TECHNICAL PUBLICATION

E4-340/E4-380

NO: 17730-195

SUBJECT: Service Instructions

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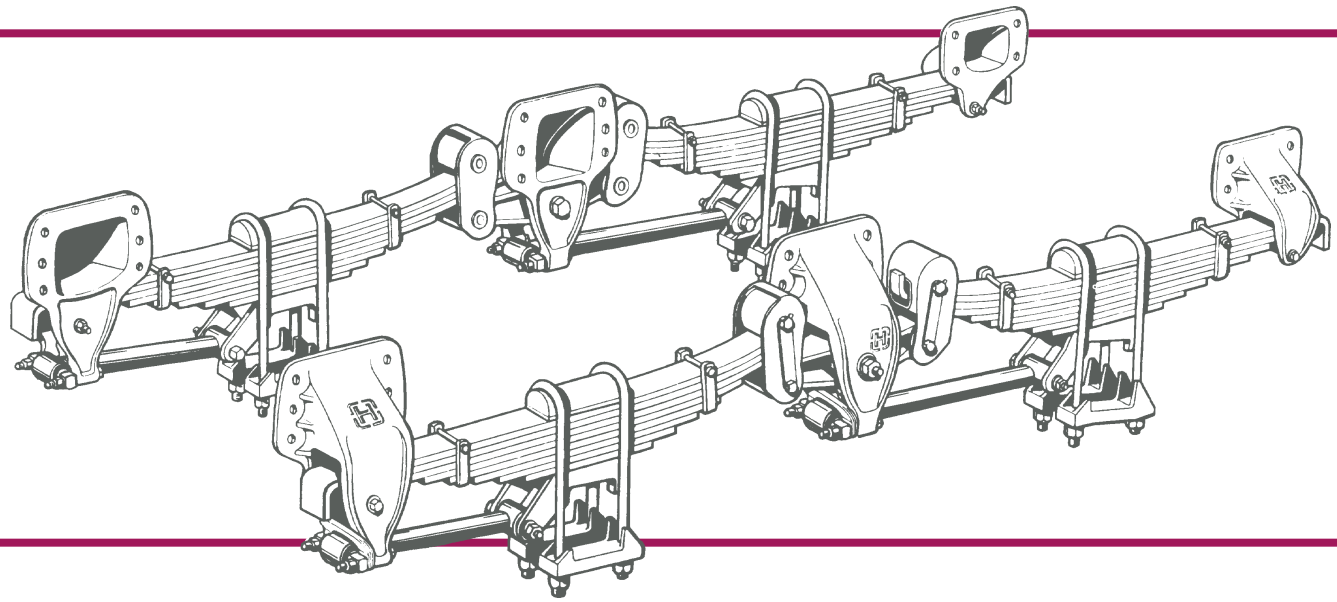

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HENDRICKSON
Truck Suspension Systems
A Boler Company

Subject 1
INTRODUCTION

This publication is to acquaint and assist maintenance personnel in preventive maintenance and rebuild of the E4-340 and E4-380 series Four Spring suspensions.

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

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.

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. Some of these operations may require the use of shop made tools for removal and installation of bushings.

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.

A mechanic using a service procedure or tool which has not been recommended by Hendrickson must first satisfy himself that neither his safety or the vehicle's safety will be jeopardized by the method or tool selected.

WARNING: Do not use a cutting torch to remove any attaching fasteners. Do not use a cutting torch to remove the bushings from the equalizing beam assemblies. 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.

Subject 3
DESCRIPTION

Hendrickson offers the E4 Series in 34,000 and 38,000 pound capacities. The following guidelines are Hendrickson's recommendations to assure proper suspension selection:

The E4-340 suspension should be used for all over-the-highway vehicles where the tandem loads do not exceed 36,000 pounds.

The E4-380 suspension should be used for over-the-highway vehicles where the tandem loads will exceed 36,000 pounds but not over 38,000 pounds.

Proper suspension selection should be based on the amount of carrying capacity required for a specific vehicle operation. Specifying the E4-380 for operations that do not exceed 36,000 pounds will not allow the suspension to perform as designed, and may cause a reduction in ride qualify.

