

# **H** TECHNICAL PROCEDURE

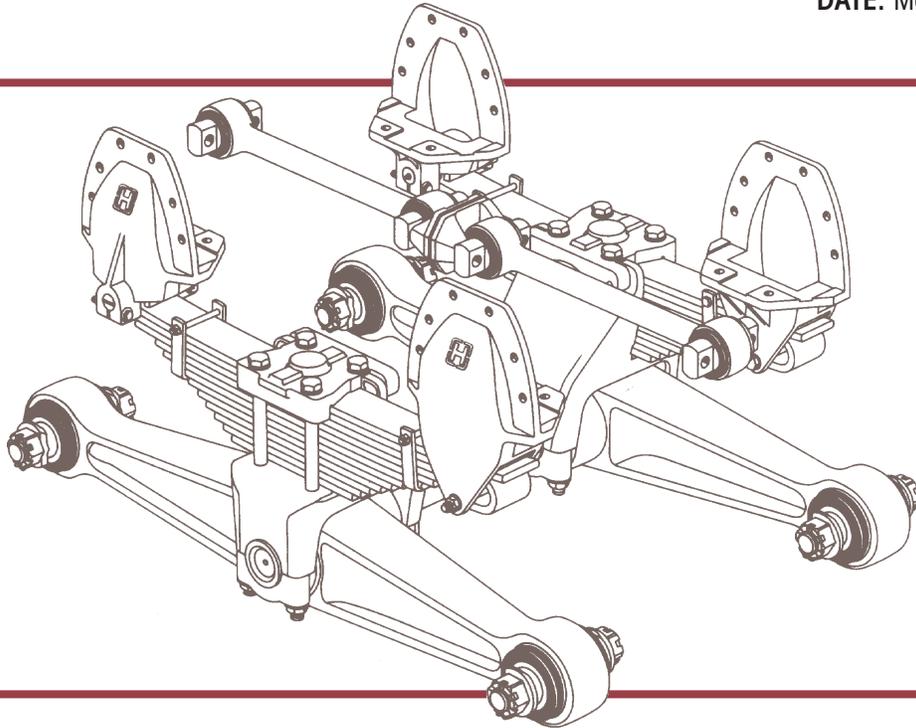
RT™ 650

SUBJECT: Service Instructions

LIT NO: 17730-214

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## Subject 1 INTRODUCTION

This publication is to acquaint and assist maintenance personnel in preventive maintenance and rebuild of the RT-650 series suspensions.

Use only genuine Hendrickson replacement parts for servicing these suspensions. Most Hendrickson parts can be identified by the Hendrickson  trademark.

Note the date of this publication. Hendrickson Suspension periodically revises and updates this publication. If this copy is more than one year old, contact Hendrickson Suspension to determine if a later copy is available.

## Subject 2 IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe and reliable operation of the tandem suspension. The service procedures recommended by Hendrickson and described in this technical publication are effective methods of performing maintenance.

There are various warnings and cautions that should be read carefully to minimize the risk of personal injury and to assure that proper methods are used. Improper servicing may damage the vehicle or render it unsafe in operation.

### WARNING:

**HENDRICKSON SUSPENSION REMINDS USERS TO ADHERE TO THE PUBLISHED CAPACITY RATINGS FOR THE SUSPENSIONS. ADD-ON AXLE ATTACHMENTS AND OTHER LOAD TRANSFERRING DEVICES CAN INCREASE THE SUSPENSION LOAD ABOVE THE RATED AND APPROVED CAPACITIES WHICH COULD RESULT IN FAILURE AND LOSS OF VEHICLE CONTROL, POSSIBLY CAUSING PERSONAL INJURY OR PROPERTY DAMAGE.**

**DO NOT MODIFY OR REWORK PARTS. DO NOT USE SUBSTITUTE PARTS. USE OF A MODIFIED OR SUBSTITUTE PART IS NOT RECOMMENDED BECAUSE THE PART MAY NOT MEET HENDRICKSON'S SPECIFICATIONS, WHICH COULD RESULT IN FAILURE OF THE PART, LOSS OF VEHICLE CONTROL, AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.**

**DO NOT USE A CUTTING TORCH TO REMOVE ANY ATTACHING FASTENERS. DO NOT USE A CUT-**

**TING TORCH TO REMOVE THE EQUALIZING BEAMS FROM THE AXLES OR TO REMOVE THE BUSHINGS FROM THE BEAM CENTERS OR ENDS. WELDING, TORCHING OR ATTACHING MATERIAL TO THE EQUALIZING BEAMS MUST NEVER BE PERFORMED. ALL HENDRICKSON EQUALIZING BEAMS ARE HEAT TREATED FOR STRENGTH AND SERVICE LIFE. THE USE OF HEAT ON SUSPENSION COMPONENTS WILL ADVERSELY AFFECT THE STRENGTH OF THESE PARTS.**

**A COMPONENT DAMAGED IN THIS MANNER MAY RESULT IN THE LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.**

**A MECHANIC USING A SERVICE PROCEDURE OR TOOL WHICH HAS NOT BEEN RECOMMENDED BY HENDRICKSON MUST FIRST SATISFY HIMSELF THAT NEITHER HIS SAFETY NOR THE VEHICLE'S SAFETY WILL BE JEOPARDIZED BY THE METHOD OR TOOL SELECTED.**

**THE USE OF EXCHANGE EQUALIZING BEAMS IS STRICTLY DISCOURAGED UNLESS THE BEAMS WERE ORIGINALLY FROM THE SAME CUSTOMER WHERE THE HISTORY OF THEIR SERVICE IS SPECIFICALLY KNOWN. USING EXCHANGE BEAMS OF UNKNOWN ORIGIN, WHERE TIME IN SERVICE OR APPLICATION AND LOADINGS ARE NOT KNOWN, CAN LEAD TO FAILURE, RESULTING IN THE LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.**

## Subject 3 ALIGNMENT

The primary control for alignment is the location of the spring hangers on the frame rail by the vehicle manufacturer, and the location of the axle brackets as installed by the axle manufacturer.

## Subject 4 DESCRIPTION

The RT-650 series suspensions (Figure 1) use leaf springs to cushion road shocks. The springs are mounted on saddle assemblies above the equalizing



Subject 4 (Continued)  
**DESCRIPTION**

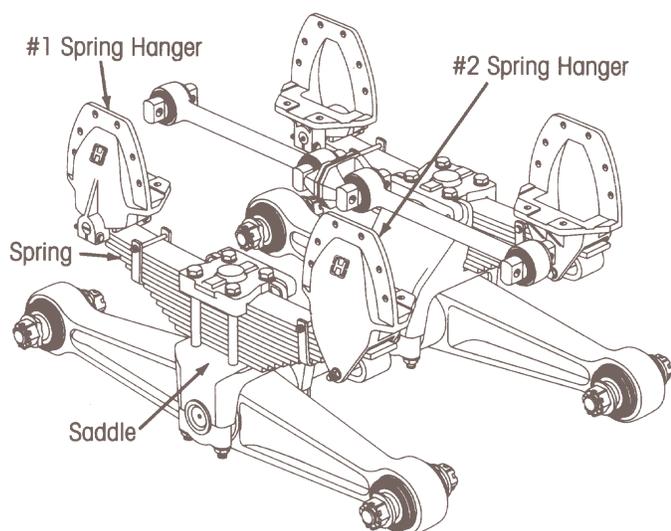
beams and are connected at the front ends to spring hangers with spring eye pins through the spring eyes. The rear ends of the springs have no rigid attachment to the spring hangers and they are free to move forward and backward to accommodate spring deflection.

All RT series leaf springs have a pilot cup forged upward in the main leaf at the center bolt. This cup pilots into a cavity in the spring top pad to insure the correct positioning of the spring in the saddle assembly.

The rubber bushings in the equalizing beam centers and ends, and the torque rods, permit the articulation of the axles without friction or metal-to-metal contact. During assembly of these bushings, the rubber is elongated and inserted between the inner and outer metals, creating a high pressure on the rubber which prevents slippage when subjected to torsional deflections. This design restricts excessive movement but allows sufficient movement to relieve stresses on the metal parts in cornering.

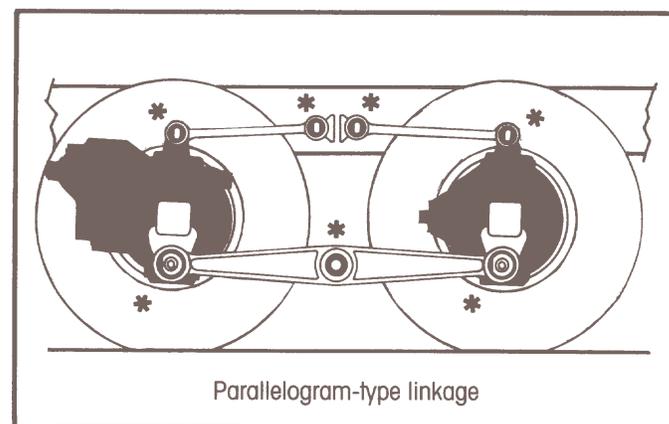
The two torque rods, together with the equalizing beams and connecting parts, make up a parallelogram style linkage as shown in Figure 2. This parallelogram arrangement assures positive axle alignment. Axle centers at the wheels always remain equidistant and therefore parallel.

**Figure 1—RT-650 Series Suspension**

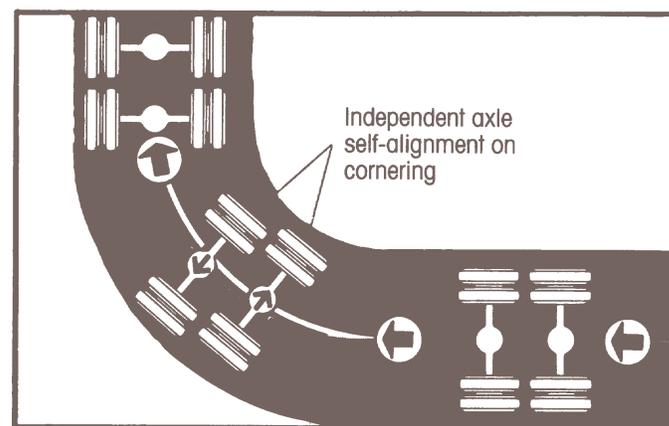


On turns, the rubber bushed joints perform another function as shown in Figure 3. Through their elasticity, each axle aligns itself independently on turns. The rubber bushings allow a certain amount of in-and-out movement of the axles from the start to completion of a turn. This self-alignment feature permits each axle to follow its own natural course more closely. Once a straight line track is resumed, the action of the bushings squares off the tandem so that the leading tires set the tracking pattern for the rear tires.

**Figure 2—Parallel Alignment**



**Figure 3—Self-Alignment/Cornering**





## Subject 5 TANDEM ARTICULATION

Suspension articulation is as shown in Figure 4.

## Subject 6 TANDEM CROSS MEMBER RECOMMENDATION

Hendrickson recommends that a tandem cross member and frame liner assembly as shown in Figure 5 be installed in the chassis.

## Subject 7 PREVENTIVE MAINTENANCE

Proper preventive maintenance programs will help control repair costs and downtime. This is important for safe and reliable operation. All new equipment should be given an initial pre-service inspection. This includes checking all the tightening torques of the Hendrickson tandem suspension as specified by the truck manufacturer, and as listed in the tightening torque specification chart at the end of the publication. We also recommend that all the tightening torques be checked with a torque wrench at least once a year.

Experience in servicing the RT-650 series suspensions indicates that when a major overhaul is required, the complete tandem unit should be removed from the frame. However, the torque rods, springs, equalizing beams and other components may be removed separately, as may be necessary.

**Lubrication:** The RT series suspensions use bronze, ball indented bushings in the spring eyes. These bushings ride on hardened steel pins which have lubrication channels. For #2 spring hangers equipped with pin rollers, lubricate to allow the pin to roll freely.

Lubrication should be performed during routine vehicle PM schedules with a good quality chassis lubricant. For severe service operations, the frequency of lubrication should be increased.

The rear of the chassis should be raised to relieve load on the bushings and pins to allow the proper flow of lubricant around the pins and bushings. Continue to lubricate until lubricant comes out both ends of the bushing. If the pin will not accept lubricant, remove the pin and clean the lubrication channels where lubricant may have hardened.

