example

two times larger than the other. This is because one measurement is taken at a point much farther away from the center of the axle than the other measurement.

The typical trailer industry alignment specification for thrust angle is ±0.1 degrees, which equals ±1/8 inch when measured from the king pin to the axle track of a 71.5-inch track axle (distances "A" and "B" in figure 9). Hendrickson suspensions are no different. However, there are two additional clarifications to this specification that must be addressed. The first one deals with axle track (figure 10). Using the value for axle track simplifies the axle thrust angle calculation, but it is impractical to use axle track for a measurement. Not only does the outer tire/wheel assembly have to come off to even attempt the measurement, but where specifically on the spindle do you measure to? What point on the spindle defines axle track? A more practical approach is to use wheel-end extenders to provide a more accurate and consistent measurement point (more wheel-end extender information is presented later in this document).

The second clarification deals with measurement limitation. The ±0.1 degrees of thrust angle is difficult to achieve because of measurement limitations. No currently existing alignment measurement method can consistently provide an alignment within this ±0.1 degree tolerance. The reason for this is measurement error.

MEASUREMENT METHOD	PRECISION/ TOLERANCE RATIO (±0.1°)	PRECISION/ TOLERANCE RATIO (±0.2°)
Tape measure to rim	330%	165%
Laser devices*	309%	155%
1/16" graduated tape measure to wheel-end extenders	207%	104%
1/32" graduated tape measure to wheel-end extenders	148%	74%
Extensometer	64%	32%

Table 2. Measurement method and associated accuracy

* per SAE technical paper 933046.

All measurement devices and procedures have variations that affect their accuracy. A study typically performed to identify measurement device or procedure accuracy is a gauge repeatability and reproducibility study. It evaluates how well the measurement device or procedure can perform with respect to specifications. The result of such a study is a factor called "precision to tolerance ratio." This ratio expresses the percent of the tolerance used up by measurement error. For example, say you have a measurement with a tolerance of ±0.125 (1/8) inches. Say also that the result of a gauge repeatability and reproducibility study revealed a precision to tolerance ratio of 75 percent. This means that ±0.0938 (3/32) inches (or 75 percent) of the ±1/8-inch tolerance could be attributed to measurement error.

As summarized by table 2, the measurement error introduced by current alignment measurement methods (except extensometer devices) is greater than the ±0.1 degree industry specification.

With the two previously described clarifications in mind, Hendrickson continues to recommend using the ±0.1 degree thrust angle alignment specification for initial alignments, realizing that, due to measurement error, the actual thrust angle may be in the ±0.2 degree range. The ±0.2 degree range complies with most tire manufacturers' recommendations for an allowable trailer axle thrust angle. Hendrickson also recommends using a steel tape measure with 1/32-inch or millimeter graduations, a tape tensioning device and wheel-end extenders to allow for greater measurement accuracy. Subsequent alignment verification measurements should use the ±0.2 degree thrust angle range recommended by most tire manufacturers.

ALIGNMENT PREPARATIONS

SELECT THE ALIGNMENT AREA

The alignment should be performed on a flat, level, debris-free surface.

PERFORM TIRE INSPECTION

The tires in each dual wheel set must be matched to within ¼ inch in diameter and ¾ inch in circumference.

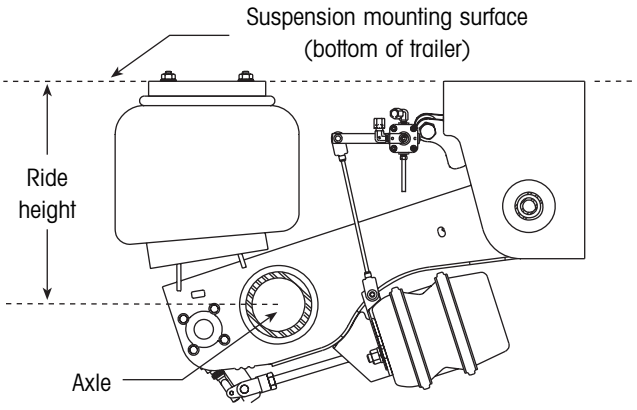


Figure 11. Ride height defined

The tires must also be at the manufacturer's recommended pressure when checking or performing an axle alignment. Inflate or deflate the tires to match this recommended pressure.

Also make sure that the same tires and rims are mounted on each side of the trailer.

SET SUSPENSION RIDE HEIGHT

The suspension must be at its designed ride height when checking or performing an axle alignment. A suspension's designed ride height is defined as the distance from the suspension mounting surface (the bottom of the trailer) to the center of the axle (figure 11). Refer to Hendrickson publication L459, *Checking Trailer Ride Height,* available at www.hendrickson-intl.com, for complete instructions on determining and setting ride height.

PROPERLY POSITION THE TRAILER

Trailer positioning is important during an axle alignment. The trailer suspension must be in a "relaxed" state without any pre-load applied to the TRI-FUNCTIONAL® Bushings.

IMPORTANT: A pre-loaded bushing will complicate the axle alignment process by providing inaccurate measurement data. Also, a seemingly-aligned axle that contains an unknowingly-compressed bushing may cause tracking problems and/or premature tire wear. To avoid these conditions, perform the proper trailer positioning procedure as follows.

1. Position the trailer for alignment:

Sliders

a. Move the slider to the rear-most position of the trailer. Make sure the slider locking pins are fully extended through the body rail holes.

b. With the trailer still coupled to the tractor, adjust the trailer landing legs so there is adequate ground clearance.

c. Pull the trailer forward in a straight line for a minimum of 10 feet and gently apply the trailer brakes. This forces the slider locking pins to the rear of the body rail holes, removing locking pin slack and relieving bushing pre-load.

Non-sliders

a. With the trailer still coupled to the tractor, adjust the trailer landing legs so there is adequate ground clearance.

b. Pull the trailer forward in a straight line for a minimum of 10 feet and ease the trailer to a stop using only the service brakes, thus relieving bushing pre-load.

2. Lower the trailer landing legs so they contact the ground. Uncouple the trailer from the tractor and apply shop air to the trailer emergency glad hand to release the parking brakes.

IMPORTANT: Keep trailer parking brakes disengaged. This allows wheel rotation to occur while positioning the suspension fore and aft.

SET DESIGNED KINGPIN HEIGHT

Set the front of the trailer to its designed kingpin height:

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. Using a tape measure, determine the current trailer kingpin height by measuring from the ground to the kingpin mounting plate (figure 12).

Figure 12. Measuring the actual kingpin height

3. 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.

CHECK INITIAL AXLE ALIGNMENT

1. From a position at the front of the trailer, sight along a line under the trailer from the kingpin to each end of the front axle (figure 13).

   If this sightline is free from under-trailer obstructions that would interfere with a measurement (i.e., landing legs, trailer frame, tool boxes, etc.), then the kingpin adapter (figure 14) can be used to make the measurement in step five.

   If this sightline is obstructed, then the kingpin extender or pogo stick (figure 15) must be used to make the measurement in step five.

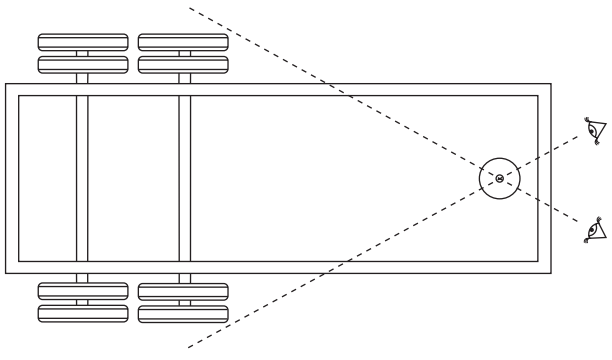


Figure 13. Checking for measurement obstructions

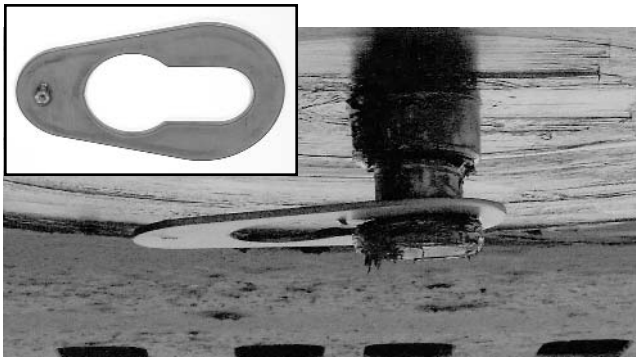


Figure 14. Kingpin adapter

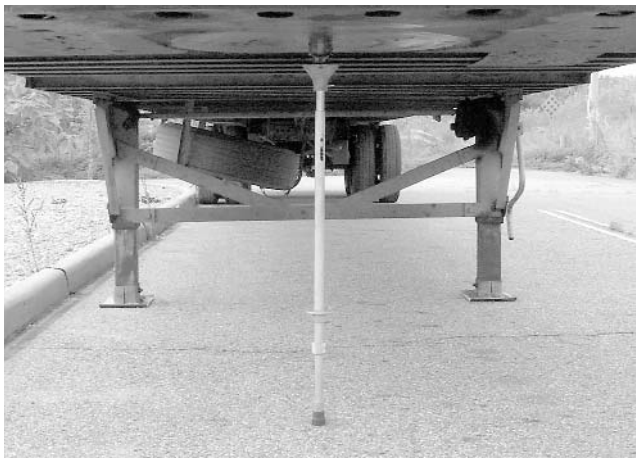


Figure 15. Kingpin extender

Figure 16. Installed wheel-end extender

2. Place the kingpin adapter (figure 14) or kingpin extender (figure 15) onto the kingpin.

3. Following the manufacturer's recommended instructions, install wheel-end extenders on each end of the front axle (figure 16).

NOTE: A wide range of wheel-end extenders are available from various companies, ranging from simple fixtures to complex devices. Wheel-end extenders are designed to ease alignment by eliminating the need to remove the outer wheel when checking or aligning the axles. Once in place, wheel-end extenders position axle reference points far enough outside of the trailer to allow the measuring tape to clear the tires when measuring the "A" and "B" dimensions from the kingpin. Some wheel-end extenders require contact with the spindle plug through the hub cap oil fill hole. Others offer a more universal mount, fitting over the entire hub. Select wheel-end extenders that work best with your style of hubs.

IMPORTANT Make sure the wheel-end extenders are a matched pair and are properly installed. Failure to properly install a matched pair of wheel-end extenders will significantly reduce the accuracy of the alignment measurement.

4. Determine front axle target value as follows:

   a. Measure the length of one wheel-end extender. Measure from the face of the wheel mounting to the tip of the wheel-end extender (figure 17).

   b. Read the front axle target value from the following chart.*

WHEEL-END EXTENDER LENGTH	AXLE TRACK 71.5"	AXLE TRACK 77.5"
12"	$\pm 5/32$"	$\pm 3/16$"
13"	$\pm 3/16$"	$\pm 3/16$"
14"	$\pm 3/16$"	$\pm 3/16$"
15"	$\pm 3/16$"	$\pm 3/16$"
16"	$\pm 3/16$"	$\pm 3/16$"
17"	$\pm 3/16$"	$\pm 3/16$"
18"	$\pm 3/16$"	$\pm 3/16$"
19"	$\pm 3/16$"	$\pm 7/32$"
20"	$\pm 7/32$"	$\pm 7/32$"
21"	$\pm 7/32$"	$\pm 7/32$"
22"	$\pm 7/32$"	$\pm 7/32$"
23"	$\pm 7/32$"	$\pm 7/32$"
24"	$\pm 7/32$"	$\pm 7/32$"

Table 3. Thrust angle target values

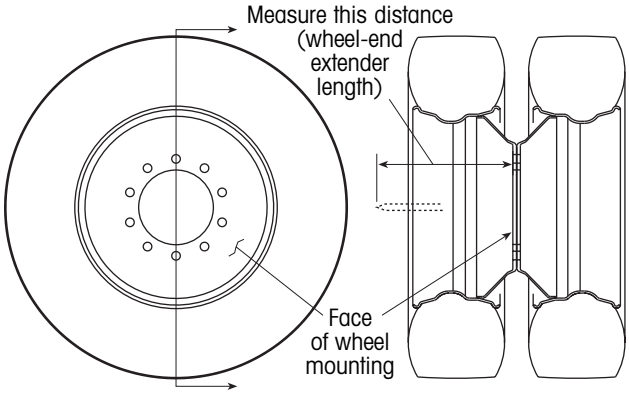


Figure 17. Measuring wheel-end extender length

For example, suppose the measured length of your wheel-end extender is 18 inches and your trailer has a 71.5-inch axle track. First, find the 18-inch row in the table. Then, find the column for 71.5-inch axle track and read down the column. The value shown where 18-inch wheel-end extender length and 71.5-inch axle track meet is $\pm 3/16$ inch, which is the front axle target value. This front axle target value will be required for a comparison in step 6.

NOTE: Axle track can be read from the suspension model identification tag, found on the inside surface of the curbside beam (INTRAAX® suspensions) or on the roadside slider box side rail above the front frame bracket (VANTRAAX® suspensions). Refer to Hendrickson publication L760, *New Product Identification System,* available at www.hendrickson-intl.com, for complete details on reading the Hendrickson suspension identification tag.

*The front axle (or thrust angle) target values presented in this chart have been pre-calculated for your convenience. To see the steps involved in this process and an example of a front axle target value calculation, refer to the section titled Front Axle Target Value Sample Calculation on page 18.

Figure 18. Using the tape tensioning device

5. Hook the 50-foot steel measuring tape to the kingpin adapter (or kingpin extender). Holding the measuring tape with the tape tensioning device (figure 18), measure the distances "A" and "B" from the kingpin to the wheel-end extender pointer on each end of the front axle (figures 19 and 20).

IMPORTANT: The same lateral tension (pulling force) applied to the measuring tape when measuring distance "A" must also be applied when measuring distance "B". When making the measurements, closely monitor the tensioning device scale to make sure that the same pulling force is used in both measurements.

6. Subtract the smaller of the "A" and "B" measurements from the larger of the two, then compare this difference with the target value obtained in step four.

   If the difference between the "A" and "B" measurements is smaller than or equal to the target value, the axle is within specification and no alignment is necessary.

Figure 19. Measuring the "A" and "B" distances

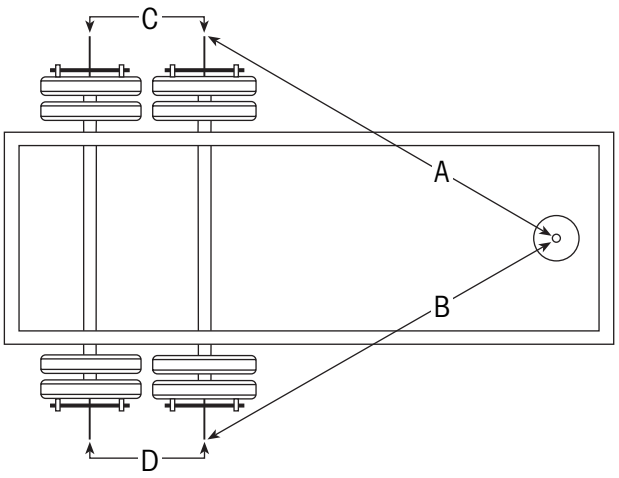


Figure 20. Axle alignment measurements

If the difference between the "A" and "B" measurements is larger than the target value, the axle must be adjusted to bring this difference within the target value.