Both the E4-340 and the E4-380 suspensions are intended for installation on overall frame widths of 33.94" to 34.19", axle dowel pin centers of 40.00", and 52.00" axle spacing. They are lightweight, four spring type suspensions designed to achieve maximum durability and low maintenance. The design features include:

- one piece cast nodular iron spring hangers, spring seats, and axle caps
- shackled equalizing beam for better load distribution and articulation
- positive shackle restraint system
- low frame height
- shot peened and pre-set multi-leaf springs
- cartridge type rubber bushings in spring eyes and equalizing beams
- longer equalizing beam center bushings with thrust washers
- tube to tube torque rods with premium rubber bushings. Standard torque rods use drop in shim type adjustment. Optional torque rods have threaded turnbuckle type adjustment
- no lubrication
- positive axle alignment

Subject 4
FIFTH WHEEL MOUNTING ANGLE CLEARANCE

Fifth wheel mounting angles that extend down over the side of the main frame rails must be cut out to provide proper clearance for the articulation of the equalizing beams and shackles as shown in figure 1.

Subject 5
FRAME SLOPE

Chassis frame slope in excess of one degree in the loaded condition will cause the equalizing beams to ride in a cocked position, i.e., not parallel to the frame, reducing the amount of available equalizing beam rotation in one direction. This condition should be corrected by adjusting the ride height at the tandem or at the front steer axle. If adjustment is required, the rear tandem usually must be raised to achieve a level frame since the E4 suspension is designed with a relatively low ride height.

When increasing the rear tandem ride height, spacer plates of equal thickness must be installed between all four spring seats and springs. Do not attempt to compensate for cocked equalizers by adding spacer plates on only one drive axle. The spacer plates can be made from 1/2" x 3" x 7" low carbon steel with a 13/16" dia. hole drilled in the center for spring center bolt clearance. A maximum of two 1/2" shop made spacer plates between each spring and spring seat is permissible. When installing spacer plates, position each plate on the center of the spring seat and tack weld the spacer to the rear edge of the spring seat casting using stainless steel welding rod as shown in figure 2. Longer U bolts will be required to accommodate spacer plates. Hendrickson has 1" and 1 1/2" thick spacers available as production items. A maximum of one 1" thick, or one 1 1/2" thick spacer is permissible.

Figure 1

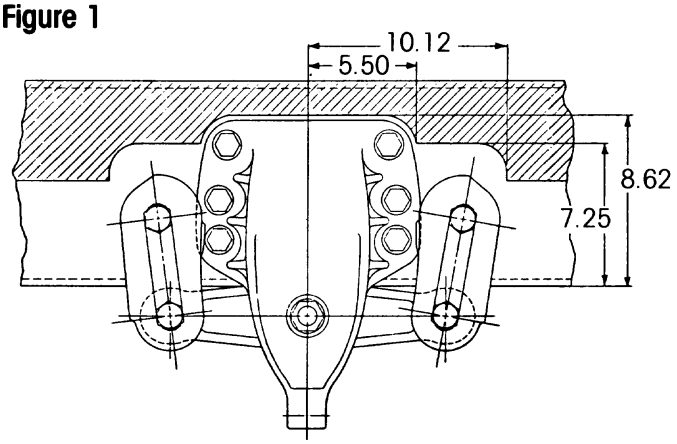
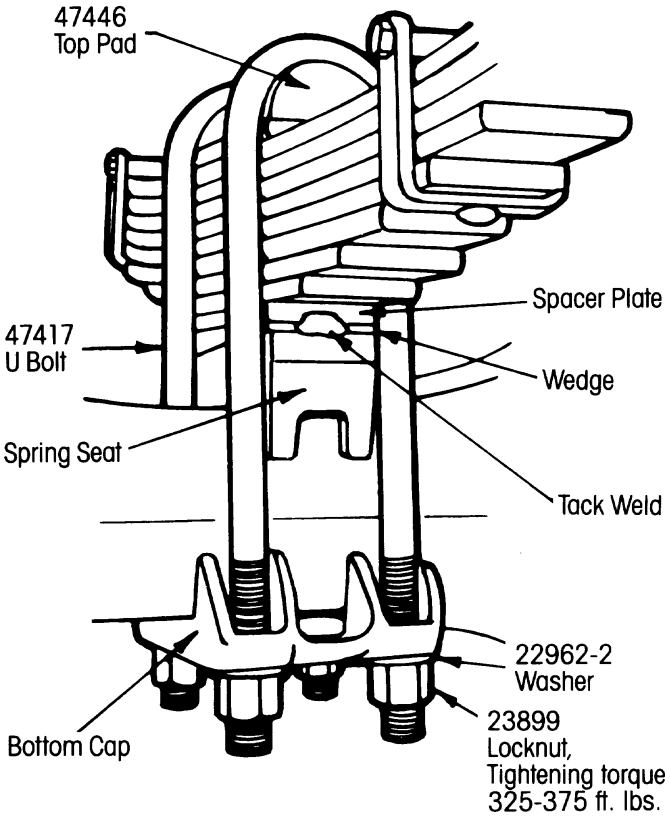