Figure 4—Tandem Articulation

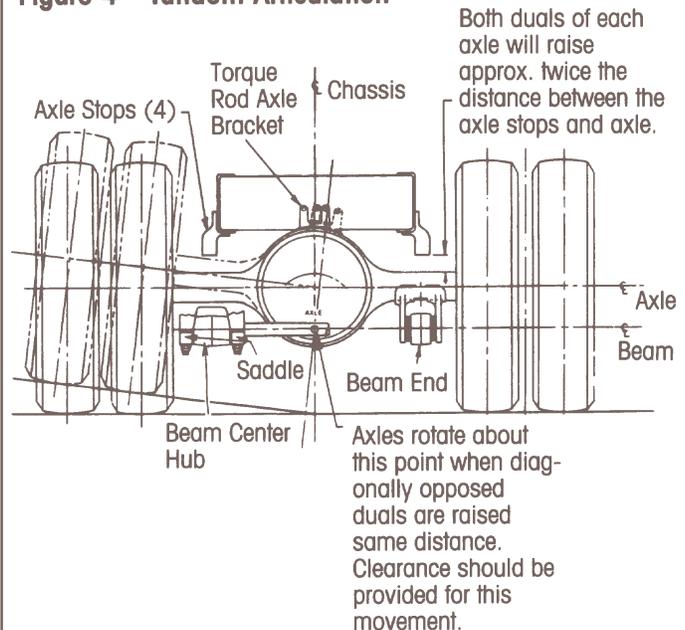
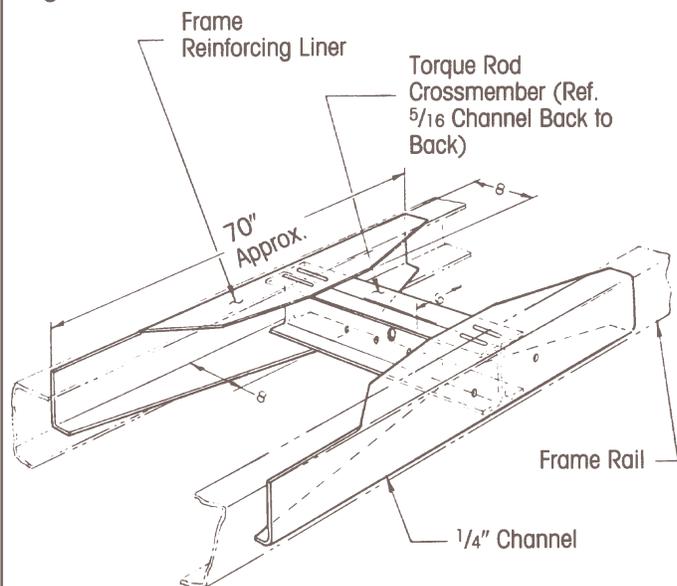


Figure 5





Subject 7 (Continued)  
PREVENTIVE MAINTENANCE

**WARNING:**

**DO NOT USE HEAT AS THIS IS A HEAT TREATED PART.**

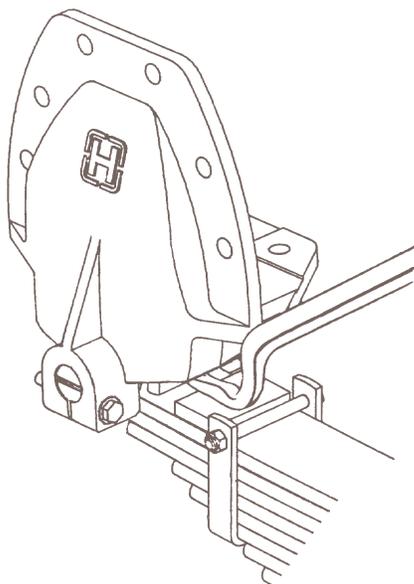
**#1 Spring Hanger:** (Double lack bolt design). Check tightening torque lack bolt locknuts. If looseness of this connection has resulted in pin hole wear, replace the hanger.

**# 1 Spring Hanger:** (Draw key design). Inspect the pin hole in the outboard leg of the hanger for wear or elongation. Wear at this point requires hanger replacement or premature fracture of the spring hanger pin may occur with possible separation of components and loss of vehicle control.

**#2 Spring Hanger:** (Costing cam surface design). Inspect the cam surface for wear due to high mileage. Also inspect the outside legs for wear which can be caused by worn spring eye bushings. Excessive wear at either point requires hanger replacement.

**#2 Spring Hanger:** (Pin roller design). Inspect the pin roller for wear, if so equipped. Excessive wear requires pin roller replacement.

**Figure 6**

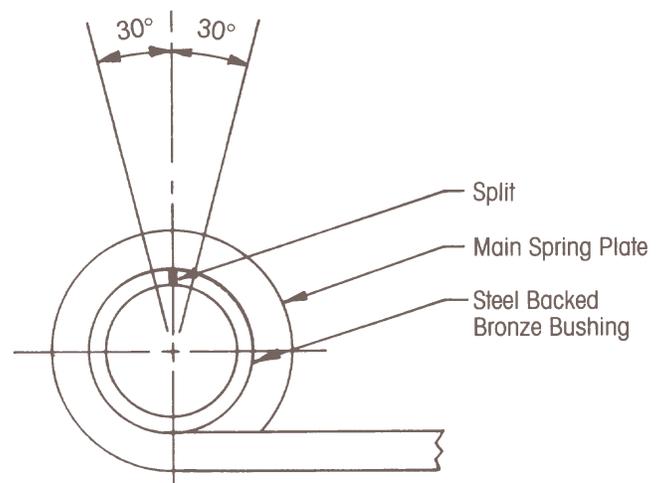


**Spring Eye Pin and Bushing:** To check for spring eye bushing wear, a block of wood can be placed on the spring and, with a pry bar, attempt to lift the spring hanger and frame as shown in Figure 6. Alternately, and with an empty chassis and brakes applied, attempt to rock the chassis back and forth while observing the spring eye. In either case, if 1/8" or more movement is noted, the bushing and pin should be replaced. This also could indicate a broken spring eye and spring is connected to the spring hanger through the wrapper eye of the second leaf. In this case, the main leaf or complete spring should be replaced immediately.

**SAFETY NOTE: USE CAUTION WHEN APPLYING THESE TECHNIQUES SO THAT PERSONAL SAFETY AND VEHICLE SAFETY ARE NOT JEOPARDIZED.**

When replacing the spring eye bushing, the split must be positioned at the top of the spring eye as shown in Figure 7.

**Figure 7**





Subject 7 (Continued)  
PREVENTIVE MAINTENANCE

**Saddle Cap Fasteners:** The locknuts should be tightened as shown in Figure 8 to prevent wear of the beam center bushing into the saddle.

**Beam End Connections and Beam End Bushings:** There are two types of Hendrickson beam end connections for rubber beam end bushings on the RT-650 series suspensions.

One is the beam end adapter connection, as shown in Figure 9, and is a two-piece design with a 1 7/8" O.D. shaft and slotted nuts. The two end adapters pilot into the inner metal of the bushing. The tightening torque for the through shaft nuts is 600 to 800 foot pounds. Beam end adapter connections require that the fasteners be kept tight to maintain the clamp of the rubber bushing inner metals to the inside surface of the axle bracket legs. All bushing motion is accommodated by rubber deflection and there should be no motion between mating metal surfaces. The beam end adapter connections have the flange of the adapter cut off for assembly clearance with the axle housing bowl. The flat must be

Figure 8

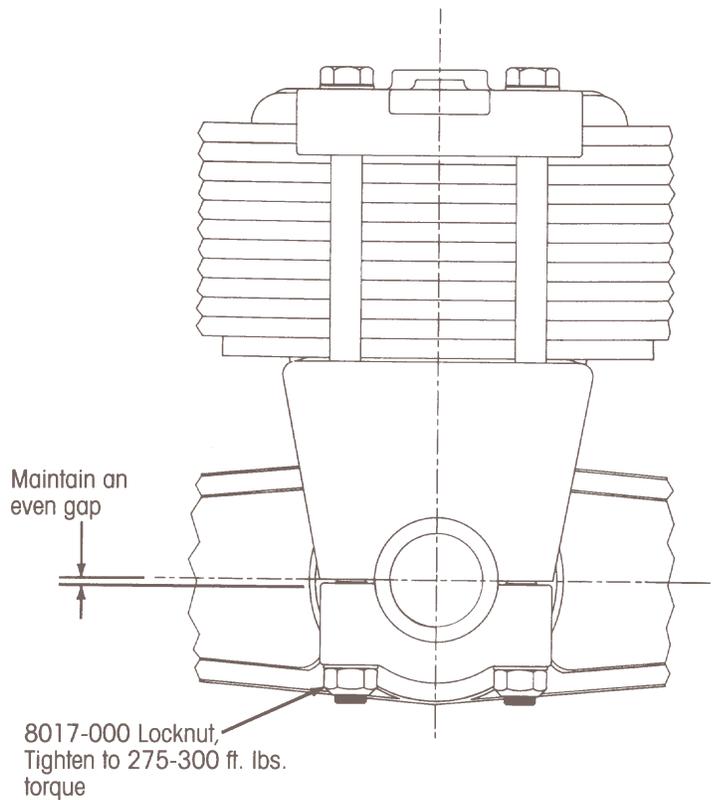
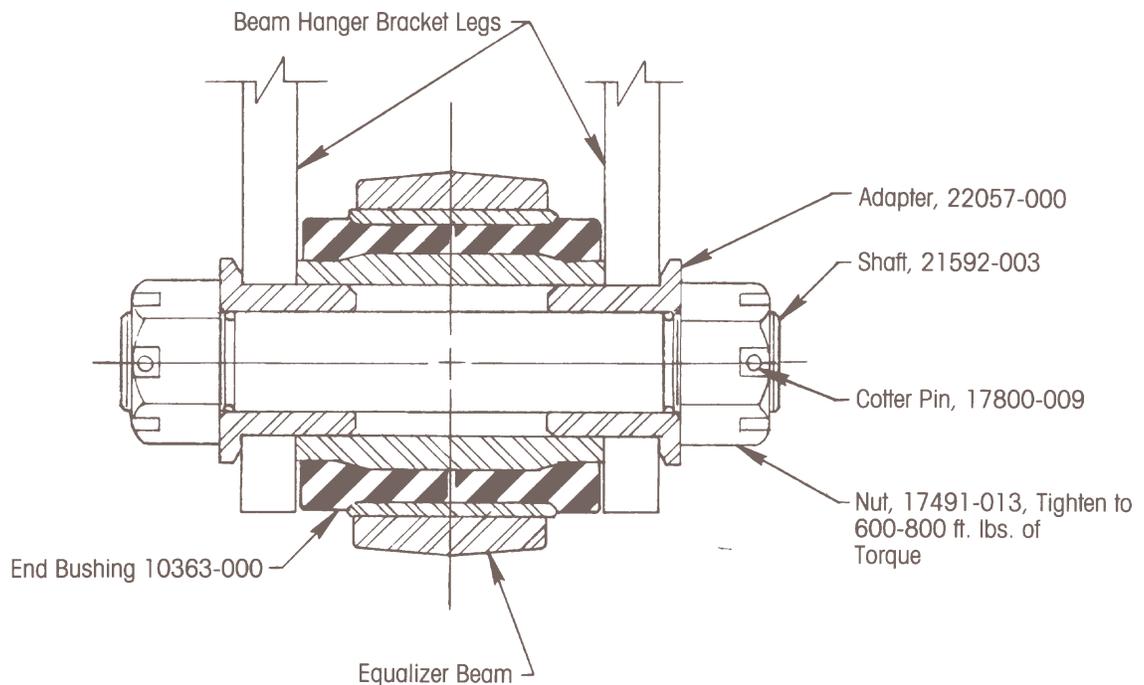


Figure 9  
Two-Piece Adapter Connection





Subject 7 (Continued)  
**PREVENTIVE MAINTENANCE**

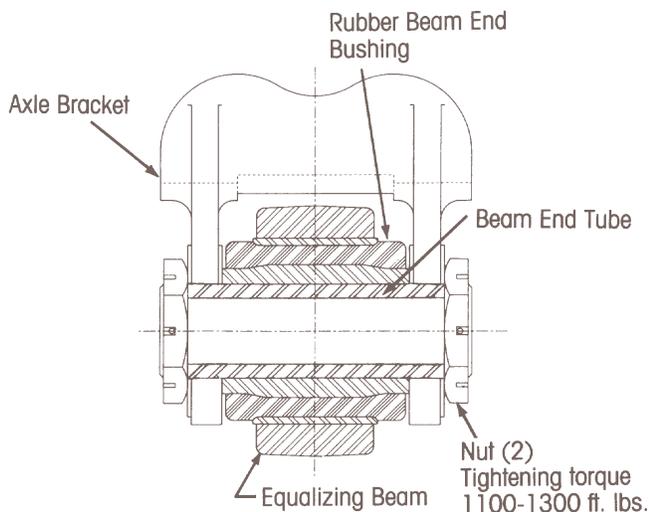
positioned vertically as shown in Figure 11 when the through bolt nuts are tightened.

The other is a tube and nut design, as shown in Figure 10: This beam end connection requires that the nuts be kept tight to maintain the clamp of the rubber bushing inner metals to the inside surface of the axle bracket legs. All bushing motion is accommodated by rubber deflection. The tube pilots through both axle bracket legs and the inner metal of the bushing. The tightening torque for the tube nuts is 11 00 to 1300 foot pounds.