For example, suppose distance "A" was measured to be $420^{1}/_{8}$ inches and distance "B" was measured to be $420^{11}/_{16}$ inches. Subtracting yields this difference:

$$420^{11}/_{16}\text{" - } 420^{1}/_{8}\text{" = } {}^{9}/_{16}\text{"}$$

When compared to the target value ($\pm{}^{3}/_{16}$ inches, read from the table in step 4), $^{9}/_{16}$ inches is larger. Therefore the axle must be adjusted to bring the "A" and "B" difference within the target value.

AXLE ALIGNMENT

QUIK-ALIGN® STYLE PIVOT CONNECTION

THRUST ANGLE

If the front axle is found to be out of the acceptable thrust angle range, it must be realigned as follows:

1. Remove and discard the existing shear-type bolt, TORQ-RITE® nut and hardened flat washers from both front axle pivot connections. If necessary, clean the surface rust from the alignment collars and frame bracket surface and inspect for excess wear. Replace if worn.

2. Install a new shear-type bolt, TORQ-RITE nut and hardened flat washers into both front axle pivot

connections, **but do not fully tighten at this time.** The pivot connection fasteners should be tight enough to hold the flanged eccentric collar in place against the alignment guides and flat against the frame bracket, but loose enough to permit the hardened flat washers to rotate freely.

⚠**CAUTION: DO NOT apply an anti-sieze compound to the pivot connection hardware or allow undercoating, paint, 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.**

IMPORTANT: The eccentric collar must remain flat against the frame bracket throughout the alignment procedure (figure 22a). If the pivot connection fasteners are too loose, the eccentric collar may raise up on the alignment guide, resulting in an improper alignment (figure 22c). If this condition occurs during alignment, refer to the raised eccentric collar information in the troubleshooting section.

3. On both front axle pivot connections, inspect the orientation of the square alignment hole in the flanged eccentric collar (figure 21). The square alignment hole must be at the 12 o'clock position, which is the middle of the alignment adjustment range.

   If the square alignment hole is not at the 12 o'clock position, insert a ½-inch breaker bar into the square alignment hole in the flanged eccentric collar and rotate the collar until the square hole is at the 12 o'clock position.

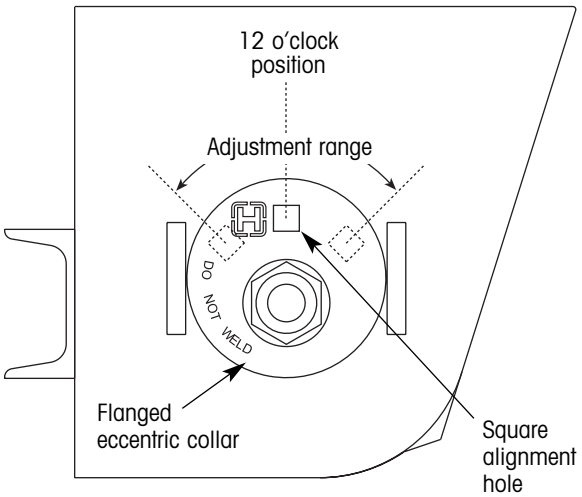


Figure 21. Eccentric collar orientation details

4. With the square alignment hole in the 12 o'clock position on both front axle pivot connections, recheck measurements "A" and "B" from the kingpin to each wheel-end extender pointer.

   If necessary, insert a ½-inch breaker bar into the square alignment hole in one of the flanged eccentric collars and adjust the axle forward by rotating the collar clockwise or rearward by rotating the collar counterclockwise.

5. While rotating the flanged eccentric collar (on the outboard side of the frame bracket), tap on the flanged concentric collar (on the inboard side of the frame bracket) with a rubber mallet.

IMPORTANT: The tapping allows the concentric and eccentric collars to move and adjust in unison. If the collars do not move and adjust in unison, the concentric collar may wedge against the frame bracket (figure 22b), causing an inaccurate alignment and an improper pivot connection that could potentially loosen. If this condition occurs during the alignment procedure, refer to the "wedged collar" information in the troubleshooting section.

6. If the flanged eccentric collar is rotated more than 45 degrees in either direction from the 12 o'clock position and alignment is still not achieved, leave this flanged eccentric collar at the 45-degree limit and go to the pivot connection on the other end of the axle. Rotate that flanged eccentric collar until alignment is achieved.

IMPORTANT: There is no change in axle adjustment when the flanged eccentric collar is rotated beyond 45 degrees from the 12 o'clock position in either the fore or aft direction.

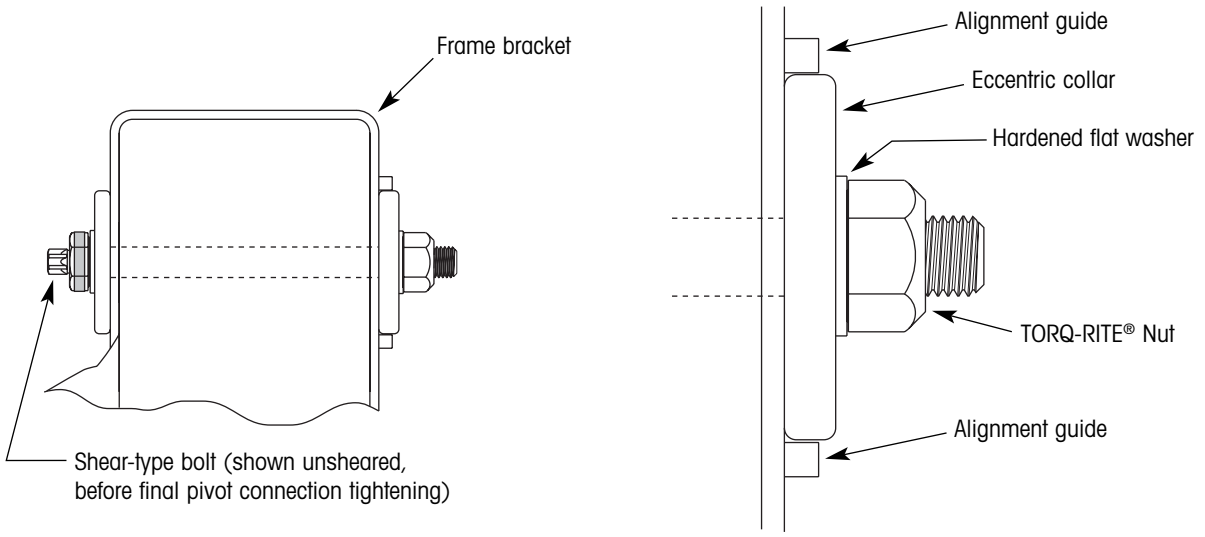


Figure 22a. Properly positioned eccentric collar

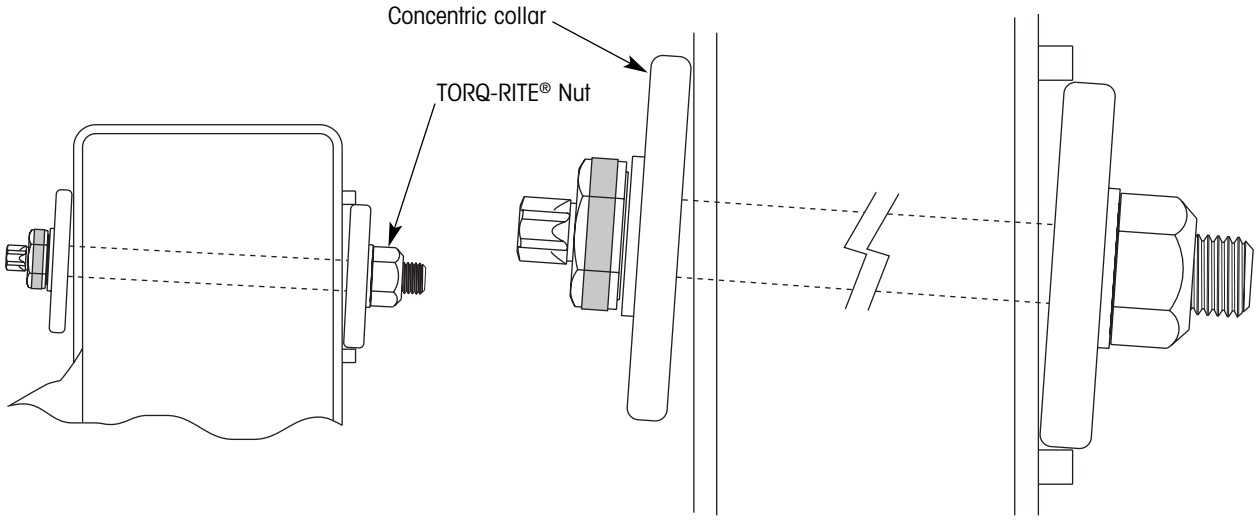


Figure 22b. "Wedged" pivot connection hardware

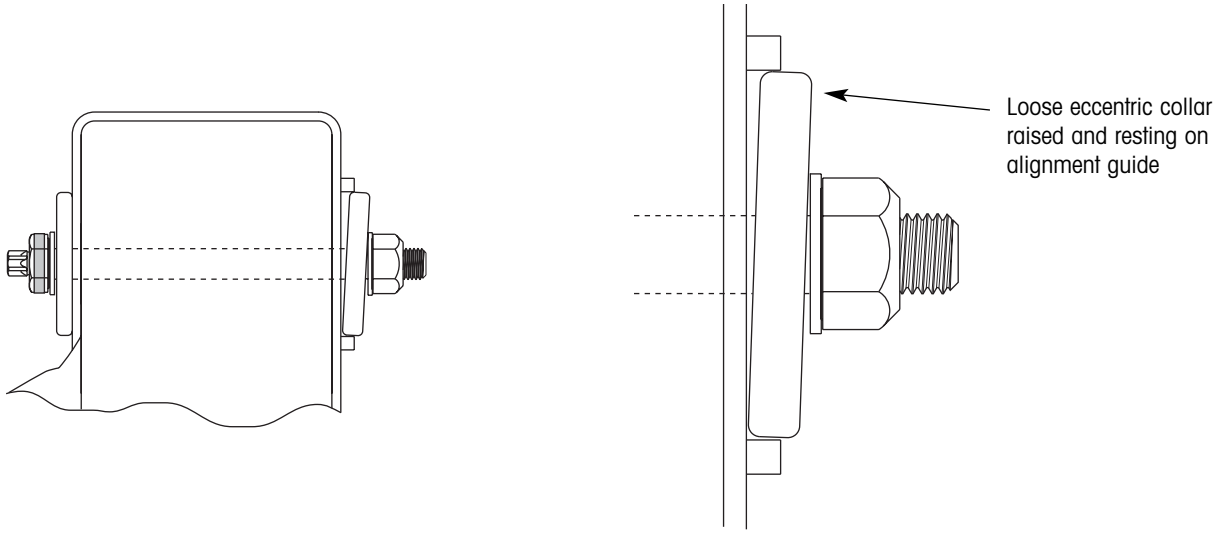


Figure 22c. "Raised" eccentric collar

7. Recheck measurements "A" and "B" from the kingpin to each wheel-end extender pointer.

   If necessary, continue this adjust-and-measure procedure until the difference between the "A" and "B" measurements is within the target value.

8. With the front axle aligned, visually inspect the eccentric and concentric collars on both pivot connections to ensure that they are in place between the alignment guides and flat against the frame bracket.

   If a collar is "wedged" or "raised", tap on the concentric collar (on the inboard side of the frame bracket) with a rubber mallet until it lays flat.

9. Hand tighten the pivot connection fasteners until the hardened flat washers do not rotate freely and recheck measurements "A" and "B" from the kingpin to each wheel-end extender pointer.

   If the difference between the "A" and "B" measurements is still within the target value, proceed with step 10.

   If the difference between the "A" and "B" measurements is not within the target value, repeat steps 3 through 8.

10. Using an E20 Torx socket, tighten the shear-type bolt on both front axle pivot connections until the Torx head shears off. This ensures the proper torque of 550 ft. lbs. (±45 ft. lbs.).

IMPORTANT: An improperly torqued pivot connection can result in injury and/or property damage.

Anyone who assembles or reassembles the pivot connection (OEMs, dealers, repair facilities, etc.) is responsible for the proper installation of the shear-type bolt.

Do not attempt to reuse a shear-type bolt. Since it requires 550 ft. lbs. (±45 ft. lbs.) of torque to achieve the proper clamping force, the shear bolt's reuse indicator will show if an attempt was made to reuse the bolt.

Failure to reach the required torque can result in an insufficient clamp load and unreliable axle alignment.

⚠**CAUTION: Always wear eye protection when operating pneumatic tooling.**

⚠**CAUTION: Make sure the socket is securely fastened to the pneumatic tooling.**

SCRUB ANGLE

To be within the acceptable scrub angle range, the rear axle must be aligned to the forward axle:

11. Following the manufacturer's recommended instructions, install wheel-end extenders on each end of the rear axle.

12. Determine rear axle target value as follows:

    a. Measure wheel-end extender length. Measure from the face of the wheel mounting to the tip of the wheel-end extender (figure 17).

    b. Read the rear axle target value from the following chart.*

WHEEL-END EXTENDER LENGTH	AXLE TRACK 71.5"	AXLE TRACK 77.5"
12"	±3/32"	±3/32"
13"	±3/32"	±3/32"
14"	±3/32"	±3/32"
15"	±3/32"	±3/32"
16"	±3/32"	±3/32"
17"	±3/32"	±3/32"
18"	±3/32"	±3/32"
19"	±3/32"	±3/32"
20"	±3/32"	±3/32"
21"	±3/32"	±3/32"
22"	±3/32"	±3/32"
23"	±3/32"	±1/8"
24"	±3/32"	±1/8"

Table 4. Scrub angle target values

*The rear axle (or scrub angle) target values presented in this chart have been pre-calculated for your convenience. To see the steps involved in this process and an example of a rear axle target value calculation, refer to the section titled Rear Axle Target Value Sample Calculation on page 19.

For example, suppose the measured length of your wheel-end extender is 18 inches and your trailer has a 71.5-inch axle track. First, find the 18-inch row in the table. Then, find the column for 71.5-inch axle track and read down the column. The value shown where 18-inch wheel-end extender length and 71.5-inch axle track meet is $\pm 3/32$ inch, which is the rear axle target value.

13. Using a trammel bar or a 12-foot tape measure with $1/32$-inch or millimeter increments, measure the distances "C" and "D" from the front axle center to the rear axle center (figure 20).

IMPORTANT: If the tape measure is used, the tensioning device must also be used. The same lateral tension (pulling force) applied to the tape measure when measuring distance "C" must also be applied when measuring distance "D". When making the measurements, closely monitor the tensioning device scale to make sure that the same pulling force is used in both measurements.

14. Subtract the smaller of the "C" and "D" measurements from the larger of the two, then compare this difference with the rear axle target value obtained in step 12.

    If the difference between the "C" and "D" measurements is smaller than or equal to the target value, the axle is within specification and no alignment is necessary.

    If the difference between the "C" and "D" measurements is larger than the target value, the axle must be adjusted to bring this difference within the target value.

    Repeat steps one through 10 of this procedure to realign the rear axle. On trailers equipped with more than two axles, measure and if necessary adjust each axle. Measure from the front axle to each remaining axle to prevent inaccuracies.