Figure 2



Subject 6
SUSPENSION ALIGNMENT

The following procedure should be performed after all repairs are completed and all suspension fasteners have been tightened to specified torque values.

1. Place tractor on level floor area. Free and center all suspension joints by slowly moving vehicle back and forth several times without using the brakes. The equalizing beams should be essentially level in this condition.
2. Chock front wheels and make sure tractor brakes are released.
3. Using "C" clamps, securely clamp a nine foot piece of STRAIGHT bar stock or angle iron across frame as shown in figure 3. Select a location as far forward of forward drive axle as possible where vehicle components will not interfere. On some vehicles, lower frame flange may be preferred. Otherwise use upper frame flange.
4. Accurately square straight edge to frame using a carpenter's square.
5. Begin alignment by checking rear drive axle first. Use a trammel bar or its equivalent to measure from straight edge to center line of rear drive axle on both sides of vehicle as shown in figure 3, Ll and Lr. If both sides measure within 3/16" of being the same, alignment of rear drive axle is acceptable. If Ll and Lr differ by more than 3/16", adjust rear drive axle by loosening up torque rod bar pin locknuts on center spring hanger and add drop in shims as shown in figure 4. Torque rod bar pin must always be mounted adjacent to forward face of spring hanger legs. No more than four shims may be used (1/4" total thickness, max.). Snug torque rod bar pin locknuts but do not torque to specification.

Figure 3

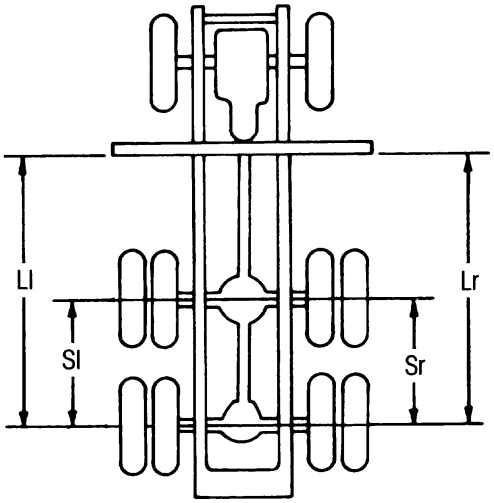
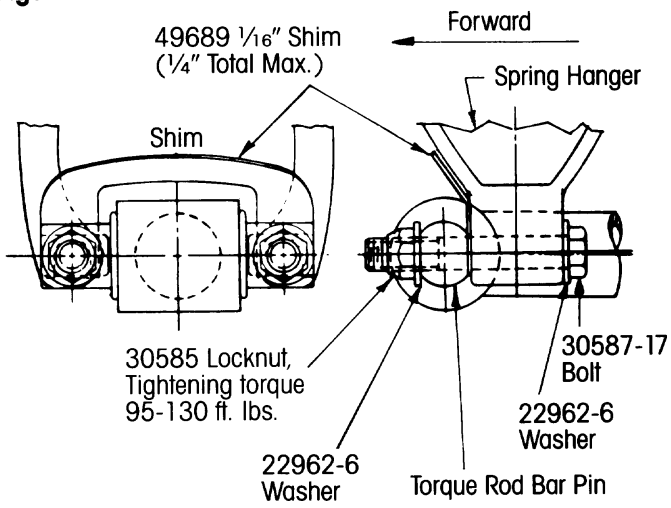


Figure 4



Subject 6 (Continued)
SUSPENSION ALIGNMENT

If the vehicle is equipped with threaded turnbuckle type torque rods, loosen all the torque rod clamp bolt locknuts and rotate the threaded shank of the torque rod. Snug torque rod clamp bolts but do not torque to specification.