All types of beam end connections require that the fastener torque be checked with a torque wrench before a new or repaired vehicle is placed in service. Check the torque again after 1,000 miles of off-highway or severe service, or 10,000 miles of on-highway service. **DO NOT EXCEED TORQUE SPECIFICATIONS.**

When it is necessary to have a vehicle in the shop for major repair work or preventive maintenance, place a jack under each beam end, as shown in Figure 12, to check for movement of the rubber end bushing inner metal. This movement cannot be eliminated by tightening the fasteners due to excessive wear to mating parts and increasing clearance tolerances. If movement is noted, do not operate the vehicle. Replace the rubber end bushing and all connecting parts.

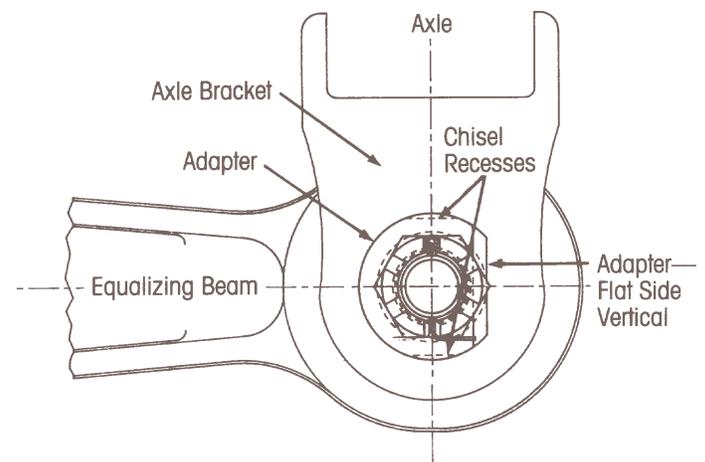
**Figure 10**  
Tube & Nut Connection (Optional).



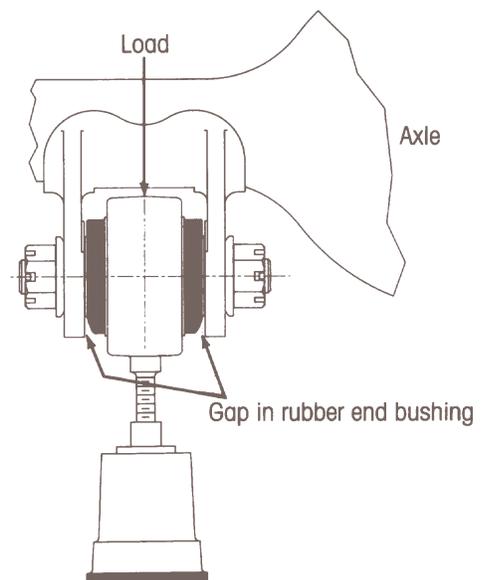
Periodic visual inspection by the driver and service personnel is also recommended. Look for the beam being lower in the beam hanger, or distorted or frayed rubber. Off-highway and severe service operating conditions require more frequent inspections than on-highway service operation.

The gap on each side of the visible rubber at the lower end of the end bushing is normal and not an indication to replace the bushing. Because all rubber end bushings are in compression, with the load bear-

**Figure 11**



**Figure 12—Jack Under Beam End**





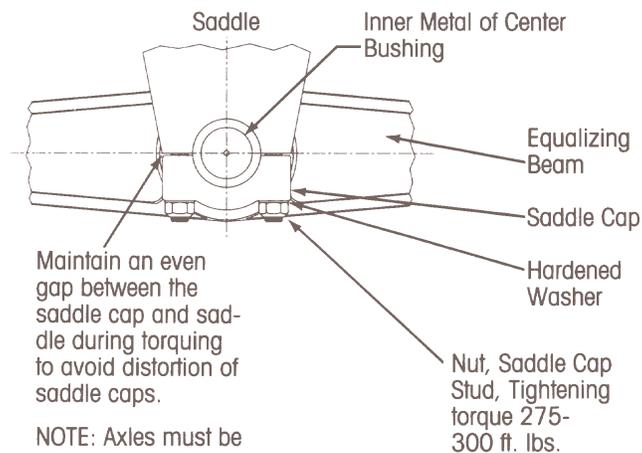
Subject 7 (Continued)  
**PREVENTIVE MAINTENANCE**

ing on the top side, the lower side of the rubber is slightly relieved, allowing the rubber to move inward, and a gap appears.

**Spring Assembly:** Inspect all leaves and spring clips for cracks or damage. We recommend that high mileage springs (for your type of operation) with one or more leaves broken below the #2 leaf be replaced with a genuine Hendrickson Suspension spring assembly of the same part number. Main and wrapper leaves are normally available as service replacements. The spring part number is stamped on the spring clips. We also recommend that both springs be replaced to insure even spring deflection. All Hendrickson Suspension springs are made to rigid specifications and each leaf is shot peened for long life. To assure compatibility and functionality as a suspension system, genuine Hendrickson Suspension springs should be specified.

**Rubber Beam Center Bushings:** The beam center bushings control the lateral movement of the axles during cornering. The service life of the rubber center bushings depends on the style of operation. Normal wear is evidenced by the rubber shredding from each end of

**Figure 13—Equalizing Beam With Center Bushing Assembly To Saddle Assembly**



Maintain an even gap between the saddle cap and saddle during torquing to avoid distortion of saddle caps.

NOTE: Axles must be in operating position before saddle cap fasteners are tightened (with rubber center bushings).

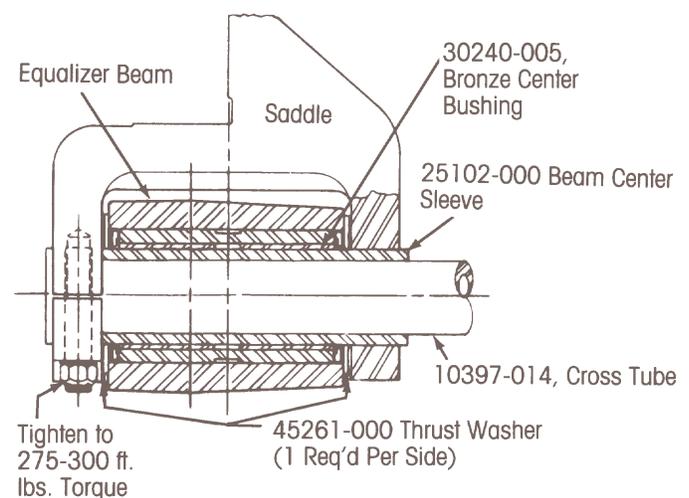
the bushings. Worn center bushings will allow increased lateral movement of the axles on turns and allow the inside walls of the tires to rub on the suspension spring hangers. This is a warning that the center bushings should be replaced before serious tire damage results.

The spring and saddle assemblies are attached to the center bushings of each equalizing beam with two saddle caps. Each cap clamps the center bushing inner metal to the saddle through studs in the saddle legs. The saddle caps must be installed so that there is an even gap between the caps and the base of the saddle legs as shown in Figure 13. If they are not installed evenly, they may become deformed, resulting in bent studs or damaged saddle cap stud threads.

**Bronze Beam Center Bushings:** As shown in Figure 14, are recommended for use on vehicles negotiating frequent tight turns or backing into position such as dump, transit mix, and refuse operations.

The lube fitting is located on the inside center hub area of the equalizing beam. Pressure lubricate with standard chassis lube until clean grease exits on both sides of the beam center hub. The rear of the chassis should be raised to relieve load on the bushings to allow the proper flow of lubricant around the bushings. The interval of lubrication must be determined by the user taking into consideration the style of operating conditions in which the vehicle is used.

**Figure 14—Bronze Center Bushings**





Subject 7 (Continued)

**PREVENTIVE MAINTENANCE**

Original factory installations of bronze center bushings may have only one thrust washer on each side of each beam center hub. Often there is room for additional thrust washers. Also, there may be wear to the beam hub or the inside of the saddle legs. We recommend that in all cases additional washers be installed until the gap is less than the thickness of one thrust washer, i.e., install as many thrust washers as will fit. Operating a vehicle with an insufficient number of thrust washers may reduce the service life of the bronze bushings, and may allow enough free side movement between the saddles and the beams to affect vehicle handling and steering "feel" by the operator.

Bronze center bushing wear can be checked by raising the saddle with a jack. Saddle movement of .125" or more before the beam raises indicates excessive wear, and the bushing should be replaced.

**Beam Center Cross Tube:** The beam center cross tube, as shown in Figure 14, connects the two equalizing beams through the inner metals of the beam center bushings. This tube restricts the side movement of the axles on turns.

The cross tube has clearance to float in the inner metals of the center bushings. In cornering it is clamped in position, maintaining suspension alignment. The length of the cross tube will allow side float of approximately 2". For this reason, the cross tube will appear polished at each end where it enters into the center bushing inner metal. This is normal.

A cross tube very seldom requires replacement, usually only when it has been bent, possibly due to hitting an unseen object. A bent cross tube will cause misalignment of the axles, and must be changed immediately to eliminate abnormal tire wear.

**Figure 15—Torque Rod End**



**Rubber Bushed Torque Rods:** The length of the torque rods is determined by the truck manufacturer for optimum drive line angles. The torque rods control these angles and also absorb driving and braking forces. The mounting brackets at the axle ends of the torque rods are furnished and welded into position on the axle housings by the axle manufacturer.

The torque rods, as shown in Figure 15, have attaching ends designated "straddle mount" and "tapered stud."

Straddle mount torque rod end attaching fasteners are furnished by the vehicle manufacturer. It is important that the tightening torque of the locknuts be checked during preventive maintenance service. Follow the vehicle manufacturer's specifications for tightening torque values.

NOTE: Hendrickson Suspension recommends Grade 8 bolts and Grade C locknuts be used for all straddle mount torque rod attachments.

Tapered stud torque rod locknuts also should be checked. The tightening torque is 175 to 225 foot pounds.

All torque rods can be inspected for looseness, or torn or shredded rubber. With brakes applied, slowly rock an empty vehicle with power while a mechanic visually checks the action at both ends. Or with the vehicle shut down, a lever check can be made with a long pry bar placed under each rod end and pressure applied.

Whether the ends are straddle mount or tapered stud, they can be renewed by pressing out the worn end and installing a cartridge style replacement. A two-piece torque rod is also available to cut and weld to the desired length.

Subject 8

**MAJOR REBUILD PROCEDURE**

Experience in servicing Hendrickson RT-650 series suspensions indicates that when a major overhaul is required, the tandem axles with wheels and tires, and the equalizing beams should be removed as a complete unit as shown in Figure 16. However, the torque rods and other components may be removed separately as may be necessary.

Block the tires of the front steering axle and both tandem axles to prevent vehicle movement.



## Subject 8 (Continued) MAJOR REBUILD PROCEDURE

Drain the vehicle air system and disconnect all air lines leading to the rear axles. Mark the air lines for later assembly reference.

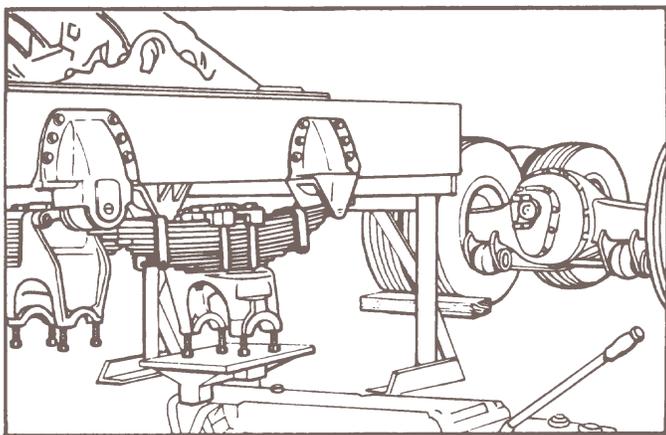
Unlock all spring parking brakes on the tandem axles and disconnect the drive shaft from the front of the forward drive axle.

Remove both torque rods at the axle bracket ends.

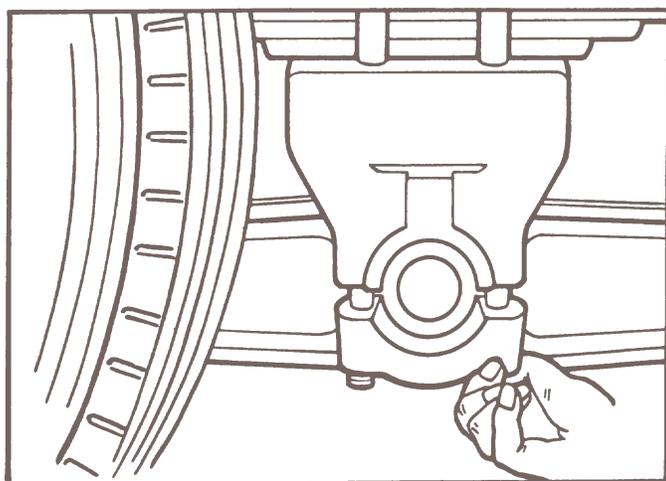
### WARNING:

IT IS POSSIBLE THAT THE EQUALIZING BEAM END CONNECTIONS TO THE AXLE BRACKETS ARE LOOSE. IF THEY ARE, THE AXLES COULD BE FREE TO PIVOT

**Figure 16—Axles With Equalizing Beams Rolled Out**



**Figure 17—Removing Saddle Caps**



ON THE BEAM ENDS. USE NECESSARY BLOCKING TO PREVENT HARM TO PERSONNEL AND TO AVOID DAMAGE TO THE INTERAXLE DRIVE LINE, POWER DIVIDER, AND DIFFERENTIAL CARRIERS. FAILURE TO DO SO COULD RESULT IN THE LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

Remove the saddle cap locknuts, washers, and saddle caps as shown in Figure 17.