WELDED COLLAR STYLE PIVOT CONNECTION

THRUST ANGLE

If the front axle is found to be out of the acceptable thrust angle range, it must be realigned as follows:

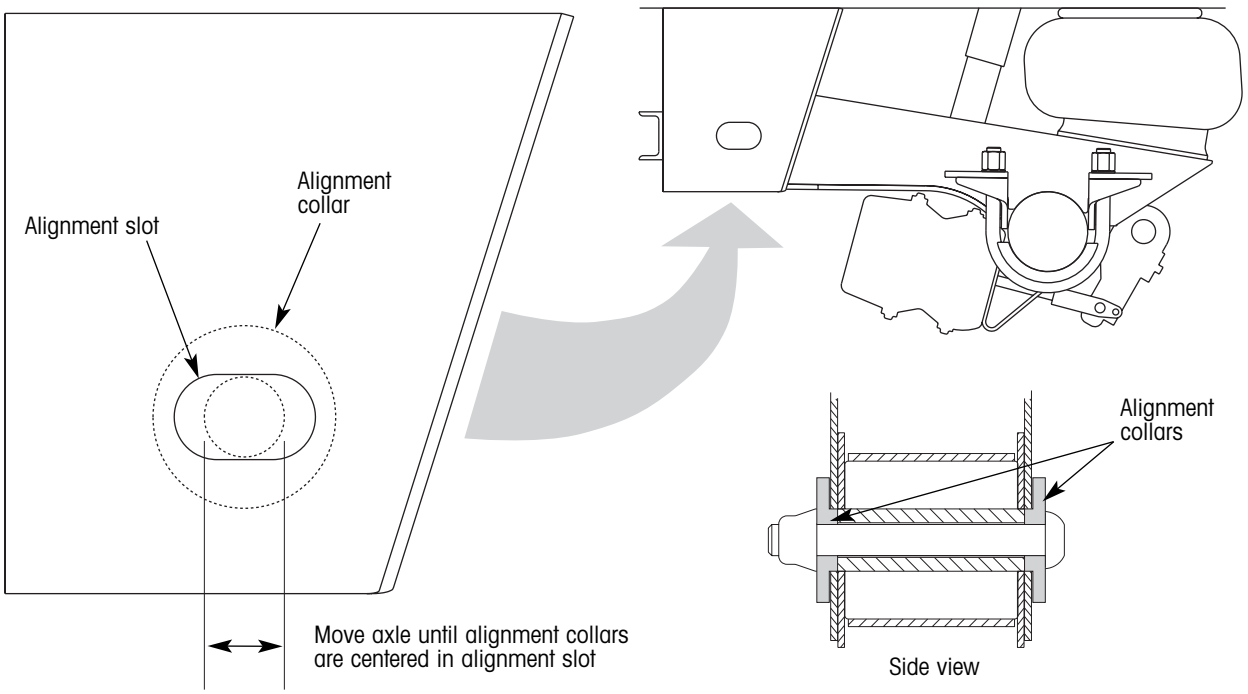


Figure 23. Axle positioning on the welded-collar type frame bracket when major adjustment (both axle ends) is necessary

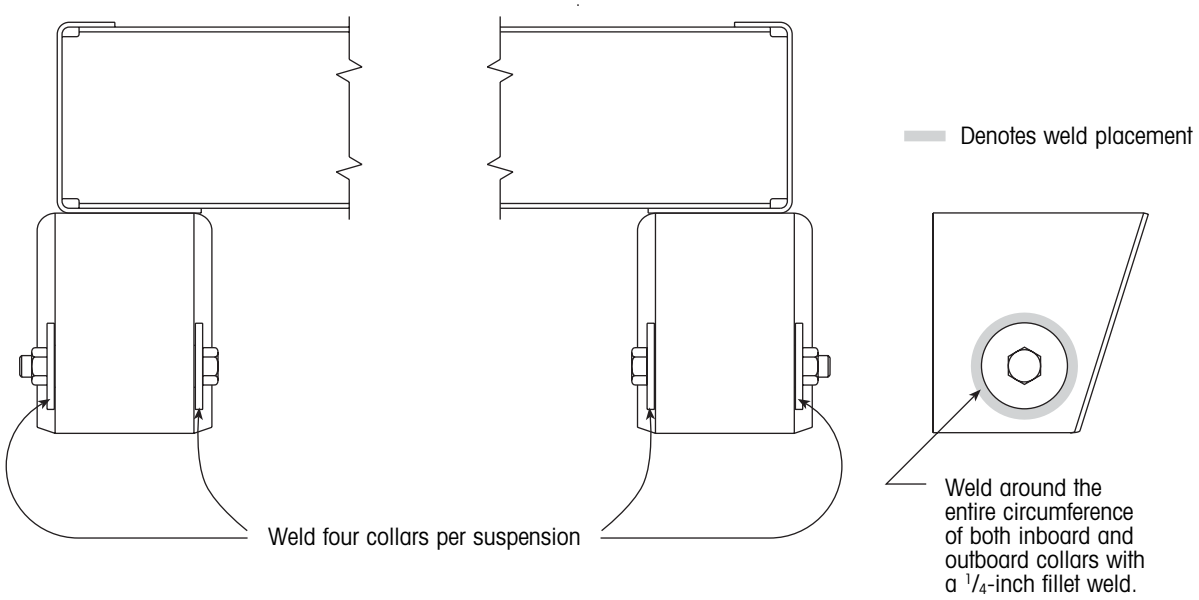


Figure 24. Welding locations on welded collars

1. Select one side of the axle and carefully grind or cut the welds securing the inboard and outboard alignment collars to the frame bracket.

IMPORTANT: Do not remove the $1^{1}/_{8}$-inch heavy hex cap screw and nut or huck fastener. Axle alignment with the welded collar style pivot connection does not require pivot joint disassembly.

IMPORTANT: On model HT250U "Y" beam underslung suspensions, the alignment slots are on the beam assembly, and the inboard and outboard alignment collars are welded to the beam assembly itself.

2. Recheck measurements "A" and "B" from the trailer kingpin to each wheel-end extender pointer. Move the loose axle end fore or aft until the difference between the "A" and "B" measurements is within the target value.

   If the alignment collars can no longer be moved within the alignment slots in the frame bracket and the axle is still not within the target value, the welds on the inboard and outboard alignment collars on the other side of the axle must also be carefully ground or cut loose. With both axle ends loose, move the axle until the alignment collars are centered in the frame bracket alignment slots (figure 23). The axle can now be repositioned until the difference between the "A" and "B" measurements is within the target value.

3. Remove all equipment used to reposition the axle.

4. Tack weld the alignment collars in place.

5. Verify correct alignment.

6. Weld around the inboard and outboard collars on each end of the axle with a $^{1}/_{4}$-inch fillet weld (figure 24).

7. Verify that the weld goes around the entire circumference of all four collars.

8. If the $1^{1}/_{8}$-inch heavy hex cap screw and nut is used, weld the nut to the cap screw.

SCRUB ANGLE

To be within the acceptable scrub angle range, the rear axle must be aligned to the forward axle as follows:

9. Following the manufacturer's recommended instructions, install wheel-end extenders on each end of the rear axle.

10. Determine rear axle target value as follows:

    a. Measure wheel-end extender length. Measure from the face of the wheel mounting to the tip of the wheel-end extender (figure 17).

    b. Read the rear axle target value from the Scrub Angle Target Value Chart on page 13.

       For example, suppose the measured length of your wheel-end extender is 18 inches and your trailer has a 71.5-inch axle track. First, find the 18-inch row in the table. Then, find the column for 71.5-inch axle track and read down the column. The value shown where 18-inch wheel-end extender length and 71.5-inch axle track meet is $\pm 3/32$ inch, which is the rear axle target value.

11. Using a trammel bar or a 12-foot tape measure with $1/32$-inch or millimeter increments, measure the distances "C" and "D" from the front axle center to the rear axle center (figure 20).

IMPORTANT: If the tape measure is used, the tensioning device must also be used. The same lateral tension (pulling force) applied to the tape measure when measuring distance "C" must also be applied when measuring distance "D". When making the measurements, closely monitor the tensioning device scale to make sure that the same pulling force is used in both measurements.

12. Subtract the smaller of the "C" and "D" measurements from the larger of the two, then compare this difference with the rear axle target value obtained in step 10.

    If the difference between the "C" and "D" measurements is smaller than or equal to the target value, the axle is within specification and no alignment is necessary.

    If the difference between the "C" and "D" measurements is larger than the target value, the axle must be adjusted to bring this difference within the target value.

    Repeat steps one through eight of this procedure using the "C" and "D" measurements to realign the rear axle. On trailers equipped with more than two axles, measure and if necessary adjust each additional axle. Measure from the front axle to each remaining axle to prevent inaccuracies.

QUIK-ALIGN® STYLE PIVOT CONNECTION HARDWARE TROUBLESHOOTING

WEDGED PIVOT-CONNECTION HARDWARE

APPEARANCE

The pivot-connection hardware (eccentric and concentric collars, hardened washers, shear-type bolt and TORQ-RITE® nut) is not flat against the frame bracket (Figure 22b, page 12). The shear-type bolt and the eccentric and concentric collars are "cockeyed" and not in their proper positions.

CAUSES

While being adjusted, the concentric (or inboard) collar did not move in unison with the eccentric (or outboard) collar.

RESULTS

An inaccurate alignment and an improper pivot connection that could potentially loosen.

SOLUTIONS

Tap on the concentric collar with a rubber mallet while rotating the eccentric collar.

Visually inspect the pivot connection after alignment. If the eccentric and concentric collars are "wedged" against the frame bracket and the Torx head on the shear-type bolt has been sheared, remove and discard the pivot connection hardware and redo the alignment using new pivot connection hardware. If the eccentric and concentric collars are "wedged" against the frame bracket but the Torx head on the shear-type bolt has not yet been sheared, carefully loosen the pivot connection and redo the alignment.

RAISED ECCENTRIC COLLAR

APPEARANCE

The eccentric collar is not flat against the frame bracket; it is resting on an alignment guide. However, the shear-type bolt is properly positioned and the concentric collar is flat against the frame bracket (Figure 22c, page 12).

CAUSES

When installing the TORQ-RITE nut on the shear-type bolt, the nut was not tightened sufficiently. Initially, the pivot connection fasteners must be tight enough to hold the eccentric collar in place against the alignment guides and flat against the frame bracket, but loose enough to permit the hardened flat washers to rotate freely. The loose nut allowed the eccentric collar to move freely and work its way onto an alignment guide.

RESULTS

Initially, the alignment appears to be accurate. However, when the eccentric collar eventually slips off the alignment guide, the pivot connection will become loose and alignment accuracy will be lost.

SOLUTIONS

During assembly, tighten the TORQ-RITE nut so the eccentric collar is in place against the alignment guides and flat against the frame bracket, but loose enough to permit the hardened flat washers to rotate freely.

Visually inspect the eccentric collar after alignment. If the eccentric collar is resting on an alignment guide in the "raised" position and the Torx head on the shear-type bolt has been sheared, remove and discard the pivot connection hardware and redo the alignment using new pivot connection hardware. If the eccentric collar is resting on an alignment guide in the "raised" position but the Torx head on the shear-type bolt has not yet been sheared, carefully loosen the pivot connection and redo the alignment.

FRONT AXLE TARGET VALUE SAMPLE CALCULATION

1. Determine front axle target value as follows:

   a. Measure the point-to-point width of the installed wheel-end extenders (figure 25).

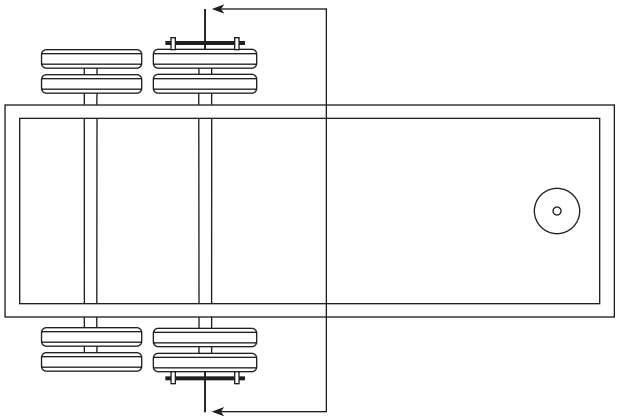


Figure 25. Measuring target value

As an alternative to measuring the point-to-point width of the wheel-end extenders, the following method can be used to approximate the distance (see figure 26):

$$\frac{\text{wheel face-to-face distance} + 2(\text{wheel-end extender length})}{\text{point-to-point width of the installed wheel-end extenders}}$$

While the wheel face-to-face distance will vary with different wheel equipment, the following values can be used to approximate the distance without significantly impacting the alignment tolerance:

79.2" for a 77.5" axle track
73.2" for a 71.5" axle track

   b. Multiply this width by 0.00175*. The resulting product is the front axle target value.

For example, suppose the point-to-point width of the wheel-end extenders is 122.625 inches. Multiplying this by the 0.00175 constant produces:

$$122.625" \times 0.00175 = \pm 0.215"$$

This provides the front axle target value.

* For axle to kingpin distances of 10 feet or more, the 0.00175 constant can be approximated by using the sine of 0.1 degrees.

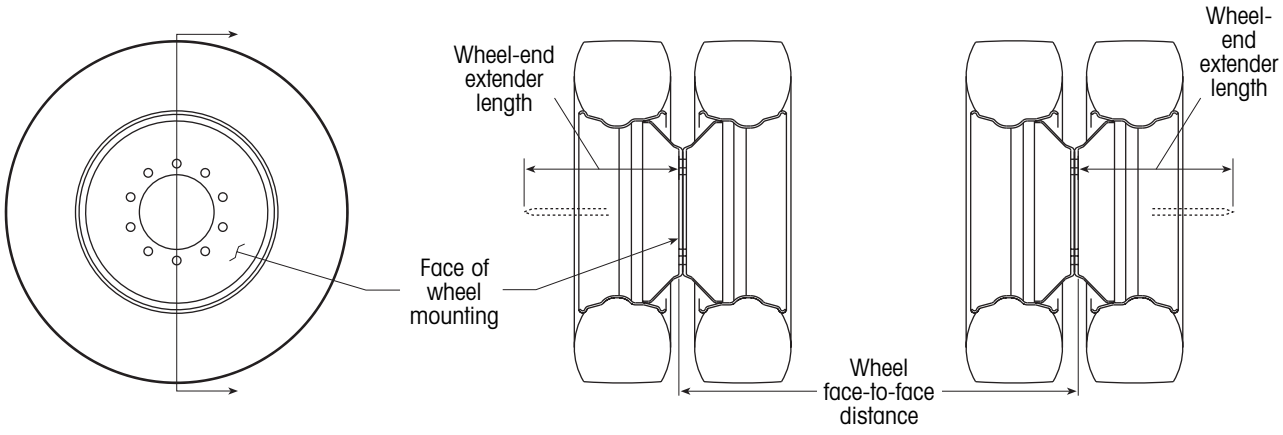


Figure 26. An alternative to measuring the point-to-point width of the wheel-end extenders

REAR AXLE TARGET VALUE SAMPLE CALCULATION

1. Determine rear axle target value as follows:

   a. Measure the point-to-point width of the installed wheel end extenders (figure 27).

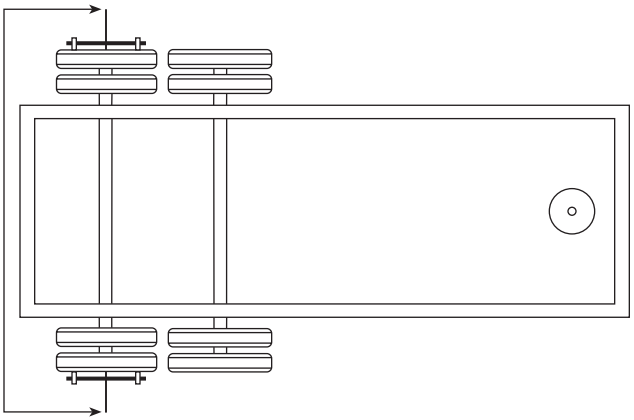


Figure 27. Measuring target value

As an alternative to measuring the point-to-point width of the wheel-end extenders, the following method can be used to approximate the distance (see figure 28):

$$\frac{\text{wheel face-to-face distance} + 2(\text{wheel-end extender length})}{\text{point-to-point width of the installed wheel-end extenders}}$$

While the wheel face-to-face distance will vary with different wheel equipment, the following values can be used to approximate the distance without significantly impacting the alignment tolerance:

79.2" for a 77.5" axle track
73.2" for a 71.5" axle track

   b. Multiply this measurement by 0.00087*. The resulting product is the rear axle target value.