6. With rear drive axle properly aligned, front drive axle alignment can then be checked by measuring forward from rear drive axle center using a trammel bar as shown in figure 5. If the forward drive axle spacing measurements differ by more than 1/8", Sl and Sr in figure 3, make adjustments at forward spring hangers in a similar manner. Snug torque rod bar pin locknuts or torque rod clamp bolt locknuts.
7. Following alignment of both axles, move vehicle back and forth several times prior to removing straight edge from frame, and recheck alignment to confirm adjustments. Tighten torque rod bar pin locknuts to 95 to 130 foot pounds as shown in figure 4, or torque rod clamp bolt locknuts to 70 to 95 foot pounds, and remove straight edge.

Subject 7
PREVENTIVE MAINTENANCE

U bolt locknuts: Retighten to 325 to 375 ft. lbs. torque as shown in figure 6 after first 1,000 miles of service on new vehicle or vehicle with serviced spring assembly, and then at regular intervals as experience dictates, not to exceed 100,000 mile intervals. **Do not exceed specified torque on U bolt locknuts.**

Springs. Inspect springs for cracked or broken leaves. A single leaf may be replaced if the spring has been in service for less than 200,000 miles. Entire spring assembly should be replaced if more than one leaf has failed, regardless of mileage, or if only one leaf has failed and the spring has been in service for over 200,000 miles.

Figure 5

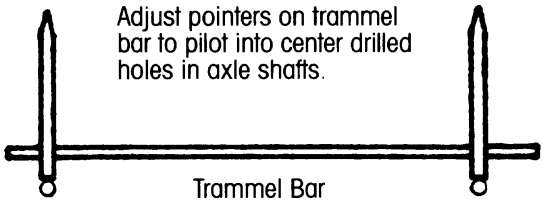
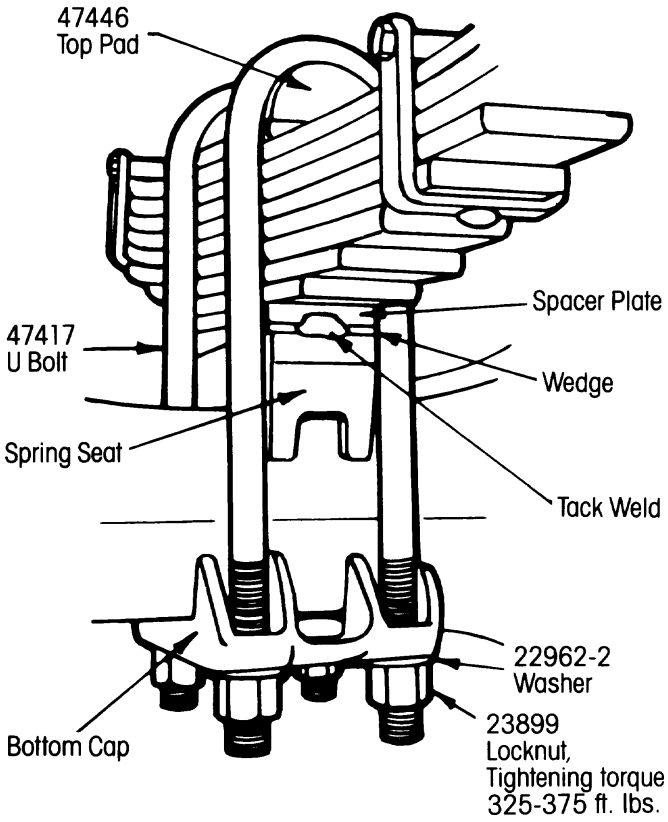


Figure 6



Subject 8
COMPONENT REPLACEMENT

Springs. The following procedure is recommended to replace any of the four spring assemblies. All four springs are identical.