Raise the rear of the vehicle frame and roll the axles with the equalizing beams attached out from under the vehicle as shown in Figure 16. Replace the locknuts on the saddle cap studs to protect the threads.

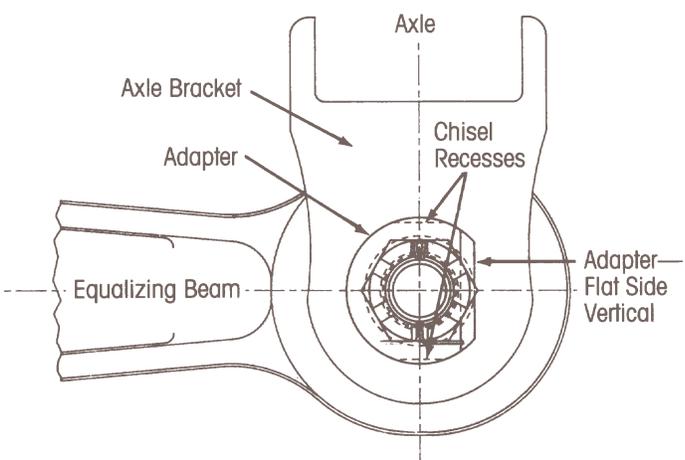
### BEAM END ADAPTER CONNECTION REMOVAL

An air hammer chisel can be used for removal of the beam end adapter. Begin by removing the cotter pins, nuts and shaft. It is recommended that a penetrating oil be applied to all beam end connections. The adapters have two chisel entry recesses located in their flanges as shown in Figure 18. With the air hammer chisel, turn the adapter to locate the recesses for entry of the chisel as shown in Figure 19.

If the adapter does not turn, use a hammer to rap the outside of the axle bracket legs around the adapter area and repeat with the air hammer chisel. When the adapter has space between the axle bracket and the

**Figure 18**

Adapter Flat/Vertical. Adapters shown in Figures 8 and 9 (see page 6) must be installed with flat in vertical position.





Subject 8 (Continued)  
**MAJOR REBUILD PROCEDURE**

adapter flange, use a bent chisel as shown in Figure 20 to wedge and force the adapter out. Support the end of the beam as it may drop when the other adapter is removed.

**WARNING:**

**WHEN THE ADAPTERS ARE REMOVED WITH THE AIR HAMMER CHISEL, DISCARD THEM, DO NOT REUSE THEM. BECAUSE THE ADAPTERS WHICH ARE REMOVED MAY BE WORN OR DAMAGED IN REMOVAL, REUSE OF SUCH ADAPTERS COULD RESULT IN A FAILURE LEADING TO LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY.**

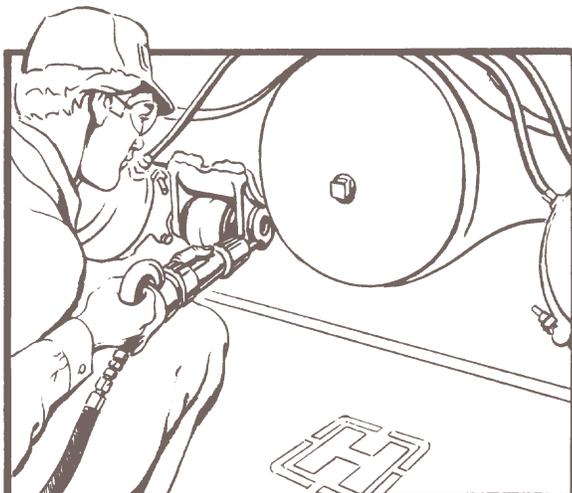
**TUBE AND NUT CONNECTION REMOVAL**

Removal of the tube and nut beam end connection, as shown in Figure 21, can be accomplished by removing the two tube nuts and using spacer washers between the hanger leg and one nut, tightening the nut to pull the tube loose.

The connection can also be removed with a powered portable reciprocating hacksaw. Begin by sawing through the tube along the inside surface of both axle bracket legs with the powered reciprocating hacksaw. Do not damage the axle bracket leg surfaces.

In all operations, it is recommended that a penetrating oil be applied to all beam end connections before attempting removal.

**Figure 19—Air Chisel Removal Of Adapters**



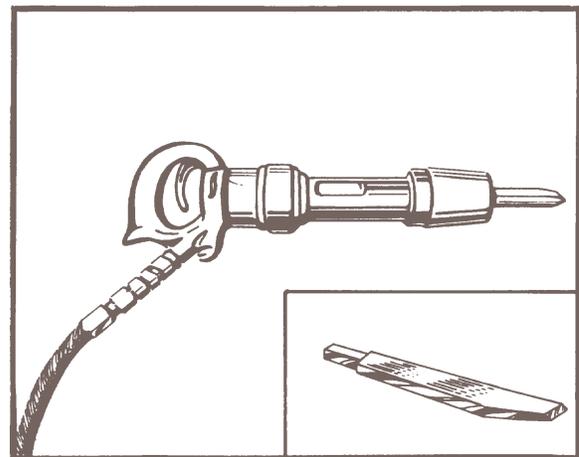
**WARNING:**

**IN ALL CASES, SUPPORT THE END OF THE BEAM AS IT MAY DROP WHEN THE END CONNECTION IS REMOVED. FAILURE TO DO SO COULD RESULT IN PERSONAL INJURY.**

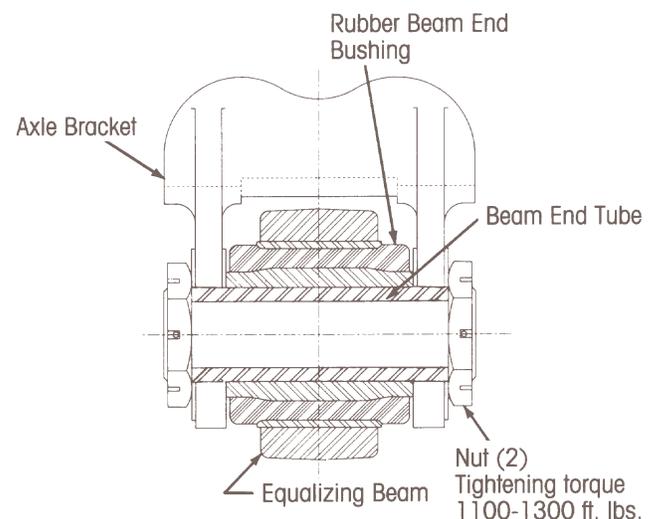
**BEAM CENTER CROSS TUBE REMOVAL**

When the equalizing beam ends have been removed from the axles, the beams can be separated from the cross tube by pulling them apart by hand.

**Figure 20—Air Hammer Chisel**



**Figure 21  
Tube & Nut Connection (Optional)**





Subject 8 (Continued)  
**MAJOR REBUILD PROCEDURE**

**TORQUE ROD REMOVAL**

Remove the torque rods from the cross member. Note the number of shims at each location as they must be reinstalled in the same manner to avoid affecting axle angle settings.

**SPRINGS/SPRING HANGERS/SADDLES DISASSEMBLY**

**Spring and Saddle Assemblies:** With the equalizing beams and axles rolled out from under the frame, support the spring and saddle assembly on a floor jack as shown in Figure 22. Remove the #1 spring hanger lock bolt(s) and drive out the spring hanger pin as shown in Figure 23. Remove the rebound bolt and spacer from the #2 spring hanger and lower the spring and saddle assembly from the spring hangers. Remove the spring and saddle assembly from the opposite side of the chassis in the same manner, and place them in a work area for disassembly.

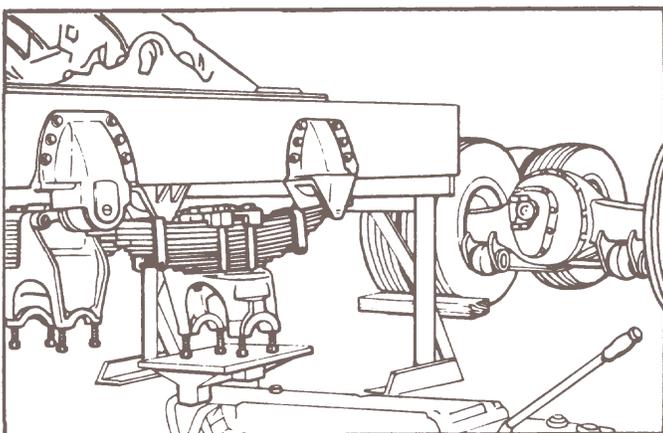
**Springs:** Loosen the spring top pad set screws, remove the top pad bolts and the top pad, and remove the spring from the saddle.

**Spring Hangers:** Remove the spring hangers from the frame.

**SPRINGS/SPRING HANGERS/SADDLES ASSEMBLY**

**Springs:** Position the new or rebuilt spring assembly on the saddle. A left-hand spring and saddle assembly, or

**Figure 22**



right-hand spring and saddle assembly can be assembled depending upon way the spring is facing on the saddle. The hole in the spring seat of the saddle is a clearance hole for the spring center bolt. It is not intended to be a pilot hole.

Assemble the top pad between the saddle chair back ears and on top of the main leaf of the spring assembly. The main leaf has a cup forged upward at the center bolt that pilots into a cavity in the top pad. This feature provides the correct alignment of the spring assembly in the saddle.

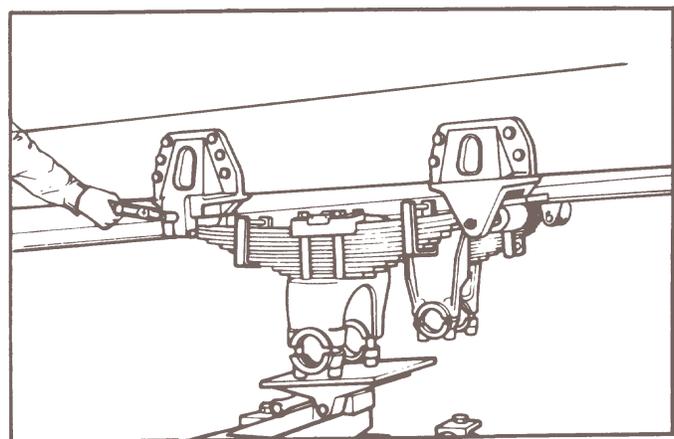
Assemble the four top pad bolts with washers and locknuts through the top pad and saddle. Snug up the locknuts enough to hold the assembly in place.

Assemble the top pad set screws and evenly tighten them as shown in Figure 24.

Evenly tighten the top pad bolt locknuts to 360-400 foot pounds as shown in Figure 24.

**Spring Hangers:** Install the new, or removed and inspected spring hangers on the frame. The vehicle manufacturer furnishes the fasteners that attach these parts to the frame. Follow their recommended tightening torque values for these fasteners. Hendrickson recommends grade 8 bolts, grade C locknuts, and flat, plated, hardened washers under the bolts heads and locknuts as shown in Figures 25 and 26.

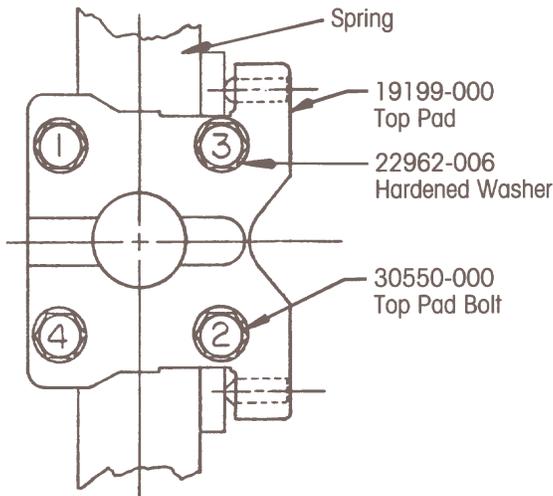
**Figure 23**





Subject 8 (Continued)  
MAJOR REBUILD PROCEDURE

Figure 24



A. 19201-002 Set Screw,  
Saddle Top Pad, Tighten to 120  
to 200 ft. lbs. Tighten  
19201-002 before Tightening  
Top Pad Bolts.