For example, suppose the point-to-point width of the wheel-end extenders is 122.625 inches. Multiplying this by the 0.00087 constant produces:

122.625" × 0.00087 = ±0.107"

This provides the rear axle target value.

* For axle to kingpin distances of 10 feet or more, the 0.00087 constant can be approximated by using the sine of 0.05 degrees.

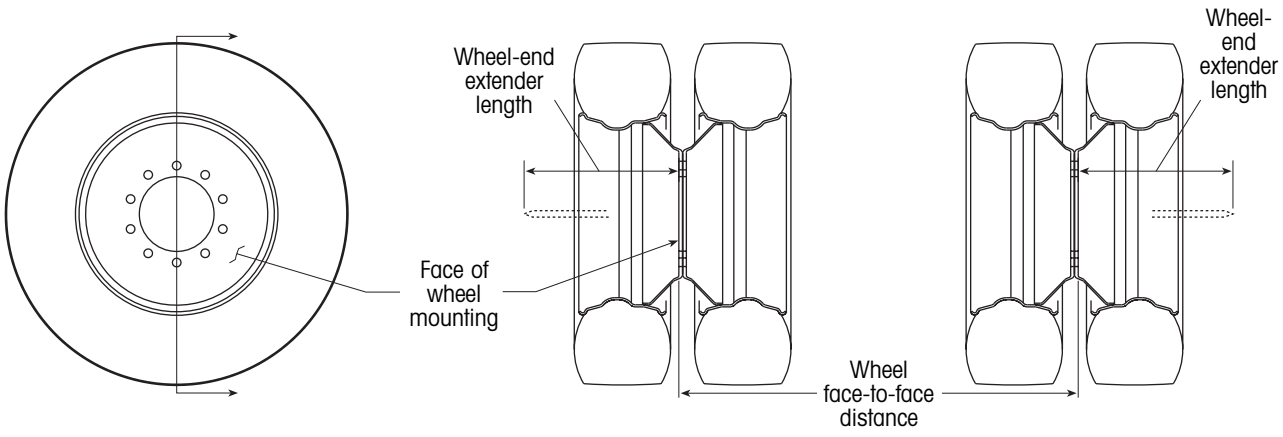


Figure 28. An alternative to measuring the point-to-point width of the wheel-end extenders

HENDRICKSON®

Trailer Suspension Systems
2070 Industrial Place SE
Canton, OH 44707-2600 USA

866.RIDEAIR (866.743.3247)
330.489.0045
Fax 800.696.4416

www.hendrickson-intl.com

Trailer Suspension Systems
250 Chrysler Drive, Unit #3
Brampton, ON L6S 6B6 Canada

905.789.1030
Fax 905.789.1033

L579 Rev B 9.5M 04-03 Printed in United States of America

TECHNICAL PROCEDURE

TRI-FUNCTIONAL® BUSHINGS

SUBJECT: Bushing Tube Spacer Inspection/Replacement Procedure

LIT NO: L750

DATE: January 2001

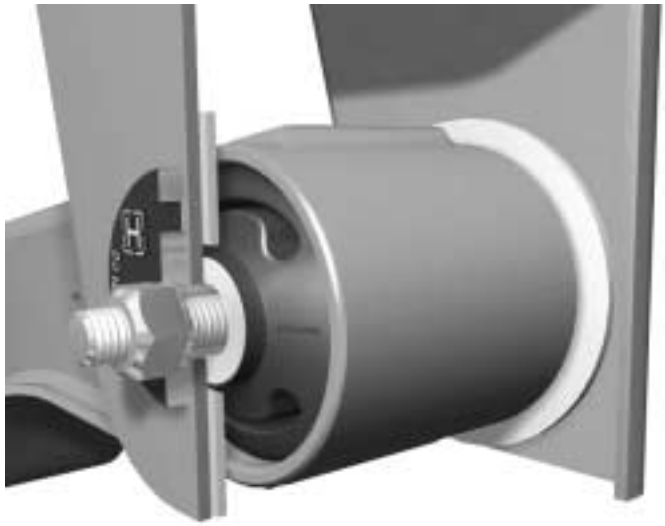


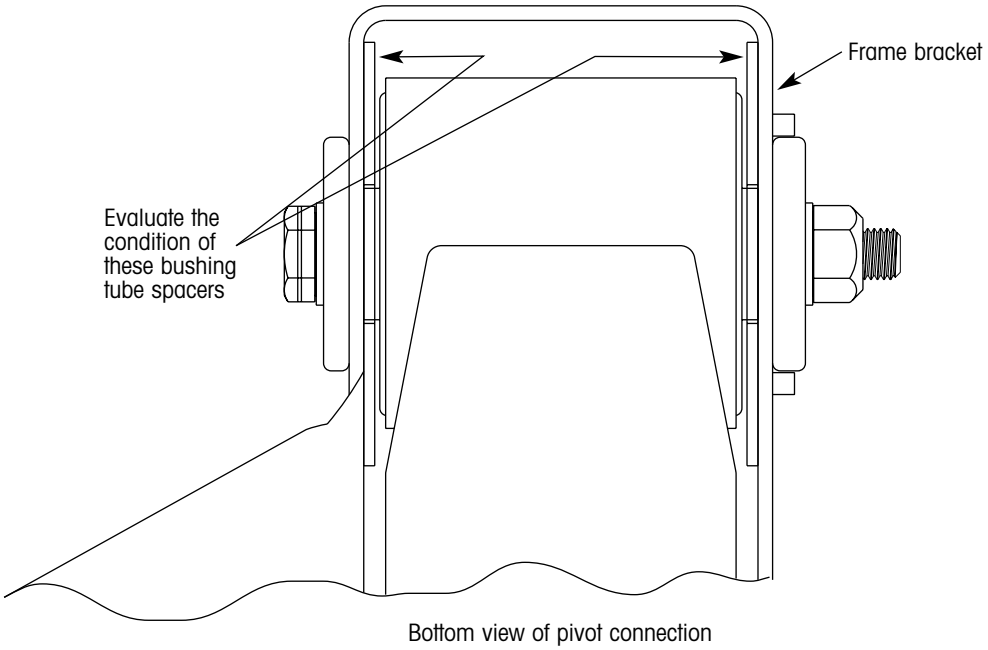
TABLE OF CONTENTS

For The Road Ahead

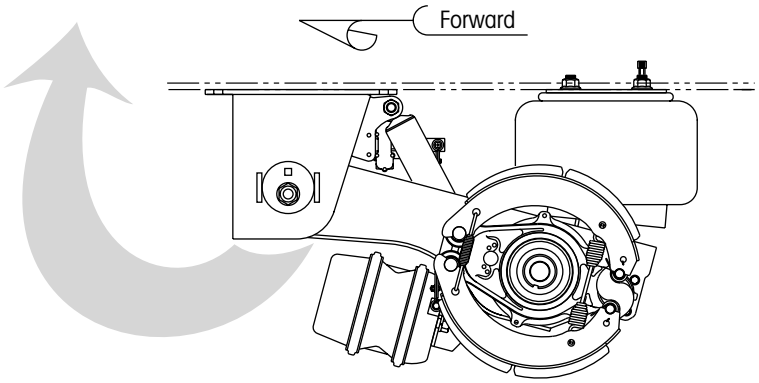
HENDRICKSON

INSPECTING THE BUSHING TUBE SPACERS

Periodic inspections are an important part of your air suspension maintenance routine. Of particular inspection importance are the bushing tube spacers, which are located inside the frame brackets on each side of the TRI-FUNCTIONAL® BUSHING. A typical inspection should include an evaluation of all bushing tube spacers on the trailer.



Bottom view of pivot connection



During this inspection, you should visually verify that the bushing 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 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.

However bushing tube spacer "wear through", where the bushing tube spacer is completely missing or has been cut or worn-through, is considered abnormal. If an inspection reveals missing, cut or worn-through bushing tube spacers, a closer, more detailed inspection (detailed on the following pages) is required to prevent more serious or costly problems and to prolong the life of the suspension.

The following page illustrates these bushing tube spacer concepts with some typical examples.

NORMAL

Normal bushing tube spacer

"CUPPED" — ALSO NORMAL

An example of a "cupped" bushing tube spacer. Friction-generated heat causes the spacer to "form" or "cup" around the bushing and bushing tube. This is normal as long as the bushing tube spacer remains intact and does not become cut or worn-through.

"WORN-THROUGH" — ABNORMAL

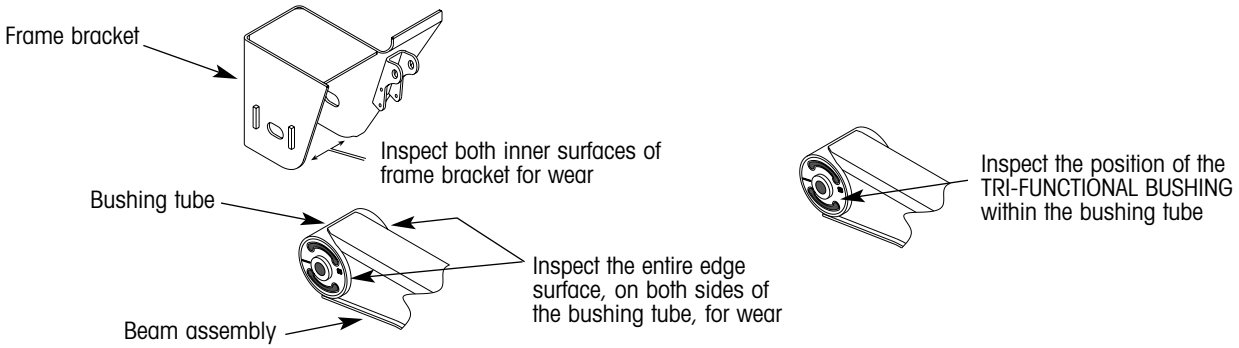
Examples of "worn-through" bushing tube spacers. The spacer on the right is an example of extreme wear. Its circumference has been completely trimmed by the bushing tube.

IF BUSHING TUBE SPACER "WEAR THROUGH" IS FOUND

If a missing, cut or otherwise worn-through bushing tube spacer is discovered, the suspension pivot connection must be disassembled and the beam assembly lowered to check for potential beam and/or frame bracket wear. Refer to L427 Bushing Replacement Procedures for complete pivot connection disassembly instructions.

⚠ WARNING: CHOCK THE TRAILER WHEELS AND APPLY THE TRAILER PARKING BRAKES SO THAT IT CANNOT MOVE DURING DISASSEMBLY.

With the beam assembly lowered, inspect the inner surfaces of the frame bracket and the edges of the bushing tube for wear. Also inspect the position of the TRI-FUNCTIONAL® BUSHING within the bushing tube. The condition of these three areas will dictate the repair requirements or the necessity to replace any parts as instructed in the table on page six.

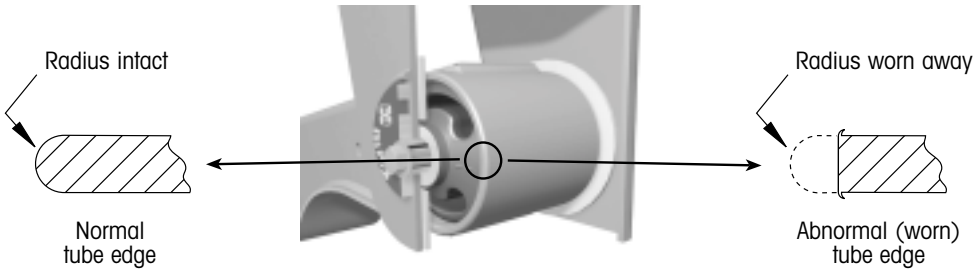


EVALUATING FRAME BRACKET WEAR

Some wear (polished metal) on the inner surface of the frame bracket is considered normal, due to the pivoting motion inherent with this connection. Gouges or grooves worn into the frame bracket are abnormal. If any gouges, grooves or missing metal is found, the frame bracket must be replaced. Refer to L341 INTRAAX® Installation Procedures for complete frame bracket replacement instructions on INTRAAX and VANTRAAX® suspensions, or L577 HT/HS/HK Installation Procedures for frame bracket replacement instructions on HT, HS or HK suspensions. After the frame bracket evaluation is complete, the next step is to evaluate bushing tube wear.

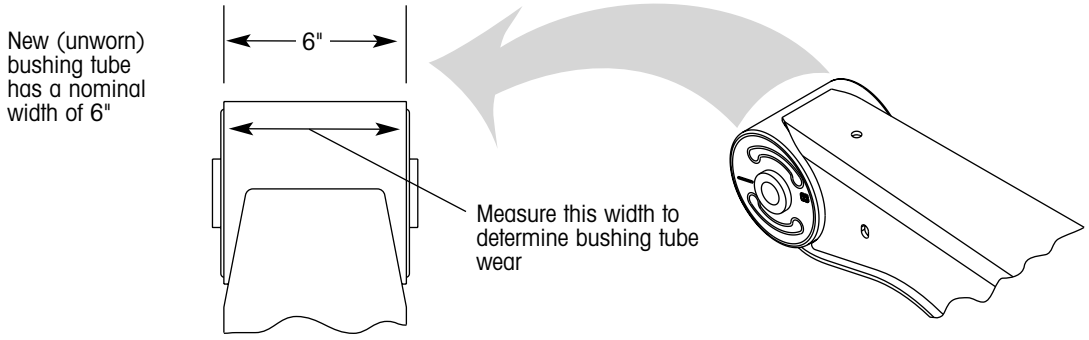
EVALUATING BUSHING TUBE WEAR

Some wear (polished metal) on the edge of the bushing tube is considered normal, due to the pivoting motion inherent with this connection. Missing metal, where the bushing tube's radius edge has been worn away, is



considered abnormal. If you see this kind of wear, the next step is to determine how much wear has occurred and whether the edge can be repaired or whether the beam assembly (or HALF-TRAAX) must be replaced.

The bushing tube, when new, has a nominal width of six inches with the exception of the HKA180, which has a nominal width of three and one-eighth inches. The amount of bushing tube wear can be determined by measuring the width of the worn bushing tube and subtracting this measured dimension from six (or three and



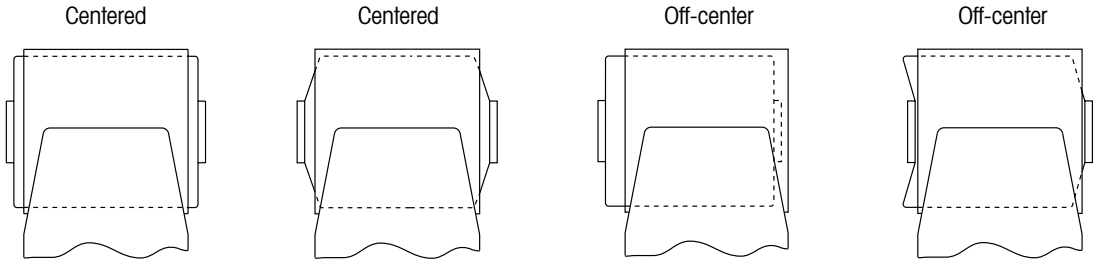
one-eighth) inches. For example, suppose your inspection reveals extensive bushing tube wear and the bushing tube measures five and fifteen-sixteenths inches. Subtracting five and fifteen-sixteenths from six reveals the amount of bushing tube material that has worn away, in this case one-sixteenth of an inch.

$$6" - 5^{15}/_{16}" = {}^{1}/_{16}"$$

After the amount of bushing tube wear has been determined, the next step is to evaluate the bushing position within the bushing tube.