Disassembly:

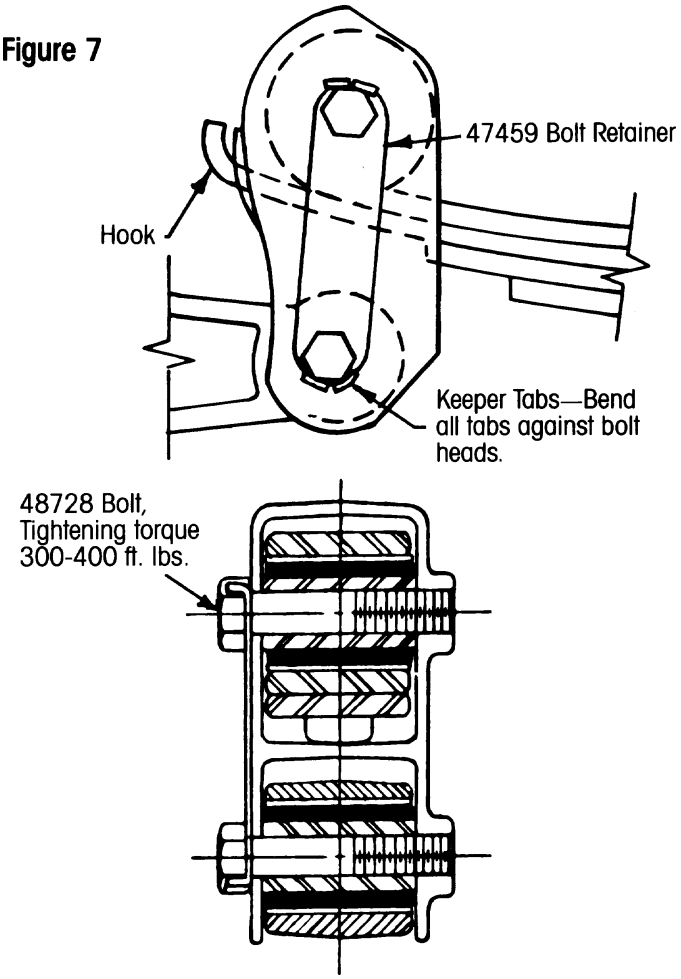
1. Chock wheels of axle.
2. Straighten keeper tabs on bolt retainer plate and loosen both upper and lower shackle bolts.
3. Remove rebound ball locknut, washers, and spacer from end spring hanger.
4. Raise rear of frame far enough to remove load from springs.
5. Remove U bolt locknuts and washers.
6. Remove U bolts, bottom cap, and top pad.
7. Remove both shackle bolts (frame may have to be raised for bolts to clear tires). Discard shackle bolt retainer plate because keeper tabs can only be bent once. Do not reuse retainer plate.
8. Remove spring assembly.

Assembly:

1. Position shackle on eye of new or serviced spring assembly as shown in figure 7. Hook must pass through opening provided in shackle. Threaded bosses of shackle must be positioned towards truck frame.
2. Assemble one shackle bolt with new shackle bolt retainer plate through upper shackle hole and spring eye.
3. Position spring on spring seat, or on spacer plate if so equipped, with spring center bolt piloting into hole in spring seat or spacer plate while aligning lower shackle legs over equalizing beam end bushing.
4. Assemble other shackle bolt through retainer and lower shackle hole and equalizing beam end bushing. Hand tighten shackle bolt.
5. Assemble top pad, U bolts, bottom cap, washers, and locknuts as shown in figure 6. Do not tighten U bolt locknuts at this time.
6. Lower frame so that end spring hanger engages spring.
7. Tighten U bolt locknuts to specified torque as shown in figure 6, rap top of U bolts, and retighten to specified torque. DO NOT EXCEED SPECIFIED TORQUE ON U BOLT LOCKNUTS.
8. Tighten shackle bolts to specified torque and bend all keeper tabs against bolt heads as shown in figure 7.
9. Assemble rebound bolt, rebound roller, spacer, washers, and locknut in end spring hanger as shown in figure 8. Tighten locknut to specified torque.
10. Recheck alignment after new spring is installed.

NOTE: U bolt locknuts must be retightened to 325 to 375 ft. lbs. torque after first 1,000 miles of service, and at regular intervals thereafter as experience dictates, not to exceed 100,000 miles. Do not exceed specified torque on U bolt locknuts.