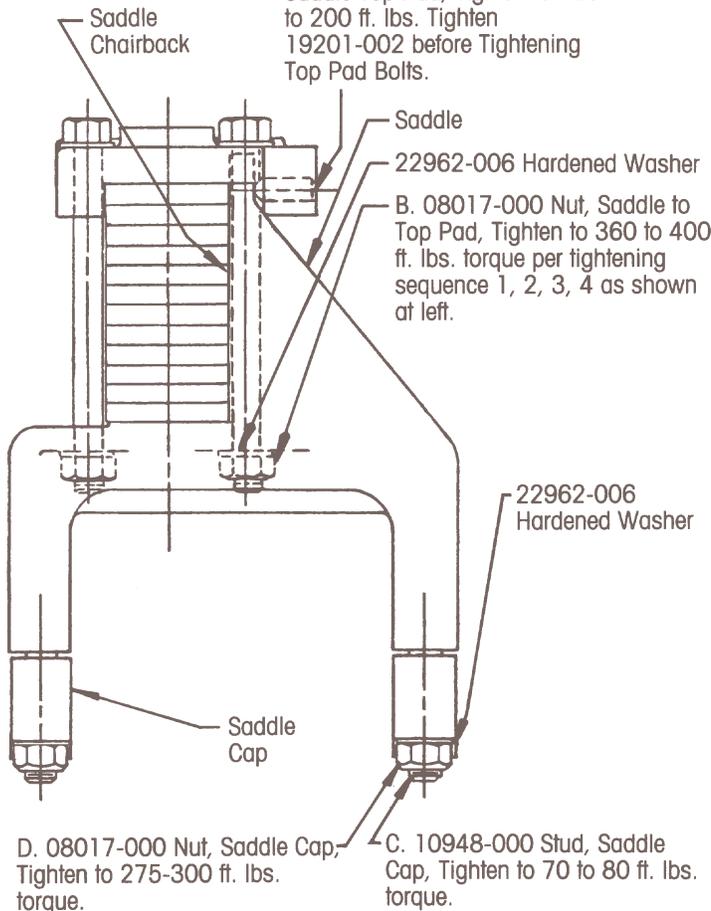
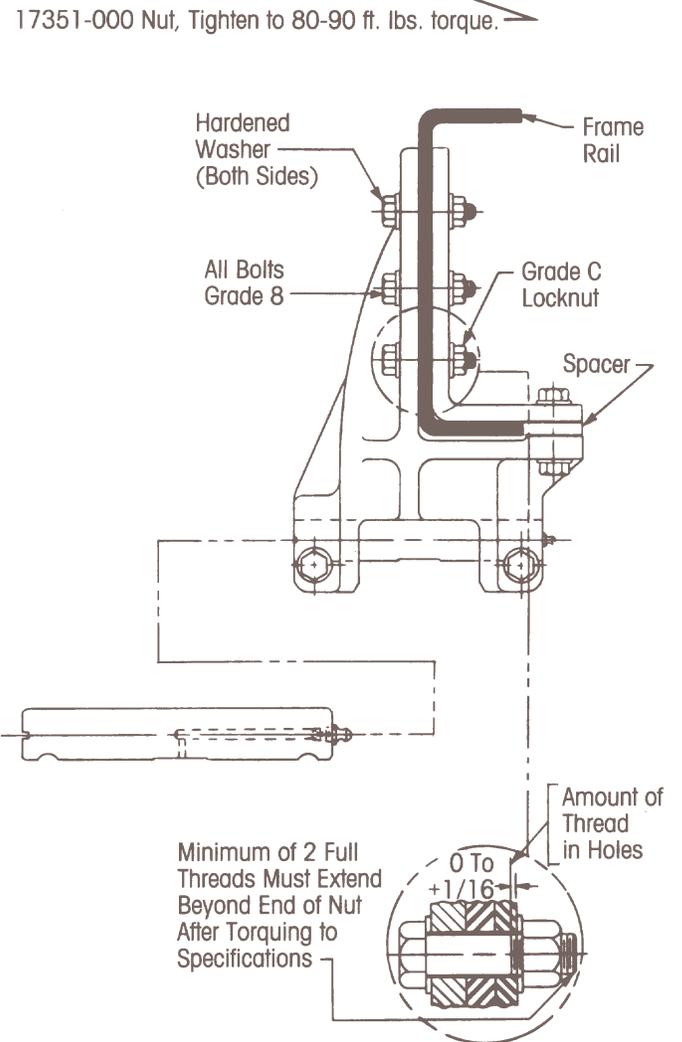
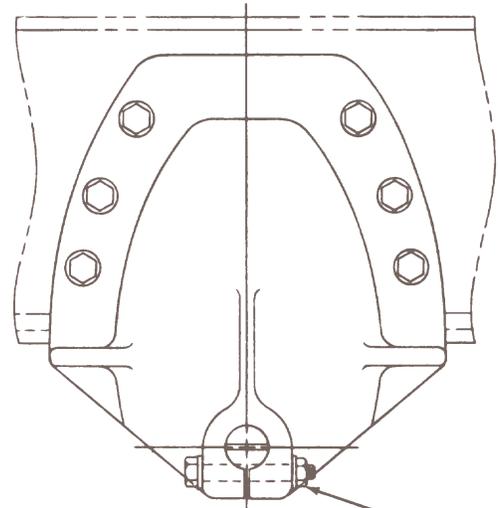


Figure 25





Subject 8 (Continued)  
**MAJOR REBUILD PROCEDURE**

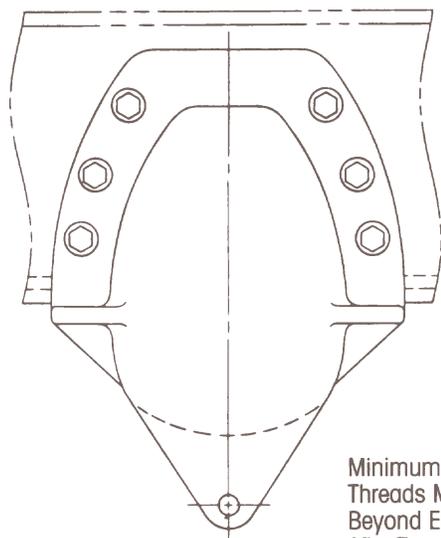
Install pin roller assembly, if so equipped, to #2 spring hanger before spring assembly is assembled as shown in Figure 27. See Figure 28 and follow instruction for draw key installation. Install lube fitting and pressure lubricate until lubricant appears at both ends of the pin roller.

**Spring and Saddle Assemblies:** Coat the I.D. of the spring eye bushing with lubricant. Using a roller jack, position the spring and saddle assembly into the #1 and #2 spring hangers. Align the spring eye with the pin hole in the #1 spring hanger. Coat the spring hanger pin with lubricant, and with the slotted end facing outboard, pilot the pin into the outside spring hanger leg, through the spring eye, and into the spring hanger inboard leg.

**Figure 26—#2 Spring Hanger and Spacer Installation**

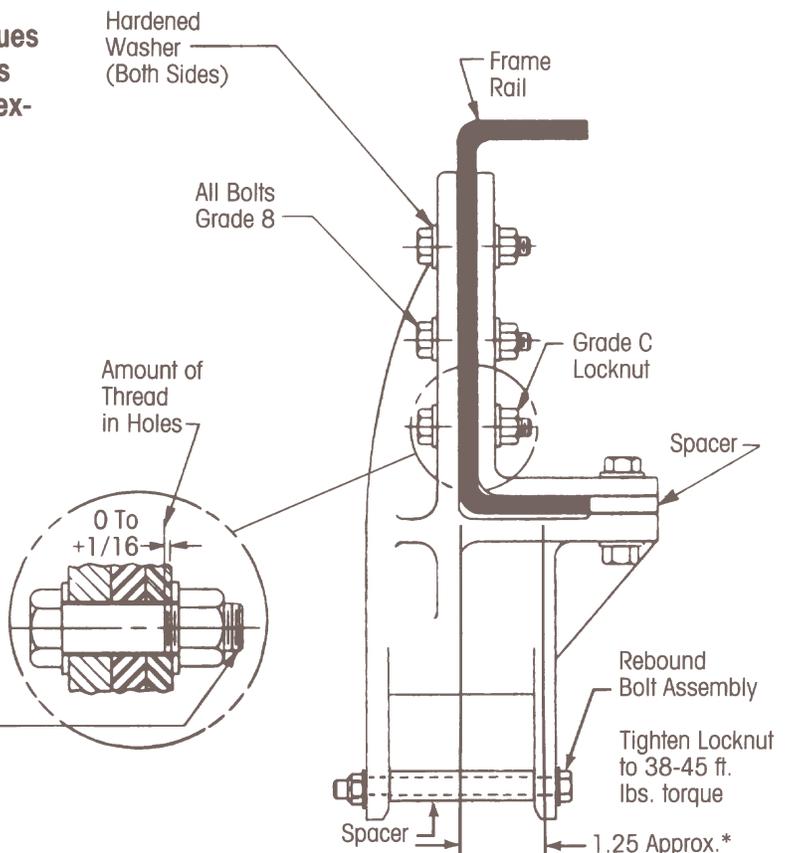
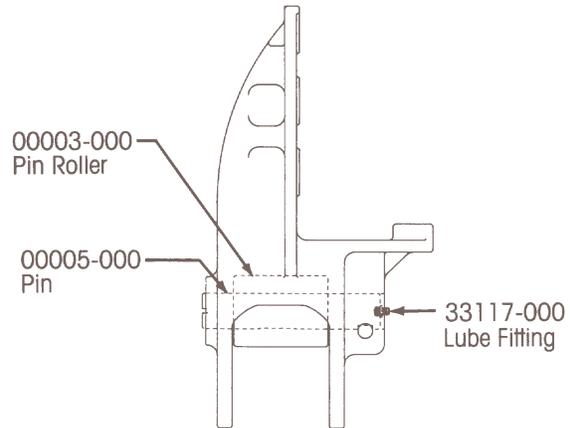
**NOTES:**

1. Lubricate all threads with SAE 20 oil.
2. Based on size of bolt, applicable tightening torques must be applied as shown in Industrial Fasteners Institute "Torque Tension Requirements, Steel Hexagonal Locknuts," Documents IFI-101.



For double lock bolt #1 spring hangers, rotate the pin using the slot to align the key ways and assemble the lock bolts, washers and locknuts as shown in Figure 25.

**Figure 27—#2 Spring Hanger Pin Roller Assembly**





Subject 8 (Continued)

MAJOR REBUILD PROCEDURE

For draw key #1 spring hangers, rotate the pin using the slot to align the key way and assemble the draw key with the flat side up. Fit the flat of the draw key into the pin key way. Drive the draw key with a hammer. Assemble the lock washer and nut as shown in Figure 28. If the draw key is allowed to enter the pin key way on an angle, it will wedge and gall. When locked in this position, it will become loose in a short time and allow the pin to turn and elongate the spring hanger pin hole. This may result in the failure of the pin, spring eye, or spring hanger.

Install lube fitting and pressure lubricate until lubricant appears at both ends of the spring eye bushing.

Assemble the rebound bolt with spacer and locknut through the legs of the #2 spring hanger as shown in Figure 29.

EQUALIZING BEAM BUSHING REMOVAL

WARNING:

WHEN REMOVING AND INSTALLING BUSHINGS IN EQUALIZING BEAMS, FOLLOW PROCEDURES OUTLINED IN THIS PUBLICATION. DO NOT USE A CUTTING TORCH TO REMOVE THE BUSHING OUTER METALS PRESSED IN THE BEAM BORES. WELDING, TORCHING OR ATTACHING MATERIAL TO THE EQUALIZING BEAM MUST NEVER BE PERFORMED. ALL HENDRICKSON EQUALIZING BEAMS ARE HEAT TREATED FOR STRENGTH AND SERVICE LIFE. THE USE OF HEAT ADVERSELY AFFECTS THE STRENGTH AND SERVICE LIFE. THE USE OF HEAT ADVERSELY AFFECTS THE STRENGTH OF THE BEAMS. DAMAGE TO THE BEAM CAUSED BY WELDING-TORCHING OR ATTACHING MATERIAL TO THE BEAM COULD RESULT IN A FAILURE WHICH MAY CAUSE LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

After removing equalizing beam bushings, thoroughly inspect each beam bore.