EVALUATING BUSHING POSITION WITHIN THE BUSHING TUBE

For evaluation purposes, the TRI-FUNCTIONAL® BUSHING is considered either centered or off-center with respect to the bushing tube. The TRI-FUNCTIONAL BUSHING is considered off-center when a portion of it extends outside of the bushing tube on one side and not on the other. Some typical examples are shown below.



Typical examples of bushing position relative to the bushing tube (not representative of every possible case).

The TRI-FUNCTIONAL BUSHINGS will flex and elongate within the bushing tube to control the forces generated by braking, accelerating, irregular road surfaces, etc. Because of this, it may be difficult at times to tell the difference between normal bushing operation and an off-center bushing. The key to identifying an off-center bushing is the bushing tube spacers. If the bushing tube spacers are in serviceable condition (not missing, cut, worn-through or otherwise deteriorated), the bushing cannot be off-center. However if a bushing tube spacer is worn-through, the potential exists for an off-center condition (as described above).

Now that each component has been evaluated, refer to the following table for repair recommendations.

REPAIR RECOMMENDATIONS

Now that each pivot connection component has been evaluated (because missing, cut or otherwise worn-through bushing tube spacers were found), use the following table to determine the correct repair action. Do not add more bushing tube spacers than what is recommended in the table. A slight degree of freedom is required by the TRI-FUNCTIONAL® BUSHING within the frame bracket to flex, elongate and otherwise absorb forces generated by braking, accelerating and irregular road surfaces. **If more bushing tube spacers than what is recommended are added, the TRI-FUNCTIONAL BUSHING will not have enough room within the frame bracket to function properly, and severe damage to the suspension could result.**

IF THE BUSHING TUBE MEASURES:	AND THE BUSHING IS:	THEN:
6" (NO WEAR ON THE BUSHING TUBE)	Centered [1]	1. Replace both bushing spacers and realign the axle.[2]
	Off-center [1, 3]	1. Install new bushing.[4] Refer to L427 Bushing Replacement Procedures for complete instructions. 2. Replace both bushing spacers and realign the axle.[2]
5 7/8" TO 6" (WEAR UP TO 1/8" ON THE BUSHING TUBE)	—	1. Remove existing bushing and dress the radius on the bushing tube edge according to the instructions in this bulletin. 2. Install new bushing.[4] Refer to L427 Bushing Replacement Procedures for complete instructions. 3. Replace both bushing spacers and realign the axle.[2]
5 3/4" TO 5 7/8" (WEAR OF 1/8" TO 1/4" ON THE BUSHING TUBE)	—	1. Remove existing bushing and dress the radius on the bushing tube edge according to the instructions in this bulletin. 2. Install new bushing.[4] Refer to L427 Bushing Replacement Procedures for complete instructions. 3. Install three new bushing spacers; one on the non-worn side of the bushing tube, and two on the worn side. Realign the axle.[2]
LESS THAN 5 3/4" (MORE THAN 1/4" OF WEAR ON THE BUSHING TUBE)	—	1. Replace the HALF-TRAAX or the beam assembly. Refer to L533 HALF-TRAAX Axle and Beam Removal/Replacement Procedures for complete HALF-TRAAX replacement instructions or L577 HT/HS/HK Installation Procedures for complete beam replacement instructions. 2. Replace both bushing spacers and realign the axle.[2]

[1] Refer to the paragraph titled "EVALUATING BUSHING POSITION WITHIN THE BUSHING TUBE" for centered/off-center bushing definitions.

[2] Refer to L579 alignment procedures for complete axle alignment instructions.

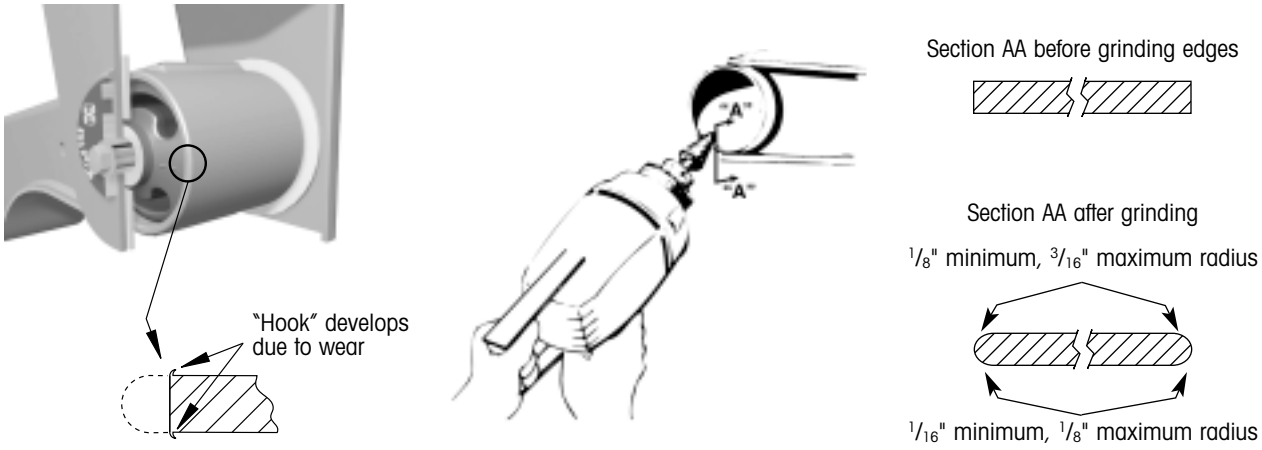
[3] DO NOT attempt to center an off-center bushing. There is no acceptable procedure and any attempt will likely do more harm than good. Simply remove the off-centered bushing and install a new one.

[4] Install the new bushing from the worn side of the bushing tube. Refer to the paragraph titled "INSTALLING THE NEW BUSHING" for complete details.

BUSHING TUBE EDGE DRESSING

As described in the repair recommendations table, it is acceptable to reuse the bushing tube when ¼-inch of wear or less is observed. However, the bushing tube edge must be dressed before the new bushing is installed. When the bushing tube wears, a slight "hook" or "tooth" of metal may develop on both inside and outside diameters of the tube. As the vehicle turns, the unique design of the TRI-FUNCTIONAL® BUSHING allows it to elongate slightly to absorb the forces associated with road surface, load, etc. When the turn is complete and those particular forces are no longer present, the TRI-FUNCTIONAL BUSHING returns to its original position. If the "hook" or "tooth" on the bushing tube is not removed, it can "bite" into the rubber TRI-FUNCTIONAL BUSHING when elongated and hold or prevent it from returning to its original position (unacceptable). As this is repeated, the TRI-FUNCTIONAL BUSHING will eventually be pulled out of the bushing tube. The rubber TRI-FUNCTIONAL BUSHING may also become damaged by these irregular edges.

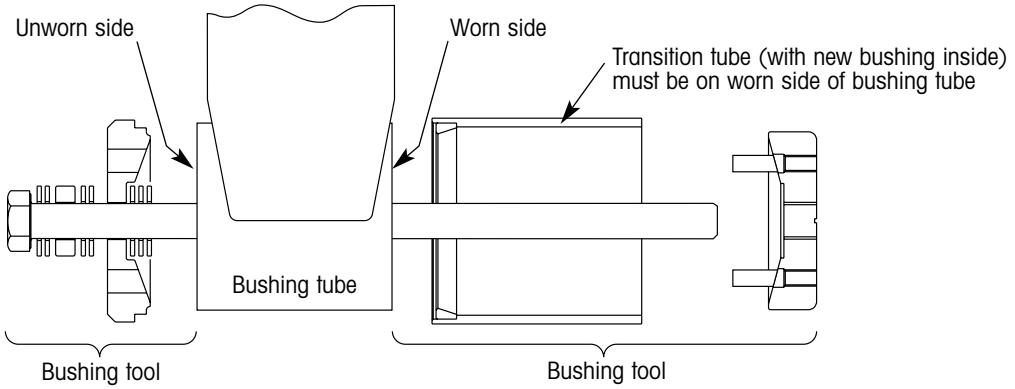
Before attempting to install a new bushing, the worn bushing tube edge must be dressed. Use a grinder to re-establish a radius on the edge of the bushing tube as shown below.



⚠WARNING: AFTER REASSEMBLY, REMOVE WHEEL CHOCKS AND RELEASE THE TRAILER PARKING BRAKES BEFORE MOVING THE TRAILER.

INSTALLING THE NEW BUSHING

The new bushing must be installed from the worn side of the bushing tube. After the bushing tube edge and inside surface have been properly prepared, assemble the bushing tool as shown below so the new bushing is installed from the worn side of the bushing tube. Refer to L427 Bushing Replacement Procedures for complete bushing tool and bushing replacement details.



Call the Hendrickson technical services department at 800-455-0043 in the United States or 800-668-5360 in Canada for any additional technical support.

Trailer Suspension Systems
2070 Industrial Place SE
Canton, OH 44707-2600 USA
800.455.0043
330.489.0045
Fax 800.696.4416

HENDRICKSON

Trailer Suspension Systems
250 Chrysler Drive, Unit #3
Brampton, ON L6S 6B6 Canada
905.789.1030
Fax 905.789.1033

L750 12M 1-01 Printed in United States of America.

www.hendrickson-intl.com

TECHNICAL PROCEDURE

HENDRICKSON SUSPENSION SYSTEMS

SUBJECT: Welding Procedures
LIT NO: L64
DATE: February 2000 **REVISION:** E

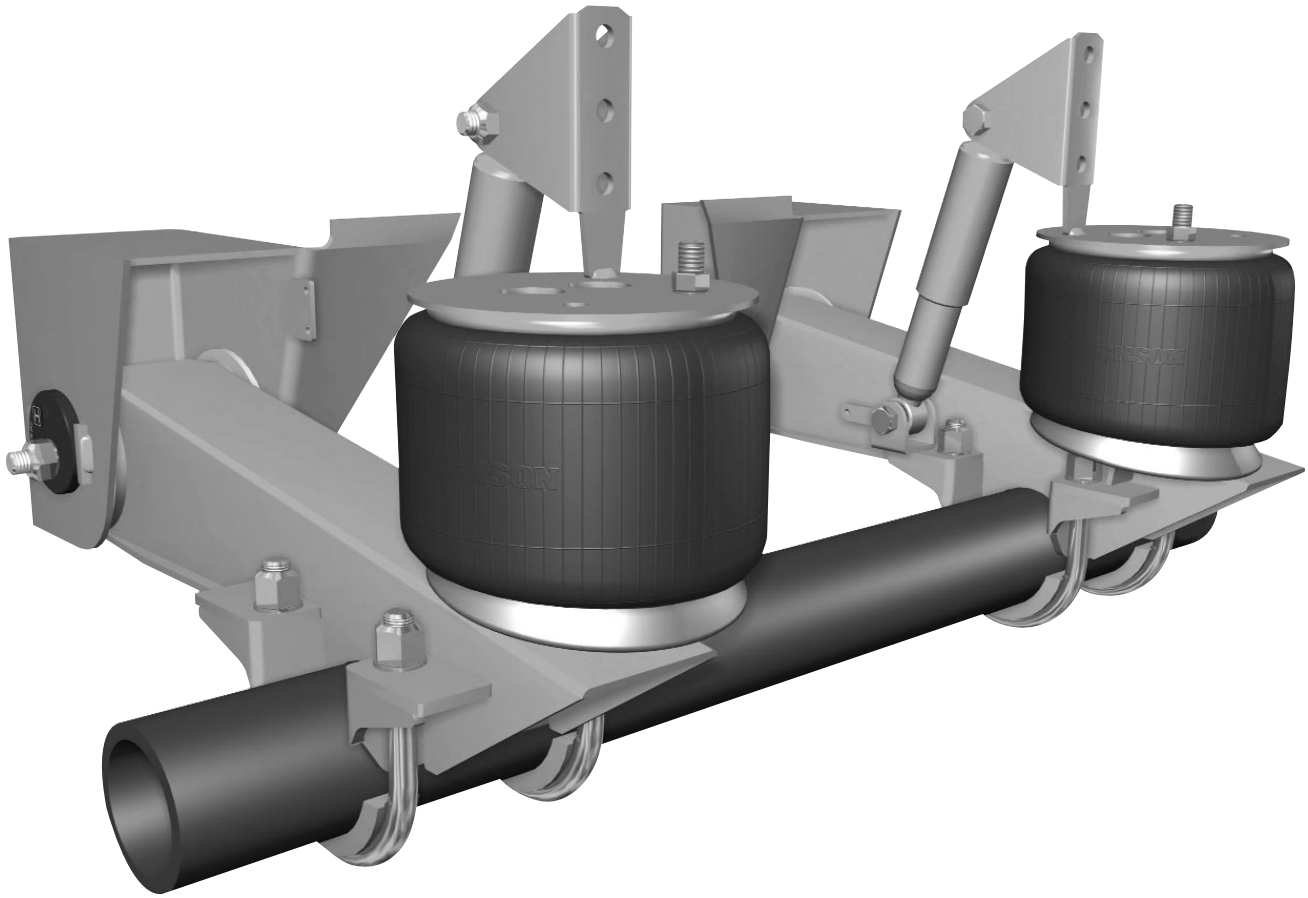


TABLE OF CONTENTS

For The Road Ahead

HENDRICKSON

⚠**WARNING: IF THESE PROCEDURES AND SPECIFICATIONS ARE NOT FOLLOWED, DAMAGE TO THE AXLE OR SUSPENSION COULD RESULT. THE RESULTING AXLE OR SUSPENSION DAMAGE COULD CAUSE AN ACCIDENT, PROPERTY DAMAGE AND/OR SERIOUS INJURY.**

NOTE: Suspension U-bolt installation and torquing should occur after completing the axle connection weld and allowing for sufficient cool-down time.

AXLE WELDING PARAMETERS — HT SUSPENSIONS ONLY

NOTE: A welder qualified in 2G position per ANSI/AWS D1.1-94 Section 5 Part C "Welder Qualification" must perform the welding.

NOTE: The specification shown below is for horizontal (2F) positioning. For flat (1F) positioning, see "Alternative Axle Weld Procedure" in the Appendix.

1. Suspension components and their mating parts must be at a minimum temperature of 60ºF (15.5ºC) and free from moisture, dirt, scale, paint and grease.

NOTE: Preheating the axle connection at the axle and suspension seat may be recommended and/or required by the axle manufacturer. Consult axle manufacturer for their axle preheating specifications and the applicable effect on their warranty coverage.

2. All axle welds must be performed in a flat or horizontal position.

3. Achieve spray arc transfer with the following welding parameters:

- Standard Electrode: AWS E-7018 (Oven Dried)
  - — .125 DIA. 120-140 AMPS D.C. ELECTRODE POSITIVE
  - — .156 DIA. 120-160 AMPS D.C. ELECTRODE POSITIVE
- Standard Wire: AWS ER-70S-6
  - — .045 DIA. (i.e., LA-56 or NS-115)
- Optional Wire: AWS ER-70S-3
  - — .045 DIA. (i.e., LA-50 or NS-101)
- Volts: 26-30 DCRP
- Current: 275-325 AMPS
- Wire Feed Speed: 380-420 IPM
- Electrode Extension: $^3/_4$-1 inch
- Gas: 86% Ar 14% CO_2 at 30 to 35 CFH

NOTE: Any deviation from these welding parameters must be approved by Hendrickson Trailer Suspension Systems in writing.