Figure 7



Subject 8 (Continued)
COMPONENT REPLACEMENT

Equalizing beam bushings. The following procedure is recommended to replace the equalizing beam rubber bushings.

Disassembly:

1. Chock wheels of rear drive axles and support rear of frame.
2. Remove torque rod bar pin locknuts, bolts, washers, and any shims from the center spring hanger. Note the number of shims at each location. These shims must be reinstalled in the same manner to avoid affecting alignment.
3. Straighten all keeper tabs on shackle bolt retainer plates and remove all shackle bolts. Discard shackle bolt retainer plates because keeper tabs can only be bent once. Do not reuse them.
4. Reinstall upper shackle bolts through spring eyes with new shackle bolt retainer plates, but do not tighten at this time.
5. Remove center spring hanger to equalizing beam locknut, washers, and bolt.
6. Lower frame so that equalizing beam ends drop clear of shackles.
7. Slide equalizing beam forward and down, out of center spring hanger. Note that there are thrust washers between center bushing and spring hanger legs, one at each end of bushing.

Bushing replacement:

1. Press out old bushings. Use a vertical shop press with a capacity of at least 15 tons. For end bushing removal use a 4" long piece of 2 1/4" O.D. by 1/4" wall steel tubing. For center bushing removal, use a 5" long piece of 2 5/8" O.D. by 1/4" wall steel tubing.

CAUTION: BE SURE THE BEAM IS SQUARELY SUPPORTED AT THE BORE AREA ON THE PRESS BED FOR SAFETY AND TO AVOID BENDING THE EQUALIZING BEAM.

WARNING: DO NOT USE HEAT OR A CUTTING TORCH TO REMOVE THE BUSHING OUTER METALS THAT ARE PRESSED IN THE BEAM. THE USE OF HEAT WILL ADVERSELY AFFECT THE STRENGTH OF THE BEAM.

2. Clean bores of equalizing beam with emery cloth to remove any nicks or metal build up from bushing removal.
3. Clean outer metals of new bushings with emery cloth to remove phosphate coating which acts as a rust preventive. Apply a thin coat of grease on the outer metals of bushings.
4. Press in new bushings. For end bushing installation use a 3" long piece of 2 1/2" O.D. by 1/4" wall steel tubing. For center bushing installation use a 3" long piece of 2 3/4" O.D. by 1/4" wall steel tubing. Center all bushings in beam. The pushing tool must contact only the outer metals of the bushings.

CAUTION: BE SURE THE BEAM IS SQUARELY SUPPORTED AT THE BORE AREA ON THE PRESS BED FOR SAFETY AND TO AVOID BENDING OF THE EQUALIZING BEAM.

5. Remove any remaining grease from ends of rubber bushings. End faces of rubber bushings should be clean and dry before assembling beam into shackles and center spring hanger.

Subject 8 (Continued)
COMPONENT REPLACEMENT

Assembly:

1. Position equalizing beam with thrust washers in center spring hanger. I.D. of thrust washers must be over O.D. of center bushing inner metal. There must be one thrust washer at each end of center bushing. Assemble bolt, washers, and locknut. With equalizing beam parallel to frame as viewed from side of vehicle, tighten locknut to specified torque as shown in figure 8.
2. Raise frame until equalizing beam ends align with lower shackle bolt holes.
3. Assemble lower shackle bolts and tighten both upper and lower shackle bolts to specified torque. Bend all keeper tabs against shackle bolt heads as shown in figure 7.
4. Position bar pin end of torque rod at forward face of spring hanger legs and reassemble bolts, washers, locknuts, and any alignment shims as noted during disassembly. Tighten locknuts to specified torque as shown in figure 4.

Torque rods. Two types of torque rods are available. Both types are adjustable for suspension alignment. Standard torque rods are fixed length, tube to tube style, and use drop in shims for suspension alignment adjustment. Optional torque rods have a threaded turnbuckle for adjustment of the rod length.

The following procedure is recommended to replace the torque rod bushings.