WARNING:

IF TORCH UNDERCUTTING IS FOUND FROM PREVIOUS REBUSHING, REPLACE WITH A NEW EQUALIZING BEAM. DO NOT TAKE THE RESPONSIBILITY FOR POSSIBLE ROAD FAILURE BY REBUSHING A BEAM IN THIS CONDITION. FAILURE TO REPLACE AN EQUALIZING BEAM THAT HAS TORCH UNDERCUTTING COULD RESULT IN THE FAILURE OF THAT BEAM, LEADING TO LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

Figure 28

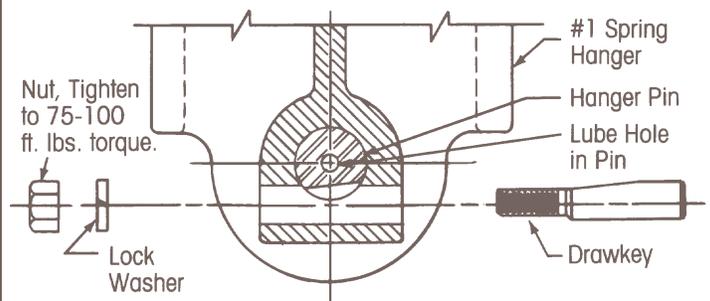
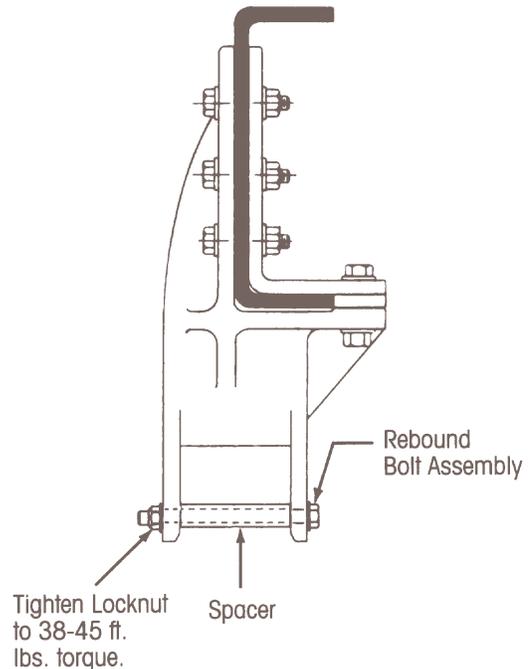


Figure 29





Subject 8 (Continued)  
**MAJOR REBUILD PROCEDURE**

**RUBBER END BUSHING REMOVAL**

Beam end rubber bushings can be removed with shop made tools.

Begin by cutting the protruding rubber off one side of each beam end bushing as shown in Figure 30. This permits the pushing tool to contact the outer metal of the bushing.

A piece of 5 3/4" O.D. by 7" long steel tubing can be used to remove the rubber end bushings.

Use a shop press with a capacity of at least 100 tons. Place the equalizing beam in the shop press with the beam end bore squarely supported on the press bed for safety, and to avoid bending the equalizing beam.

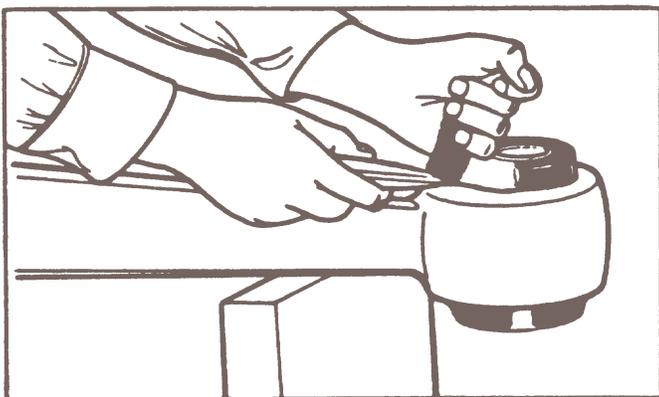
Center the bushing tool on the outer metal of the bushing and push the bushing out of the beam bore.

**RUBBER CENTER BUSHING REMOVAL**

Before attempting to remove the beam center bushings, inspect the inside face of each equalizing beam center hub. If the outer metal of the center bushing is worn, the edge may have mushroomed over the face of the beam hub. This material must be removed with a chisel or disc sander before the tooling adapters can be positioned for bushing removal.

Use a shop press with a capacity of at least 100 tons. Begin by placing the equalizing beam in the shop press with the beam center bore squarely supported on the press bed for safety, and to avoid bending the equalizing beam.

**Figure 30—Cutting Off Rubber On One Side For Pushing Tool Clearance**



Use a 5 1/4" O.D. by 10" long piece of steel tubing to remove and install the bushings.

Center the pushing tool on the outer metal of the rubber bushing and push the bushing out of the beam bore.

After removing the bushings, thoroughly inspect the beam bores.

**BRONZE CENTER BUSHING REMOVAL**

Bronze center bushings can be removed with shop made pushing tools. The procedure is the same as for rubber center bushings, except that the seal on the pushing side of the equalizing beam must be removed first. The center sleeves of the bronze bushing assembly and the cross tube can be removed by hand.

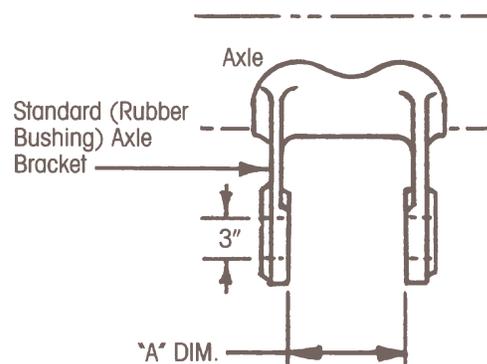
After removing the bushings, thoroughly inspect the beam bores.

**WARNING:**

**IF TORCH UNDERCUTTING IS FOUND FROM PREVIOUS REBUSHING, REPLACE WITH A NEW EQUALIZING BEAM. DO NOT TAKE THE RESPONSIBILITY FOR POSSIBLE ROAD FAILURE BY REBUSHING A BEAM IN THIS CONDITION. FAILURE TO REPLACE AN EQUALIZING BEAM THAT HAS TORCH UNDERCUTTING COULD RESULT IN THE FAILURE OF THAT BEAM, LEADING TO LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.**

Clean the bores of the equalizing beams with emery cloth, removing any nicks or metal buildup from bushing removal.

**Figure 31**





Subject 8 (Continued)  
MAJOR REBUILD PROCEDURE

CLEANING AND INSPECTION

RUBBER END BUSHING/AXLE BRACKET INSPECTION

Inspect the 3.0" diameter holes in each of the axle bracket legs as shown in Figure 31. Remove any burrs or material left there by the old adapters. Use a new adapter as a gauge for fit, being sure it enters the holes from the outside of each bracket leg.

The dimension between the inside surfaces of the axle bracket legs, as shown in Figure 31, with 6.00" long end bushings as dimension A must be 6.010/6.020". For 7.0" long end bushings, dimension A must be 7.010/7.020".

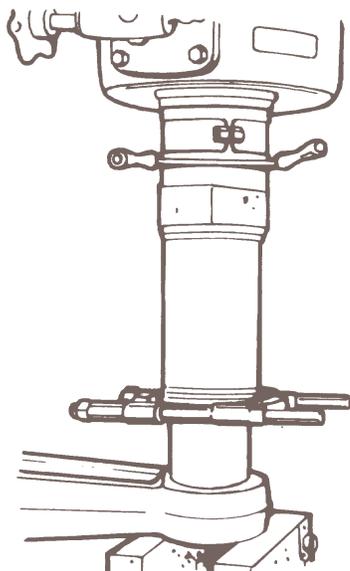
BEAM CENTER CROSS TUBE INSPECTION

Clean the cross tube and inspect it for cracks or excessive wear 8" to 10" from each end where it enters into the equalizing beam center bushings. Use a straight edge to check the straightness of the cross tube. If there is a doubt as to fracture, wear or straightness, replace it.

AXLE STOP INSPECTION

The four axle stops are furnished and installed on the frame by the truck manufacturer. The location of these stops limits axle articulation so that drive line action

Figure 32



and brake chamber clearance specifications are not exceeded.

Check the axle stop to frame fasteners for proper tightening torque. Follow the vehicle manufacturer's specifications.

If the axle stops are peening the top of the axle housing, contact the truck manufacturer, advising them of this condition.

INSTALLING NEW BUSHINGS

The outer metals of Hendrickson rubber bushings may be covered with a phosphate coating which acts as a rust preventive. This coating must be removed with emery cloth before installation.

Also apply a coating of white lead or grease to the cleaned outer metals of the bushings and to the beam bores to facilitate pressing the new bushings into the beam bores.

BEAM END BUSHING INSTALLATION

Rubber end bushings can be installed with shop made tools. A piece of 6.0" I.D. by 4.0" long steel tubing will install all RT-650 series rubber end bushings. A sheave puller as shown in Figure 32 is required to compress the rubber to allow contact with the bushing outer metal.

The part numbers and identification for rubber end bushings as shown in Figure 33 are:

Part No.	Inner Metal I.D.	Overall Length
10363-000	3.0"	6.0"
10364-000	3.0"	7.0"

When pressing new 6" long end bushings into beam, they must be centered within the beam end hub.

Figure 33





Subject 8 (Continued)  
**MAJOR REBUILD PROCEDURE**

When pressing new 7" long end bushings into beam, they must be offset 1/2" towards the outboard side of the beam. This is critical for correct fit up in suspension. See Figure 34.

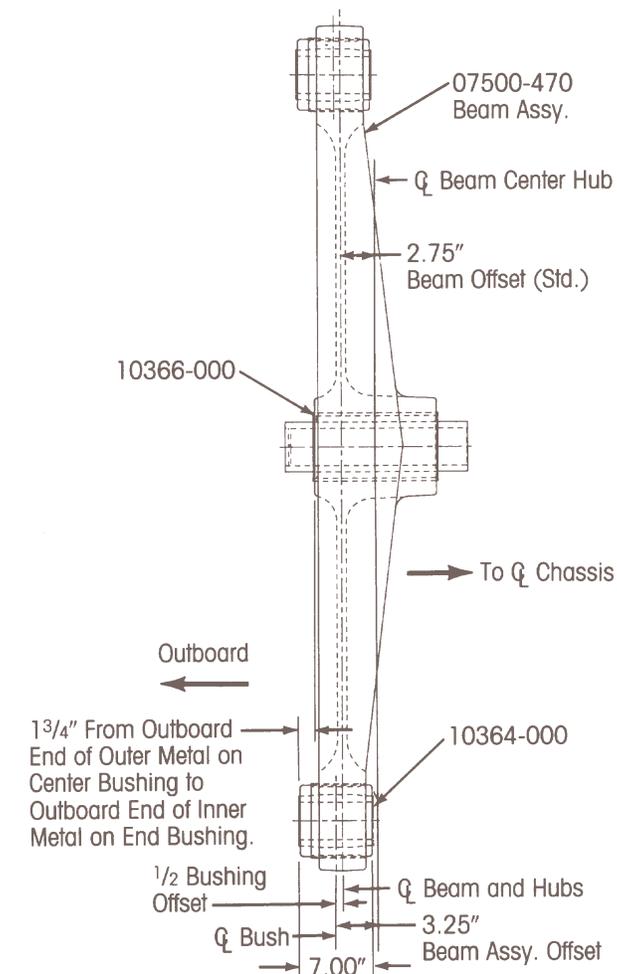
Place the equalizing beam in the shop press with the beam bore squarely supported on the press bed for safety, and to avoid bending the equalizing beam.

Press in the new bushing.

**RUBBER CENTER BUSHING INSTALLATION**

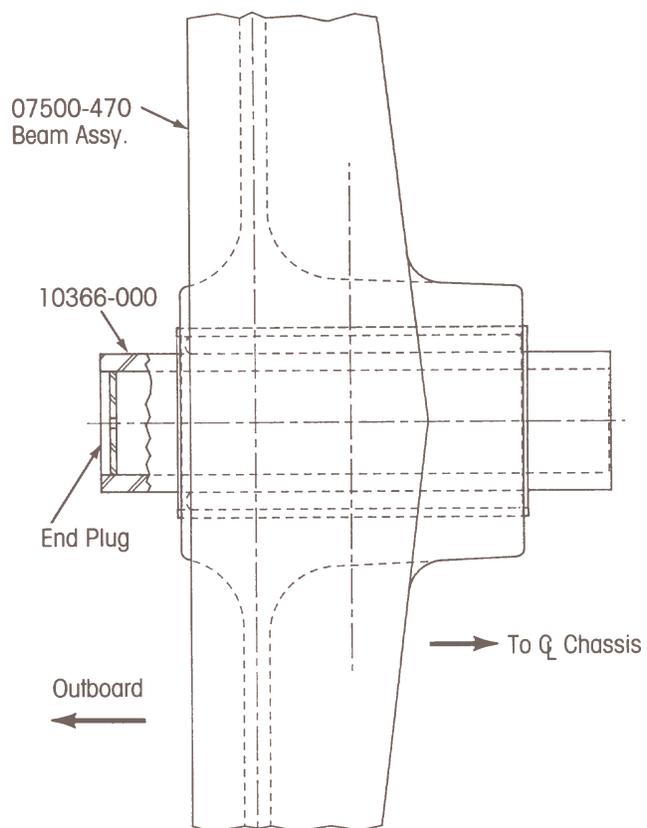
When installing rubber center bushings the following steps will minimize the chance of spoiling a new bushing:

**Figure 34—R-650 Beam With R-850 (7.00" Long) End Bushings**



1. Clean the bores of the equalizing beams with emery cloth, removing any nicks or metal buildup from bushing removal.
2. The outer metals of new Hendrickson rubber bushings may have a phosphate coating which acts as a rust preventive. This coating must be removed with emery cloth before installation.
3. The equalizing beam bore may have a more substantial lead chamfer at one end of the bore than the other. Take advantage of the larger chamfer by pressing in the new bushing from this end.
4. Support the beam squarely at the bore area to avoid distortion of the beam bore or bending of the beam.
5. Lubricate the O.D. of the bushing and I.D. of the

**Figure 35—R-650 Beam With R-850 (7.00" Long) End Bushings**





Subject 8 (Continued)

MAJOR REBUILD PROCEDURE

beam bore with white lead, grease, never seize, or other lubricant.