SUSPENSION BEAM AND AXLE SETUP — HT SUSPENSIONS

1. Use a **clamping device** to secure the centered axle onto the positioned beams.

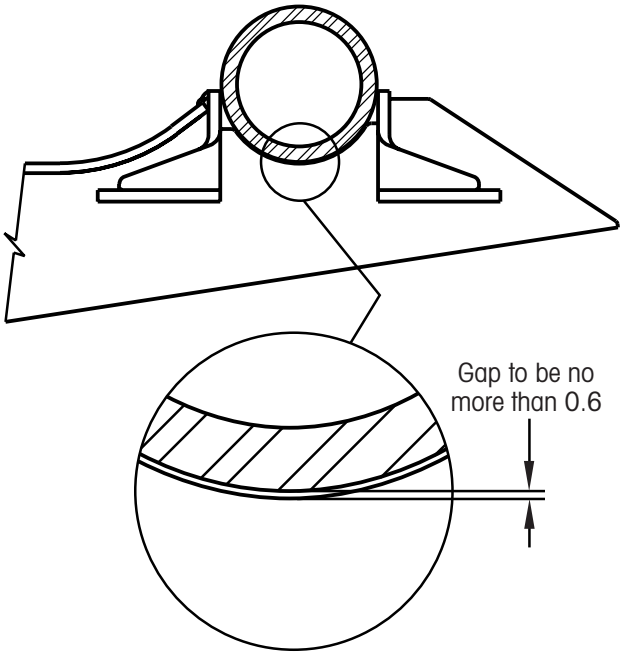
2. Use the Hendrickson locating fixture to properly position the suspension beams.

NOTE: Refer to "Using the 'HT' Series Fixture" in L577 *HT/HS/HK Installation Instructions*.

NOTE: If the Hendrickson locating fixture is not available, then refer to "Axle Installation without Fixturing" in L577 *HT/HS/HK Installation Instructions*.

IMPORTANT: At least one side of each axle seat radius must be tight against the axle. Any resulting gap must be no more than $^{1}/_{16}$ inch (Figure 1).

3. Place a 1-inch long tack weld in the center of each forward trailing arm/axle connection. There is one tack weld per suspension beam (Figure 2).



(All dimensions in inches unless noted)

Figure 1. Axle seat gap

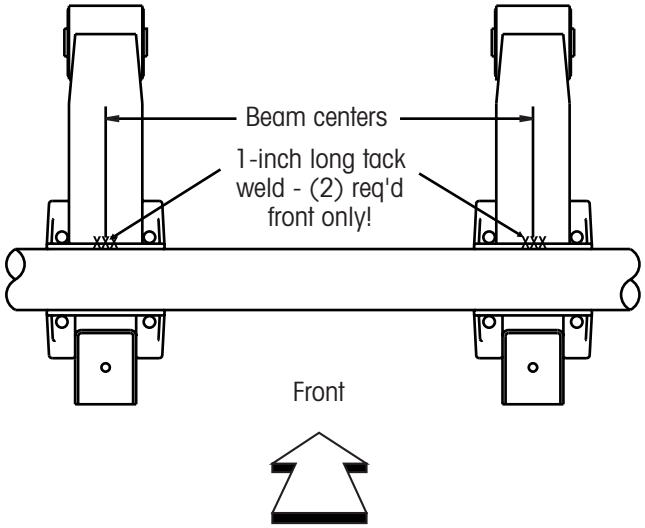


Figure 2. Locations of tack weld

AXLE WELD PROCEDURE — HT SUSPENSIONS

NOTE: If you are adjusting the weld position to the horizontal 2F position, with the suspension beams in the horizontal position, follow the welding procedure shown in Figure 3.

NOTE: If you are welding the 1F position with the suspension beams oriented in the vertical position, refer to the "Alternative Axle Weld Procedure" found in the Appendix.

IMPORTANT: Do not use attachment welds on an INTRAAX® axle.

⚠**CAUTION:** **Avoid all cold laps and undercuts. Fill all craters. Clean weld between each pass. If these steps are not followed, then failure may occur with the axle-to-suspension connection.**

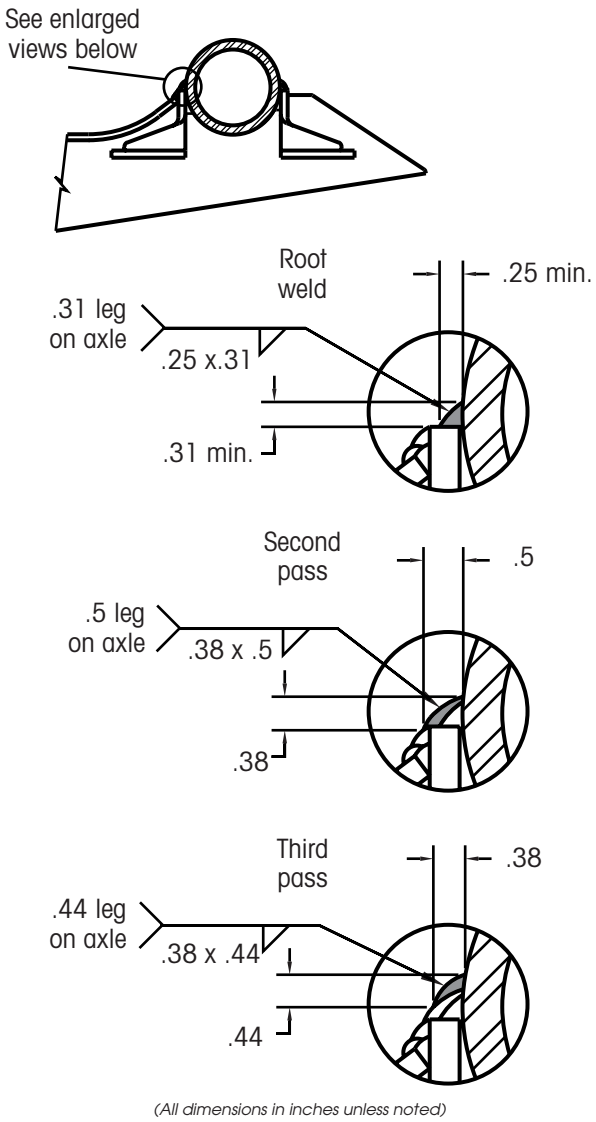


Figure 3. Axle weld passes — all HT suspensions

WELD PASS LENGTH AND PLACEMENT

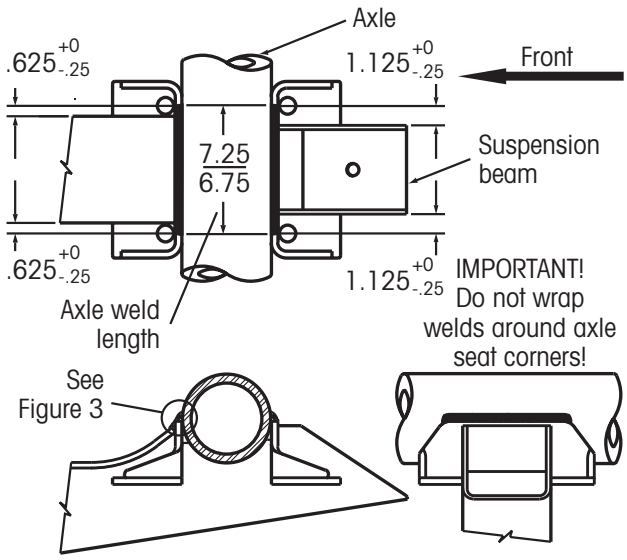
AXLE WELD PASSES — SIZE AND LOCATION

NOTE: All axle seat connections require three weld passes. Figure 3 shows the location and size of each weld. All passes are to be performed as shown.

AXLE WELD LENGTH AND POSITION

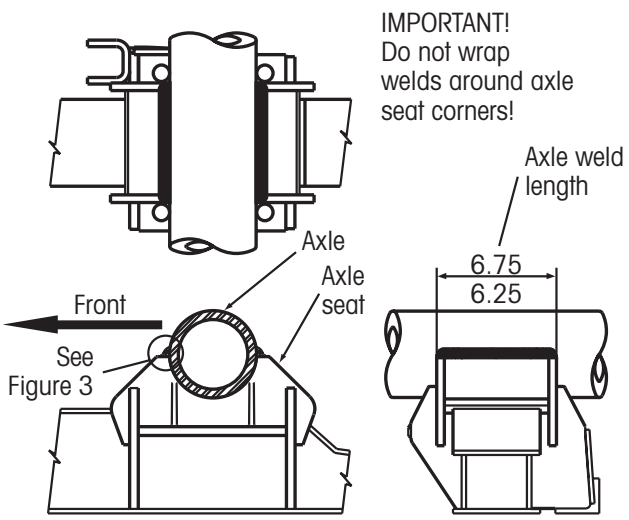
Figures 4a and 4b show the length and position of the axle weld. All weld passes are to be performed as shown.

IMPORTANT: The weld length is dependent on the type of suspension being installed. When installing the HT190T, HT190U, HT230, HT250T, or HT300, use Figure 4a. When installing the HT250U or HT300U, use Figure 4b.



(All dimensions in inches unless noted)

Figure 4a. HT190T, HT190U, HT230, HT250T and HT300T



(All dimensions in inches unless noted)

Figure 4b. HT250U and HT300U

WELD DIRECTION AND SEQUENCING

NOTE: The following instructions for direction and sequence must be followed when applying the weld.

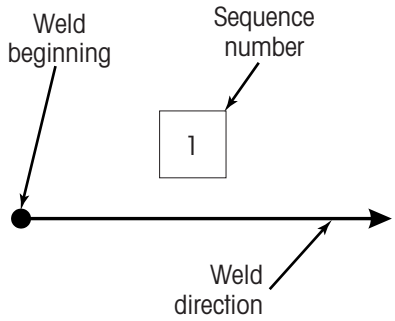


Figure 5a. Weld instructions legend

1. Beginning on the rear side of the axle/seat connection, place four single root pass welds (Figure 5b).

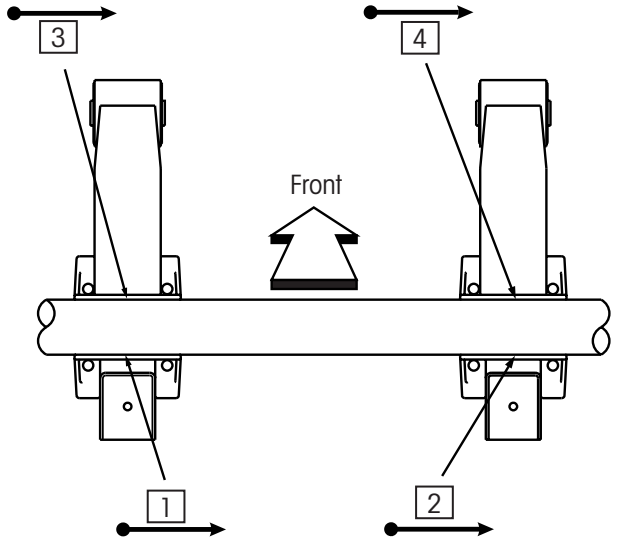


Figure 5b. Root pass sequence

2. Continue with the second and third weld passes after all four root passes (Figure 5c).

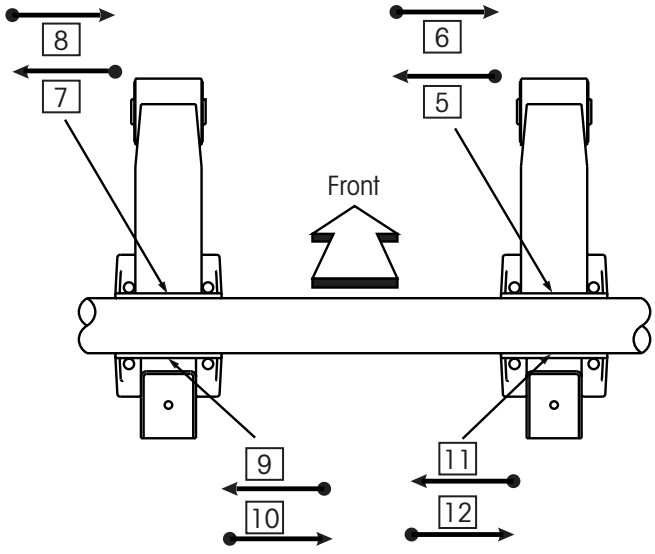


Figure 5c. Second and third pass weld sequences

U-BOLT INSTALLATION — HT SUSPENSIONS

1. Check the U-bolts for thread damage or burrs.

⚠**CAUTION:** **Do not apply additional lubricant to the U-bolt. Failure of the U-bolt could occur.**

2. Install U-bolts and spacers on the axle and through the mounting holes in both suspension beams. Ensure U-bolt spacer fits properly in the mounting area (Figure 7).

3. Install the washers and nuts on the U-bolts and use a wrench to snug the nuts.

4. Check U-bolt spacers to ensure correct positioning on the axle.

5. Tighten the nuts on the U-bolts by alternately tightening opposing corners of the clamp assembly. Use a calibrated torque wrench set from 475-525 ft-lbs (Figure 6).

NOTE: Proper tightening will result in an equal amount of thread visible above the nut on each side of the U-bolt (Figure 7).

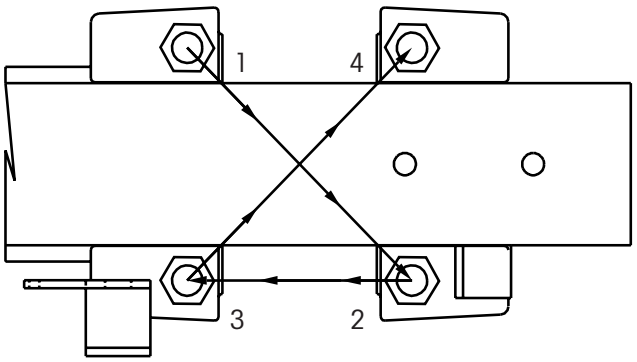


Figure 6. U-bolt nut tightening sequence

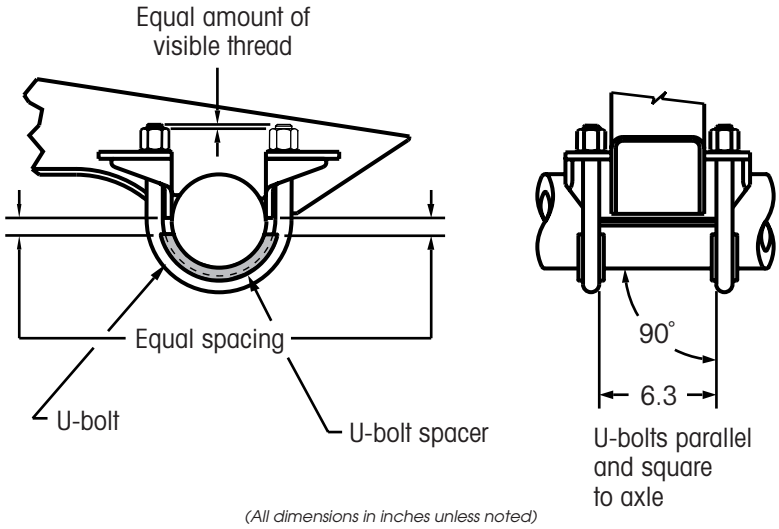


Figure 7. U-bolt positioning with U-bolt spacer

FRAME BRACKET, CROSSMEMBER, UPPER SHOCK BRACKET AND AIR SPRING MOUNTING WELDING PROCEDURES

Weld all miscellaneous suspension componentry using the parameters at the beginning of this section.

The following figures are examples of typical suspension installations. The procedures illustrated may need to be adapted due to varying trailer designs.

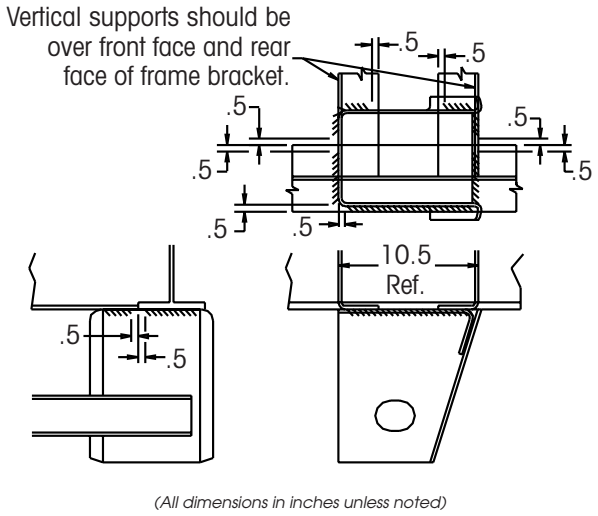
NOTE: Unless otherwise noted, all welds are to be $^1/_4$ inch minimum.

IMPORTANT: Starting and stopping points should be **no closer than $^1/_2$ inch** from the mating edge of the suspension component and the trailer frame and/or the crossmembers.

NOTE: It is the responsibility of the suspension installer and the vehicle designer to provide both adequate vehicle frame design and proper securing method for the suspension system.

NOTE: The suspension installer has the responsibility to determine the proper welding parameters for the materials being used. For specifications of the suspension component material, contact Hendrickson.

The attachments shown are designed to properly support the suspension. The suspension frame brackets are not to be used as a structural component of the trailer. Close attention should be paid to the attachment of the trailer crossmember to the trailer main rail to ensure that the frame bracket does not support this connection. Contact Hendrickson Trailer Suspension Systems at (330) 456-7288 with any questions concerning this connection.



(All dimensions in inches unless noted)

Figure 8. Typical frame bracket-to-frame attachment

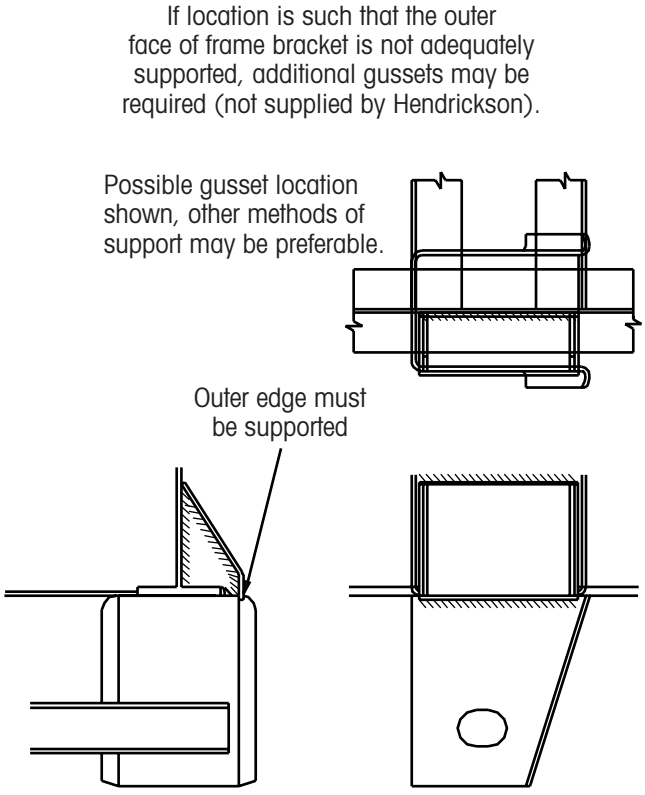
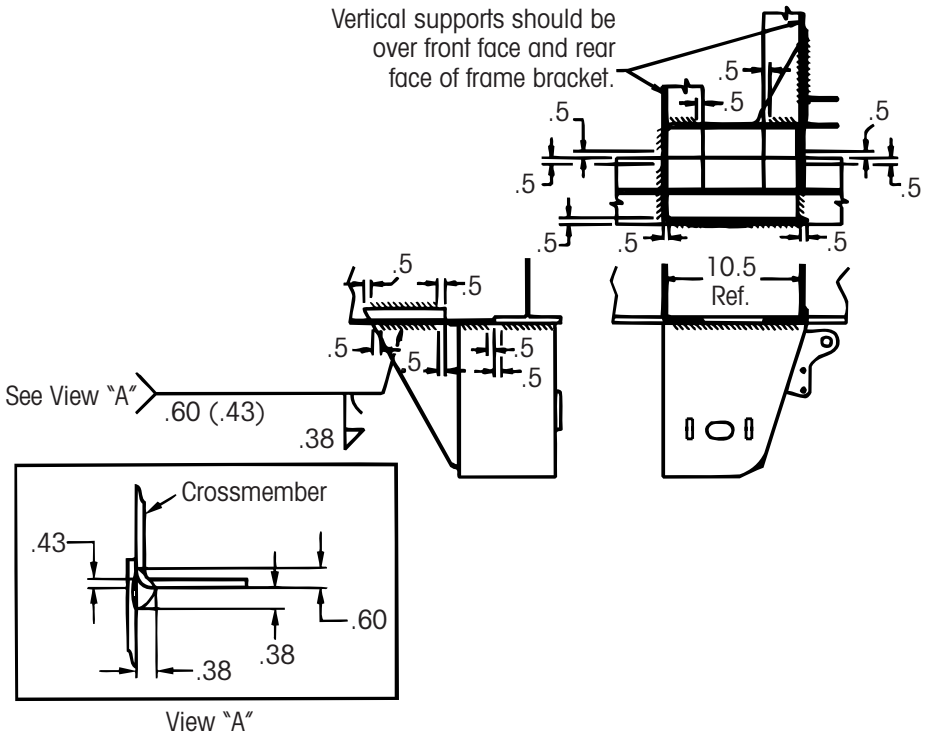
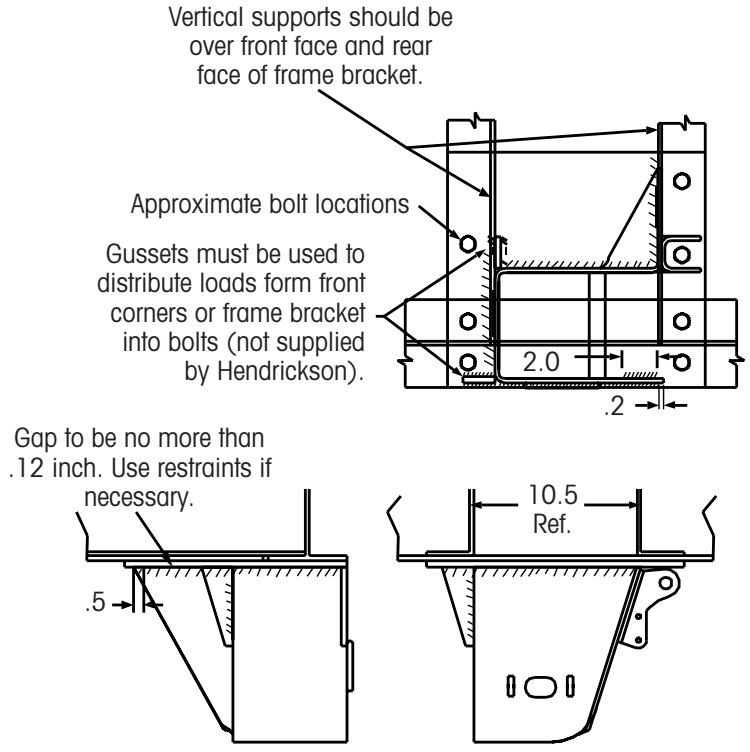


Figure 9. Severe offset frame bracket attachment; winged or wingless



(All dimensions in inches unless noted)

Figure 10. Typical winged frame bracket-to-frame attachment



(All dimensions in inches unless noted)

Figure 11. Frame bracket-to-mounting plate attachment (customer supplies bolt-on plate and gussets)

WELDING THE AIR SPRING MOUNTING PLATE

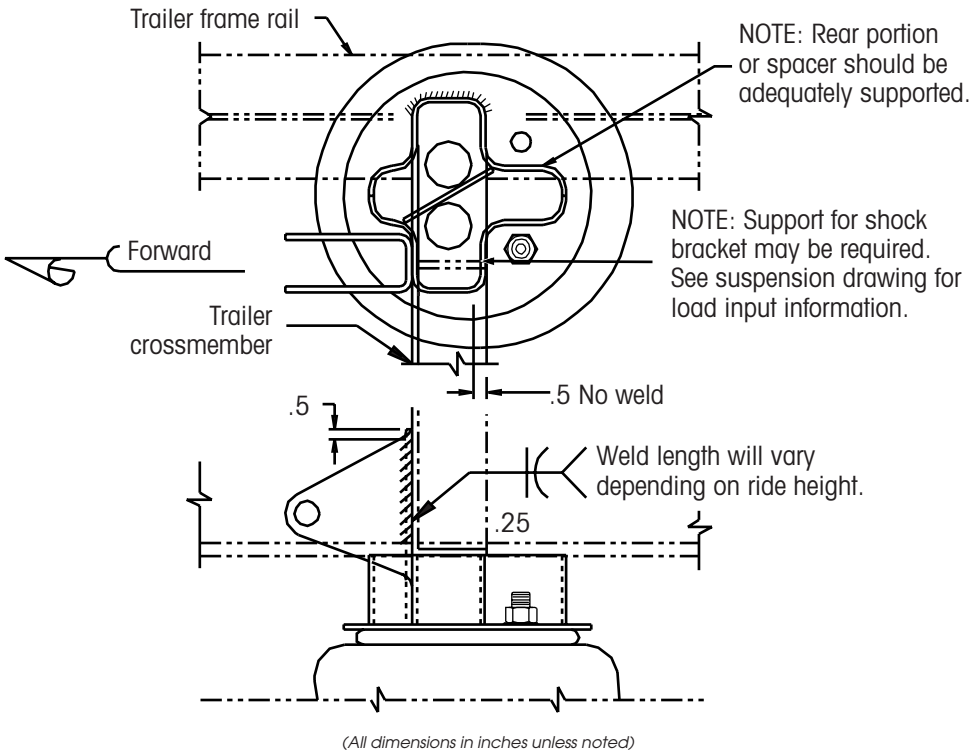


Figure 12. Air spring spacer attachment

NOTE: DO NOT ATTACH the air spring mounting plate or air spring to **BOTH** the trailer main rail and the trailer crossmember. The air spring mounting is not designed to resist the movement between the trailer crossmember and the main rail.