6. The open end of the bushing inner metal must be located adjacent to the long end of the beam center hub, facing the chassis center line. The plugged end of the center bushing must be located adjacent to the short end of the beam center hub, facing to tire side of the beam. See Figure 35.
7. Make sure the bushing is square to the beam bore and press the bushing into beam using a 5 1/4" O.D. by 10. 0" - long piece of steel tubing. Center the bushing within the beam bore.

BRONZE CENTER BUSHING INSTALLATION

Bronze center bushings can be installed with shop made tools. Begin by placing the equalizing beam in the shop press with the beam center bore squarely supported on the press bed for safety, and to avoid bending the equalizing beam.

Apply a coating of white lead or grease to the bushings and to the beam bores to facilitate pressing the new bushings into the beam bores.

Use a 5 1/4" O.D. by 10.0" - long piece of steel tubing to install the bushings.

Center the pushing tool on bushing and push the bushing in the beam bore.

All center bushings must be centered within the beam center hub as shown in Figure 36 to allow equal space at both ends of the bushing for placing the seals in position.

The seals must be inside the beam center hub faces 1/16" or they will be damaged when the beam is assembled into the saddle with thrust washers. Note that the seals are installed with their lips pointing outward. This allows grease to be purged past the seals during lubrication, and prevents outside contaminants from entering the bushings.

The equalizing beam bronze center bushing service kit part numbers is 45374-000. The kit includes enough parts for one vehicle as shown in Figure 37.

Conversion From Rubber To Bronze Center Bushings:

The inside of the equalizing beam center hubs must be drilled and tapped for the installation of the lube fittings as shown in Figure 38.

Figure 36—Bronze Center Bushings With Seals

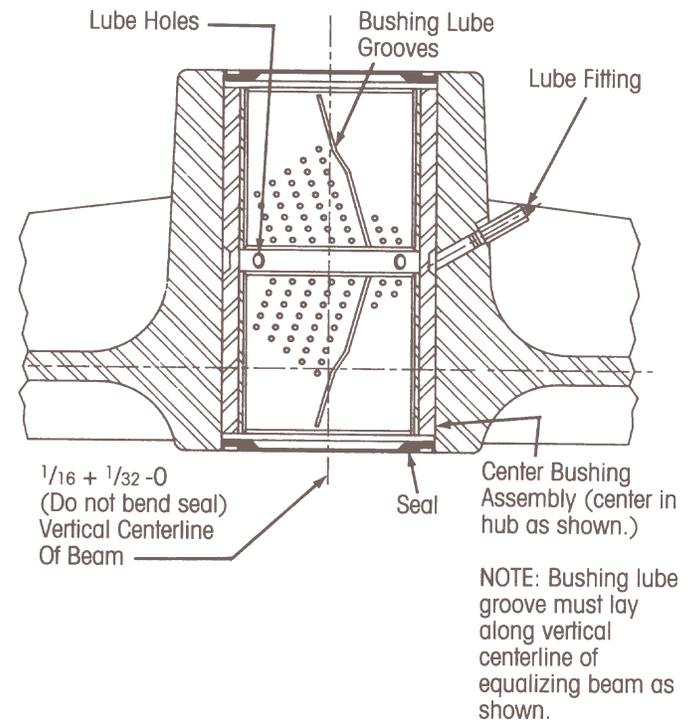


Figure 37—Bronze Center Bushing Kit

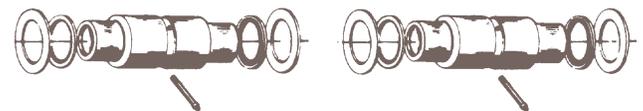
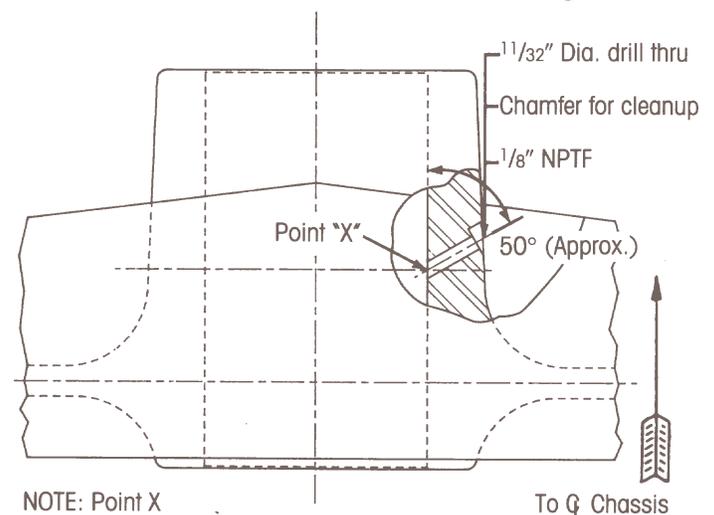


Figure 38—Hole Drilling Location/Lube Fitting





Subject 8 (Continued)  
MAJOR REBUILD PROCEDURE

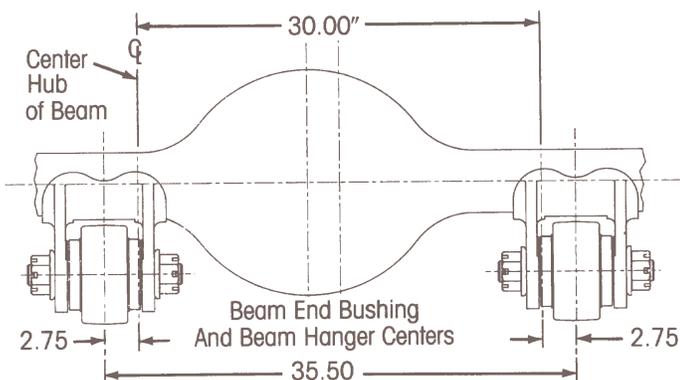
INSTALLING BEAMS TO AXLES

When installing beams with 6.00" long end bushings part number 10363-000, they must be assembled with the 2.75" beam offset facing the chassis centerline as shown in Figure 39.

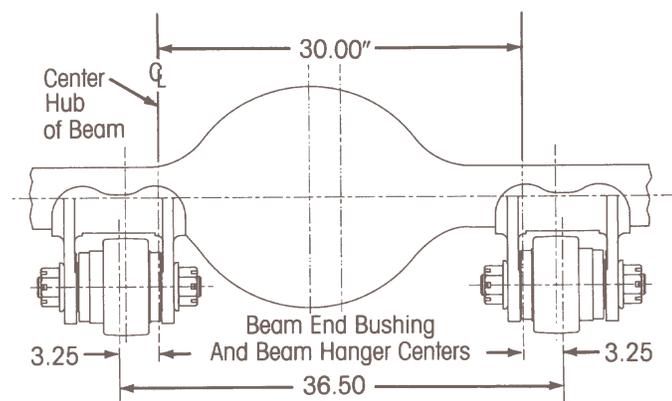
When installing beams with 7.0" long end bushings part number 10364-000, they must be assembled with the 3.25" beam assembly offset facing the chassis centerline as shown in Figure 40.

If the equalizing beams have bronze center bushings, apply chassis lube to the bronze linings and to the beam center sleeves. Assemble the sleeves with

**Figure 39—Installation of 6" Length Offset Beam End Bushings To Align With 35½" Beam Hanger Axle Bracket Centers**



**Figure 40—Installation of 7" Length Offset Beam End Bushings With 36½" Beam Hanger Axle Bracket Centers**



thrust washers into the center bushings. Assemble enough thrust washers so that any remaining gap with the saddle legs is less than the thickness of one thrust washer as shown in Figure 41.

With the two equalizing beams on the floor, insert the beam center cross tube into the rubber center bushing inner metals or the bronze center bushing sleeves.

Apply an anti-seize compound to all mating metal surfaces of the axle brackets, end bushings, and connecting hardware. This will hold in the assembly as well as prevent possible corrosion making future disassembly difficult.

TWO-PIECE ADAPTER INSTALLATION

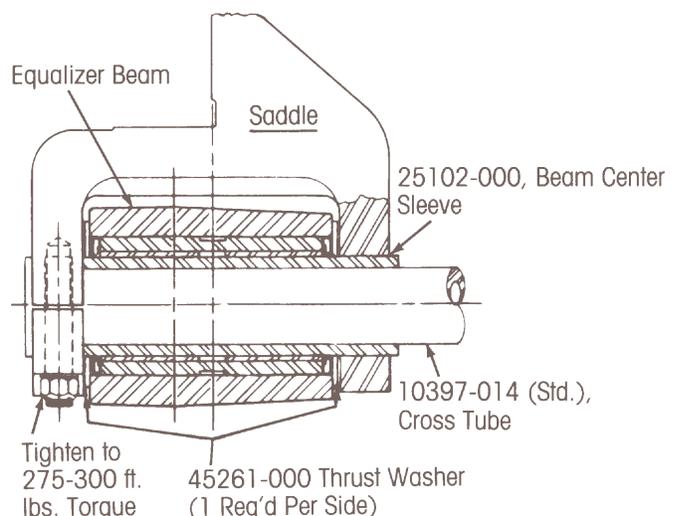
Raise one end of both beams with the cross tube installed, into the axle brackets on one axle. Install one adapter through the axle bracket leg at the wheel side, into the beam end bushing. Then install the other adapter through the axle bracket leg at the bowl side with the through shaft, taking advantage of the cut off flange on the adapter to clear the bowl.

Assemble the nut, but do not torque to specification yet.

Assemble the adapters, through shaft, and nuts in the opposite axle bracket in the same manner. Raise the opposite ends of the beams into the axle brackets on the other axle and assemble the adapters, through shaft, and nuts, in the same manner.

Place the axles in their normal operating positions before the nuts are torqued to specifications.

**Figure 41—Beam Center Installed To Saddle**





Subject 8 (Continued)  
**MAJOR REBUILD PROCEDURE**

Two-piece adapter assemblies, as shown in Figure 42, with a 2.0" diameter through shaft, must have the nuts tightened to 600 to 800 foot pounds torque. DO NOT EXCEED SPECIFIED TORQUE. If cotter pin holes do not line up, do not back off nut. The nut may be tack welded to the shaft.

**WARNING:**

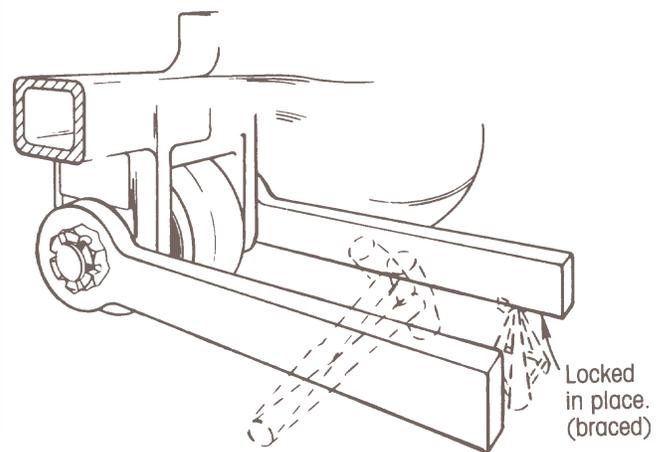
IF THE TIGHTENING TORQUES RECOMMENDED ABOVE ARE NOT ACHIEVED, METAL SURFACES WILL WORK AND WEAR THE AXLE BRACKET LEGS, HOLES, ADAPTERS AND RUBBER BUSHING INNER METALS. PROPERLY TIGHTENED END CONNECTIONS WILL ELIMINATE COSTLY REPAIR, DOWNTIME AND POSSIBLE SEPARATION OF COMPONENTS AND LOSS OF VEHICLE CONTROL, PROPERTY DAMAGE OR PERSONAL INJURY.