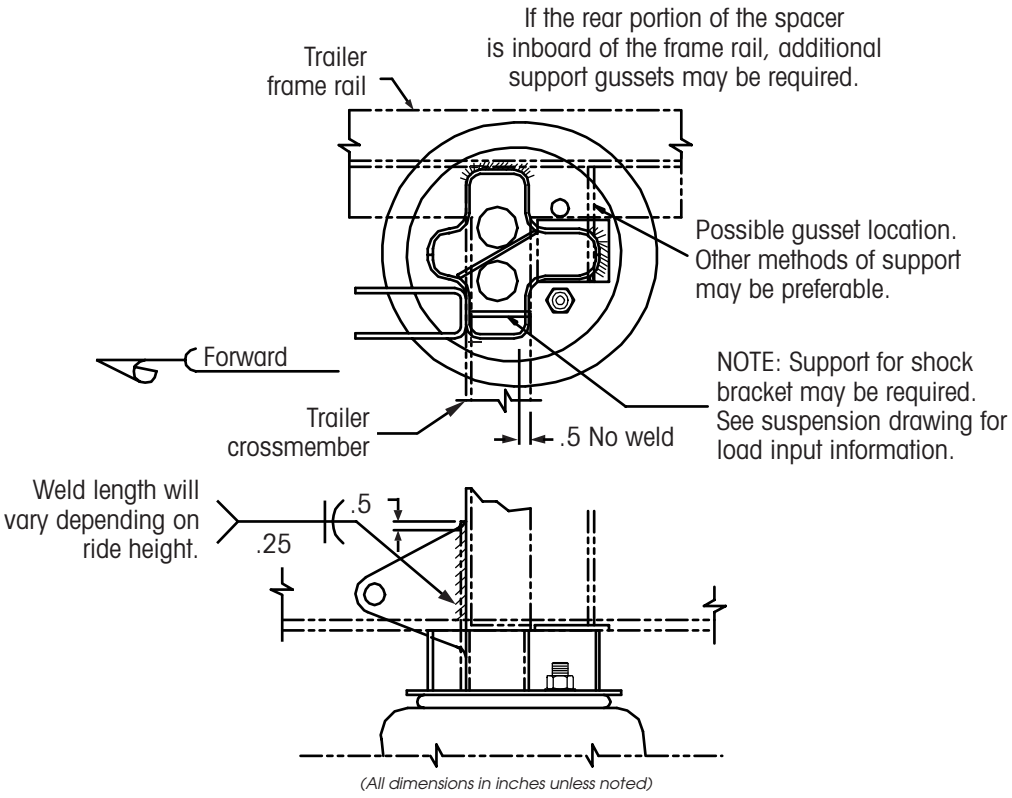


Figure 13. Severe offset mounting with spacer

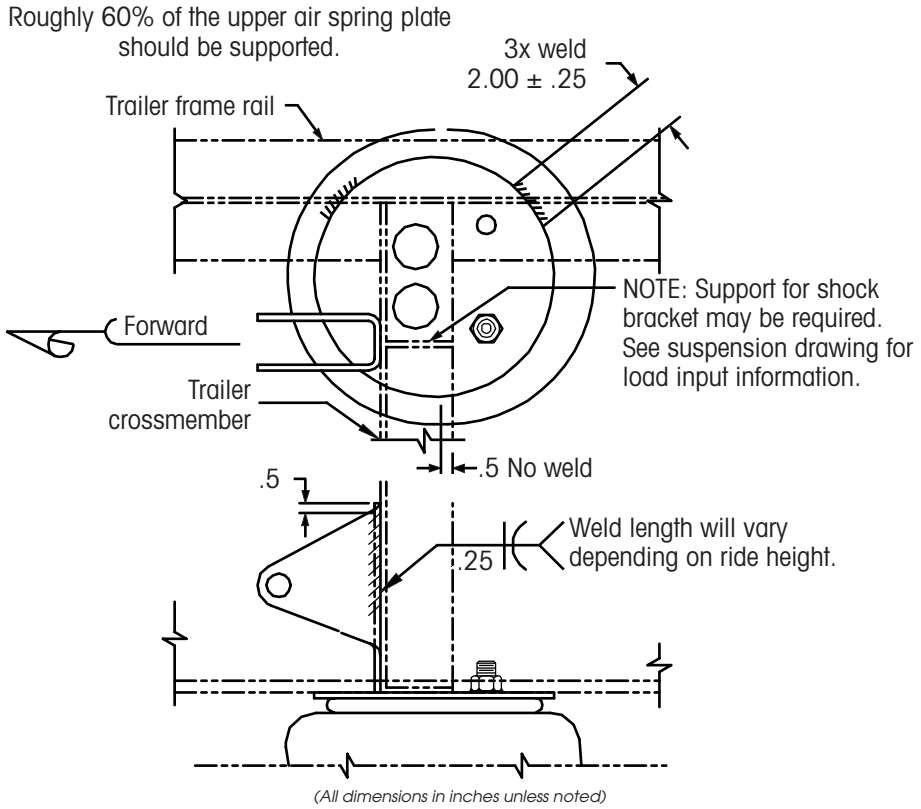


Figure 14. Air spring mounting plate attachment

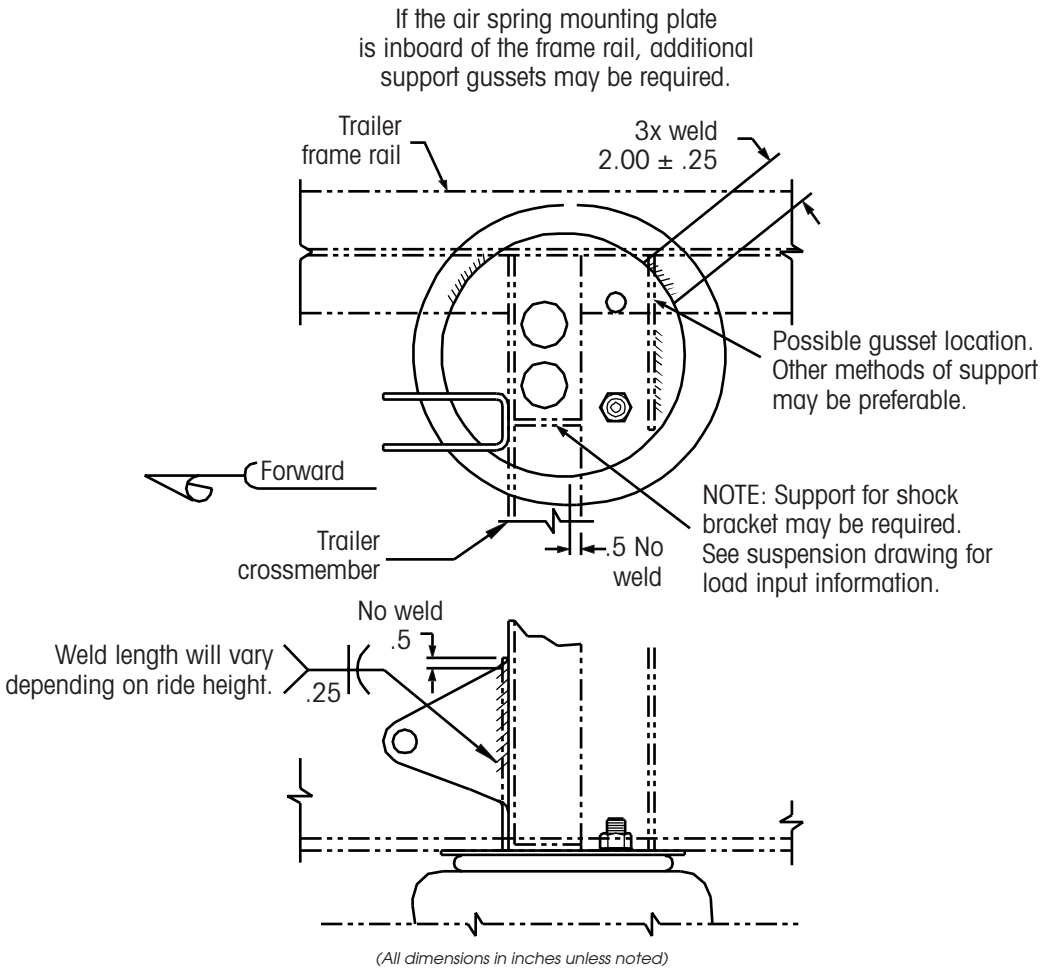


Figure 15. Severe offset mounting without spacer

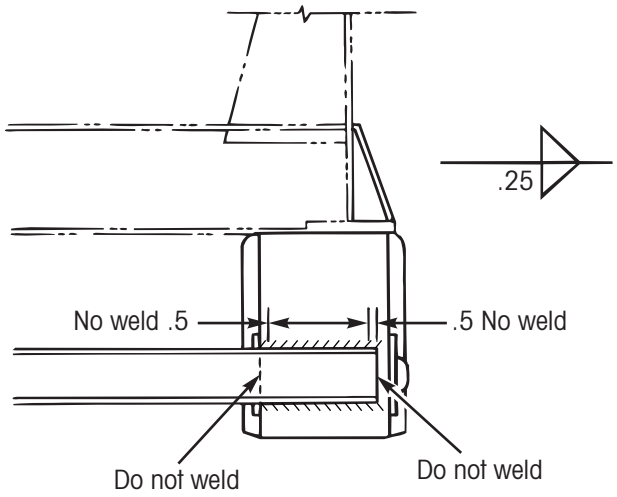
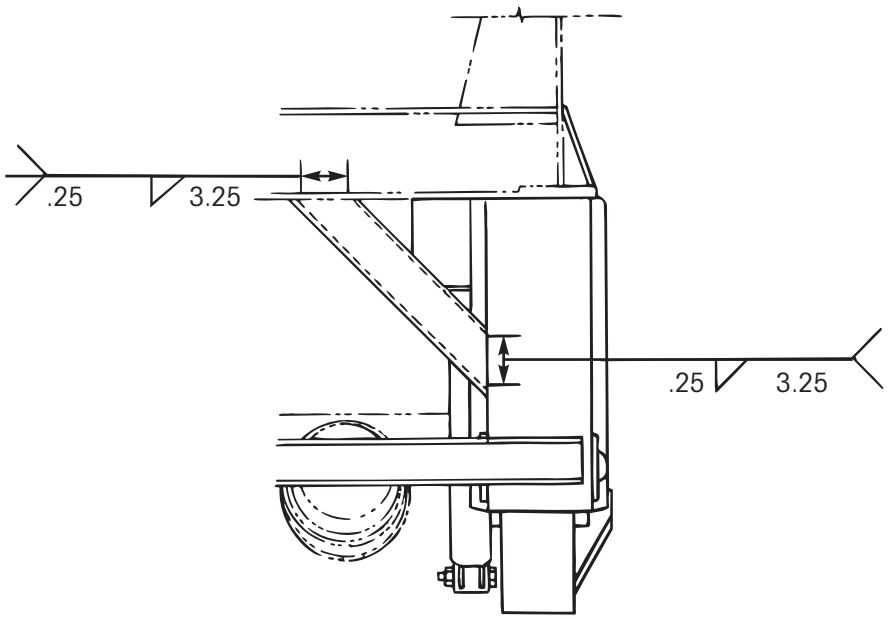


Figure 16. C-channel attachment to frame bracket



(All dimensions in inches unless noted)

Figure 17. Frame bracket knee brace attachment

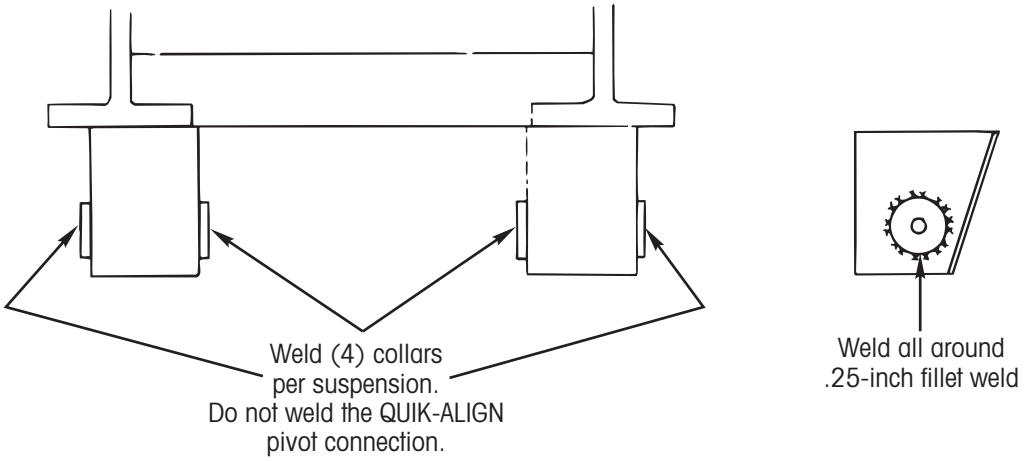


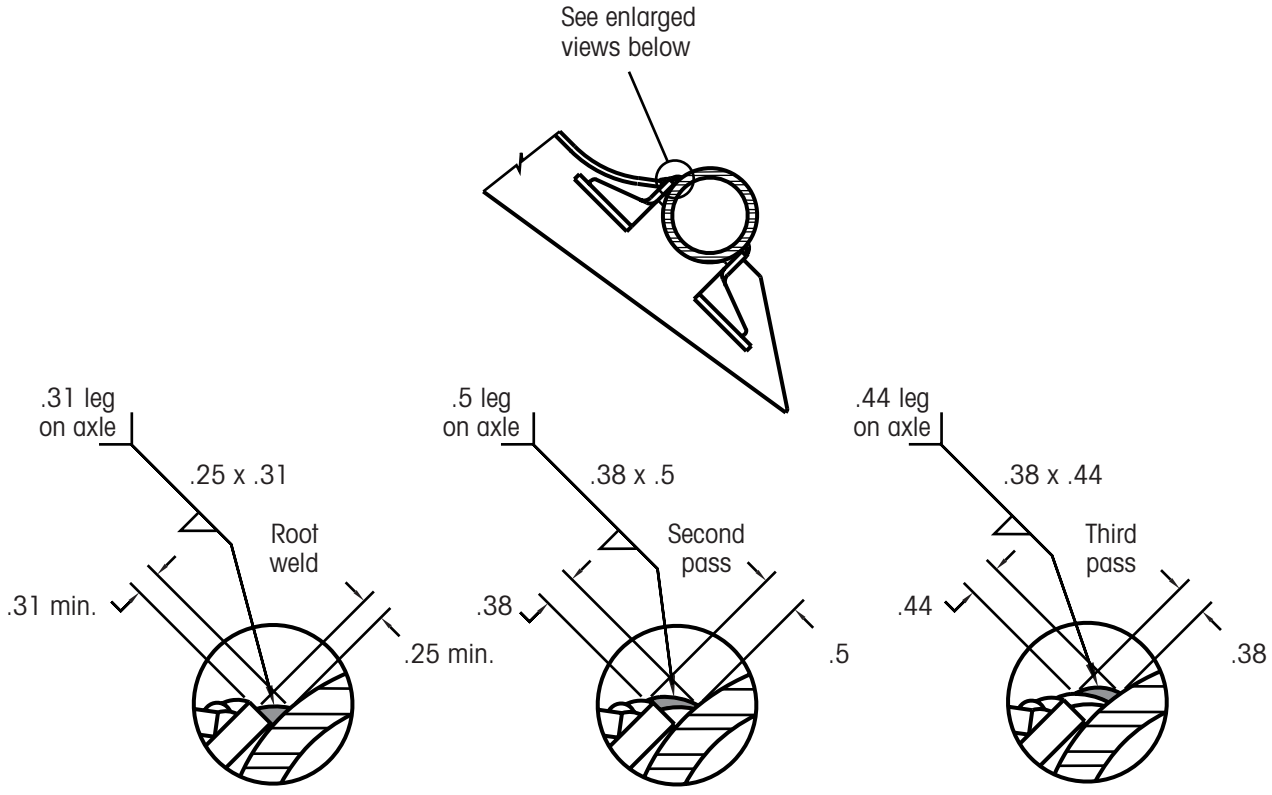
Figure 18. Welding collars

APPENDIX A: ALTERNATIVE AXLE WELD PROCEDURE

NOTE: If you are adjusting the weld position to the flat position 1F with the suspension beams in the vertical position, follow the alternative welding procedure shown in Figure A1.

NOTE: If you are welding the 2F position, refer to the AXLE WELD PROCEDURE — HT SUSPENSIONS section found on page 4.

⚠**CAUTION:** **Avoid all cold laps and undercuts. Fill all craters. Clean weld between each pass. If these steps are not followed, then failure could occur with the axle-to-suspension connection.**



(All dimensions in inches unless noted)

Figure A1. Axle weld passes — all HT suspensions

WELD PASS LENGTH AND PLACEMENT

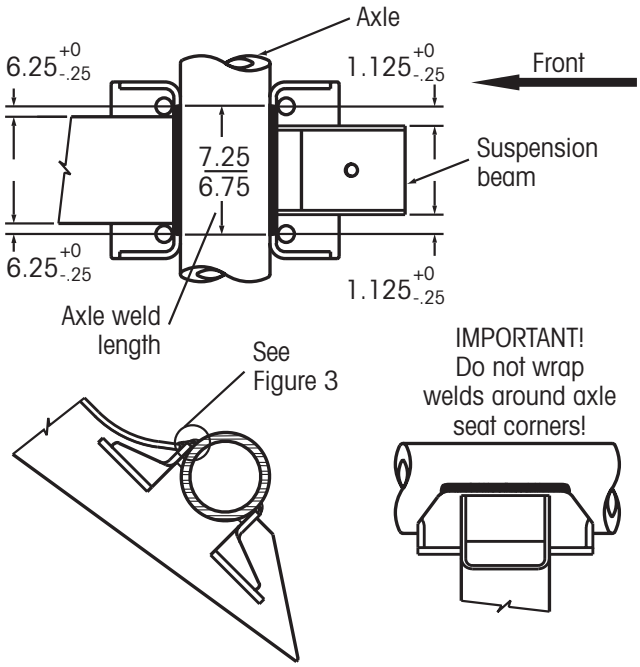
AXLE WELD PASSES — SIZE AND LOCATION

NOTE: All axle seat connections require three weld passes. Figure A1 shows the location and size of each weld. All passes are to be performed as shown.

AXLE WELD LENGTH AND POSITION

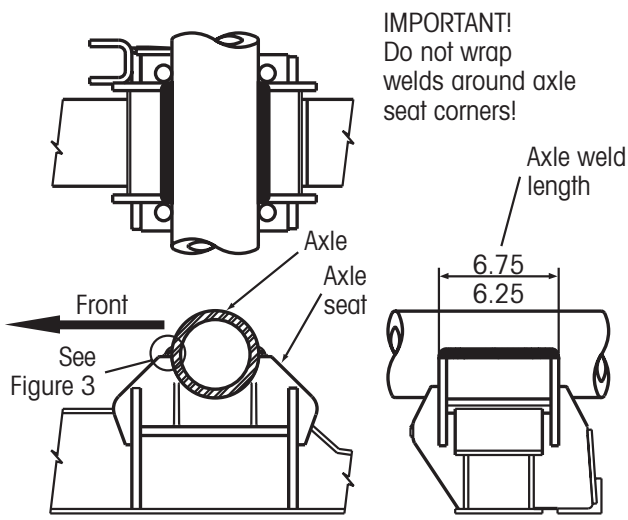
Figures A2 and A3 show the length and position of the axle weld. All weld passes are to be performed as shown.

IMPORTANT: The weld length is dependent on the type of suspension being installed. When installing the HT190T, HT190U, HT230, HT250T, or HT300, use Figure A2. When installing the HT250U or HT300U, use Figure A3.



(All dimensions in inches unless noted)

Figure A2. HT190T, HT190U, HT230, HT250T and HT300T



(All dimensions in inches unless noted)

Figure A3. HT250U and HT300U

HENDRICKSON
Trailer Suspension Systems

A Boler Company

2070 Industrial Place SE • Canton, Ohio 44707-2600 USA
Phone (330) 456-7288 • Fax (330) 456-0105

250 Chrysler Drive, Unit #3 • Brampton, Ontario L6S 6B6 CAN
Phone (905) 789-1030 • Fax (905) 789-1033

www.hendrickson-intl.com

L64 Rev E February 2000 Printed in United States of America.