If it is not practical to tighten these parts to this torque value with a torque wrench, an alternate method using 9200-014 Wrenches and a 4 pound hammer is

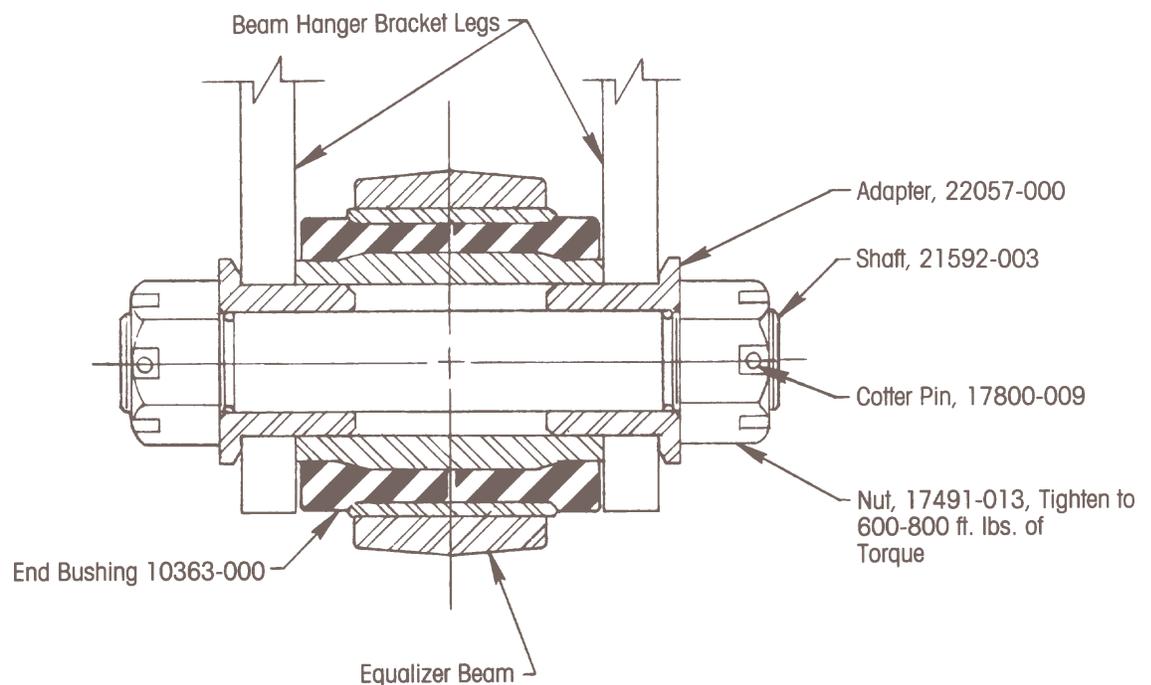
acceptable when following this procedure. As shown in Figure 43.

1. Position equalizer beam assembly in beam hanger on axle.
2. Insert beam end adapter (22057-000).
3. Insert shaft (21592-003) through adapters.
4. Assemble nut (17491-013) on shaft and fasten with cotter pin (17800-009).
5. Assemble nut on other end.

**Figure 43**



**Figure 42—Two-Piece Adapter Connection**





Subject 8 (Continued)  
MAJOR REBUILD PROCEDURE

**NOTE: AXLES MUST BE IN OPERATIONAL POSITION BEFORE FASTENERS ARE TIGHTENED TO PREVENT PRELOADING OF RUBBER IN BUSHING.**

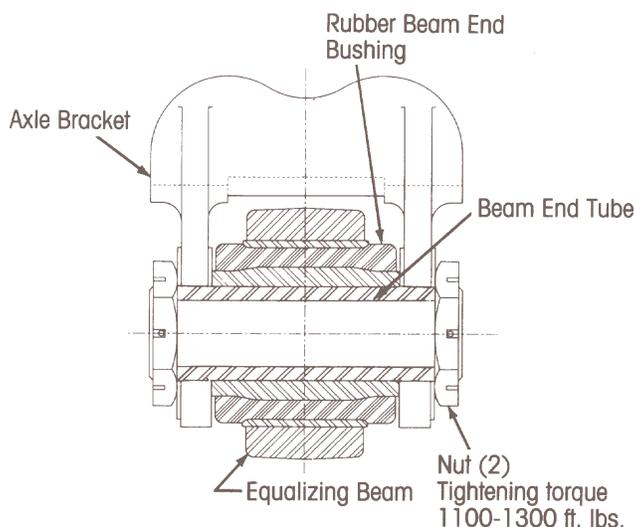
- At 125 foot pounds of initial torque on assembly, using 9200-014 slug wrenches on nuts, tighten assembly by moderately hitting wrench with a 4 pound hammer near handle end to approximately 1/4 of a turn of the nut or 90 degrees rotation. Be sure other wrench on pinned nut is solidly braced to prevent movement. Do not back off nut to install cotter pin. If cotter pin holes do not line up, this nut may be tack welded to the shaft. Repeated hammering beyond this point may be detrimental to this assembly.

The part numbers and identification for two-piece adapter assemblies are as follows:

Part No.	Description	Shaft Dia.	End Bushing Length
21140-007	Fixed Flange Adapter Assy.	2"	6.0"
21140-004	Fixed Flange Adapter Assy.	2"	7.0"

Each adapter assembly contains parts for one beam end connection.

**Figure 44—Tube and Nut Beam End Connection**



**TUBE AND NUT INSTALLATION**

Tube and nut assemblies, as shown in Figure 44, with a 3.0" O.D. tube and a 6.0" or 7.0" long bushing require the nuts to be tightened to 1100 to 1300 foot pounds torque. DO NOT EXCEED SPECIFIED TORQUE.

Raise one end of both beams with the cross tube installed, into the axle brackets on one axle. Install the tube through the axle bracket legs and the end bushing. Center the tube within the axle bracket.

Hand start both nuts on the tube but do not torque to specification yet.

Assemble the tube and nuts in the opposite axle bracket in the same manner.

Raise the opposite ends of the beams into the axle brackets on the other axle and assemble the tubes and nuts in the same manner.

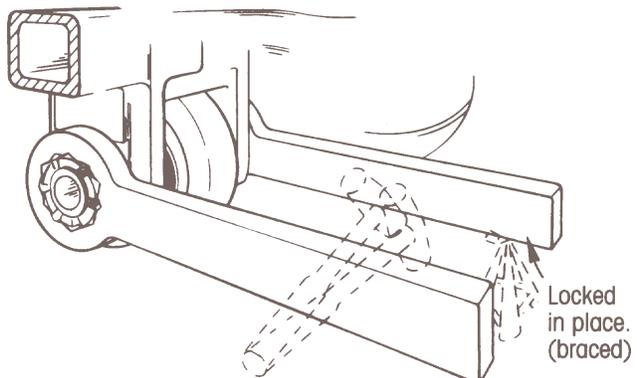
Place the axles in their normal operating positions before the nuts are torqued to specifications.

If it is not practical to tighten these parts to this torque value with a torque wrench, an alternate method using 9200-015 slug wrenches and a 4 pound hammer is acceptable when following this procedure. As shown in Figure 45.

- Position equalizer beam assembly in beam hanger on axle.
- Insert tube.
- Assemble one nut (10371-000) on shaft and fasten with cotter pin (17800-010).
- Assemble nut on other end.

**NOTE: AXLES MUST BE IN OPERATIONAL POSITION BEFORE FASTENERS ARE TIGHTENED TO PREVENT PRELOADING OF RUBBER IN BUSHING.**

**Figure 45**





Subject 8 (Continued)

**MAJOR REBUILD PROCEDURE**

- At 200 foot pounds of initial torque on assembly, using 9200-015 slug wrenches on nuts, tighten assembly by moderately hitting wrench with a 4 pound hammer near handle end to approximately 1/3 of a turn of the nut or 120 degrees rotation. Be sure other wrench on pinned nut is solidly braced to prevent movement. Do not back off nut to install cotter pin. If cotter pin holes do not line up, this nut may be tack welded to the tube. Repeated hammering beyond this point may be detrimental to this assembly.

The part number and identification for the tube & nut assemblies are as follows:

Part No.	Description	Tube Dia.	End Bushing Length
21140-006	Tube & Nut Assy.	3.0"	6.0"

The assembly contains parts for one beam end connection.

**EQUALIZING BEAMS**

With the equalizing beams attached to the axles, roll them under the vehicle in center of the saddle making sure the beam center bushings are lined up with the center of the saddle legs. With the saddle caps removed, lower the chassis so that the saddles contact the equalizing beam center bushings. Assemble the saddle caps, washers, and locknuts.

Evenly tighten the locknuts to prevent distortion of the saddle cap and studs as shown in Figure 46 to 275 to 300 foot pounds torque.

Install both torque rods at the frame bracket ends.

Install both torque rods at the axle bracket ends.

To install a straddle mount end, position the torque rod end at the bracket, and assemble the grade 8 bolts, washers, locknuts, and any adjustment shims as noted during disassembly. The vehicle manufacturer furnishes the attaching fasteners. Follow their tightening torque specifications.

To install a tapered stud end, the bracket hole must be free of all foreign matter. Place the stud in the bracket and assemble the locknut, with spacer washer if so equipped, and tighten the locknut to 175 to 225 foot

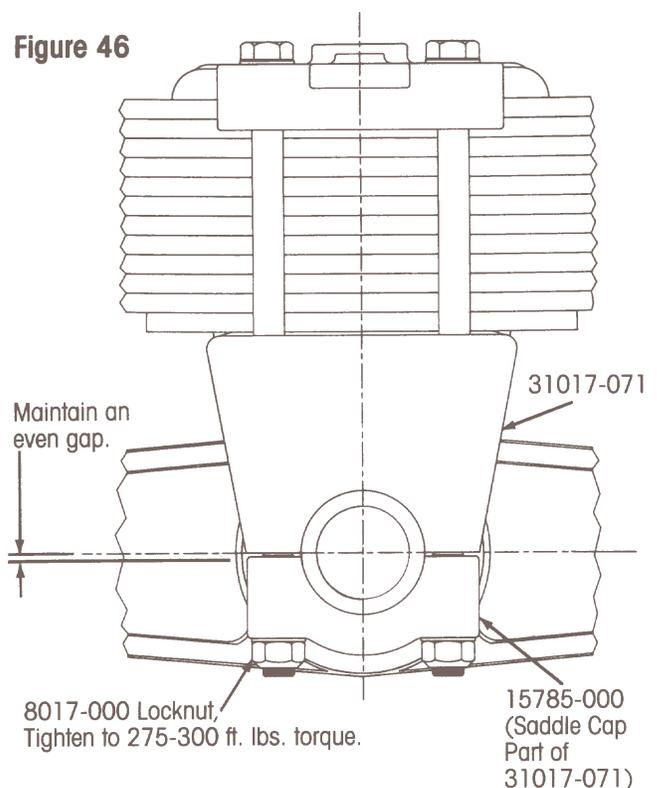
pounds torque. After tightening, rap the bracket with a hammer as shown in Figure 47, and retighten to 175 to 225 foot pounds torque.

Reset all spring parking brakes on the tandem axles and connect the drive shaft to the front of the forward drive axle.

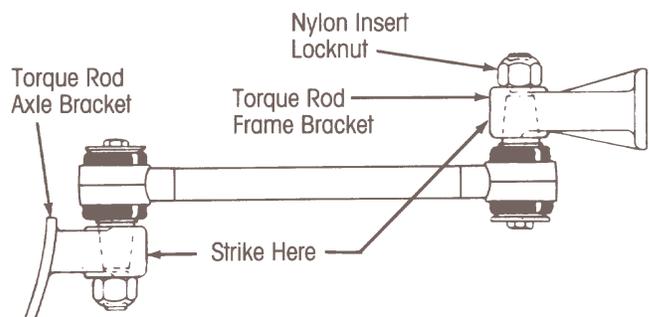
Connect all air lines leading to the rear axles and charge the vehicle air system.

Remove the blocks at the tires of the front steering axle.

**Figure 46**



**Figure 47—Tapered Stud Ends/Installation**





Subject 9  
TIGHTENING TORQUE SPECIFICATION CHART

DESCRIPTION	HENDRICKSON PART NO.	THREAD/ GRADE	RECOMMENDED TORQUE (FT. LBS.)
Spring Hanger to Vehicle Frame Bolts, Nuts and Washers	None	Furnished and Installed by Truck Manufacturer	Follow Manufacturer's Specifications
Spring Center Bolt Nut	5070-000	1/2"-13 UNC-2B Grade 5	65-75
Spring Pin Draw Key Nut	17351-000	1/2"-13 UNC-2B Grade 5	75-100
Spring Pin Double Lock Locknut	46578-000	1/2"- 13 UNC-2B Grade C	45-63
Top Pad Set Screw	19201-002	3/4"- 10 UNC-2A Grade 2	120-200
Top Pad Bolt Locknut	8017-000	1"-14 UNS-2B Grade C	360-410
Rebound Bolt Locknut	46578-000	1/2"-13 UNC-2B Grade C	38-45
Saddle Cap Stud	10948-000	1"- 14 UNS-2A Grade 5	70-80
Saddle Cap Stud Locknut	8017-000	1"-14 UNS-2B Grade C	275-300
Adapter Nut	17491-013	1 7/8"-12 UNF-2B Grade C	600-800
Tube Nut	10371-000	3"- 12 UN-2B Grade C	1100-1300
Torque Rod Locknut (Tapered End)	29749-000	1 1/4"-12 UNF-3B Grade 5	175-225
Torque Rod Locknut (Straddle Mount)	None	Furnished and Installed by Truck Manufacturer	Follow Manufacturer's Specifications

All threads must be clean and lubricated with SAE 20 oil before assembly to obtain the correct relationship of torque and fastener tension.

To obtain maximum service life from the suspension system, mounting bolts and nuts should be checked at least once a year and tightened to specified torque.



A Boler Company