Disassembly:

1. Chock wheels of drive axles.
2. Remove locknut, thru bolt, and washers at axle end of torque rod.
3. If forward torque rod is to be rebushed, loosen rebound bolt locknut.
4. Remove straddle mount bar pin locknuts, bolts, and washers, and any alignment shims at spring hanger ends of torque rod. Note the number of shims as they must be reinstalled in the same manner to avoid affecting alignment.

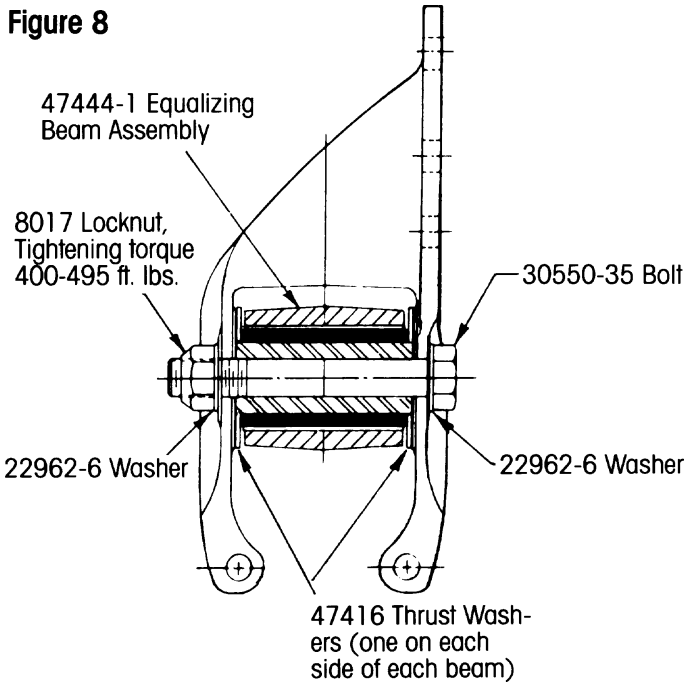
Bushing Replacement:

1. Push out old bushings. Use a vertical shop press with a capacity of at least 10 tons. A 5" long piece of 2" I.D. by 1/4" wall steel tubing receiving tool is required. These bushings are not cartridge type bushings. They do not have outer metals. Support torque rod end on receiving tool with end tube of torque rod centered on tool. Push directly on bushing inner metal or straddle mount bar pin until bushing clears torque rod end tube.

CAUTION: BE SURE THE TORQUE ROD IS SQUARELY SUPPORTED ON THE PRESS BED FOR SAFETY.

WARNING: DO NOT USE HEAT OR A CUTTING TORCH TO REMOVE THE BUSHINGS FROM THE TORQUE ROD. THE USE OF HEAT WILL ADVERSELY AFFECT THE STRENGTH OF THE TORQUE ROD.

Figure 8



Subject 8 (Continued)
COMPONENT REPLACEMENT

2. Clean and inspect I.D. of torque rod ends, removing any nicks with emery cloth.
3. Lubricate I.D. of torque rod ends and new rubber bushings with a vegetable base oil (cooking oil or lard). DO NOT use a petroleum or soap base lubricant.
4. Press in new bushings. Support torque rod end on receiving tool with end tube of torque rod centered on receiving tool. Straddle mount bar pin type bushing must have mounting flats positioned perpendicular to shank of torque rod. Press directly on inner metal of bushing. Bushings must be centered within torque rod end tubes. When pressing in new bushings, overshoot desired final position by approximately 3/16" and press bushing again from opposite side to center bushing within torque rod end.

CAUTION: BE SURE THE TORQUE ROD IS SQUARELY SUPPORTED ON THE PRESS BED FOR SAFETY.

Assembly:

1. Position through bolt end of new or rebushed torque rod in spring seat and assemble through bolt, washers, and locknut. Through bolt head must be installed with bolt head toward center of vehicle. Hand tighten locknut.
2. Position straddle mount bar pin end of torque rod on forward face of spring hanger legs and assemble bolts, washers, locknuts, and any alignment shims. Tighten locknuts to specified torque as shown in figure 10. The No. 2 (center) spring hanger to equalizing beam attaching bolt must be tightened before the torque rod is installed.
3. Tighten through bolt at axle end of torque rod to specified torque as shown in figure 9.

Figure 9

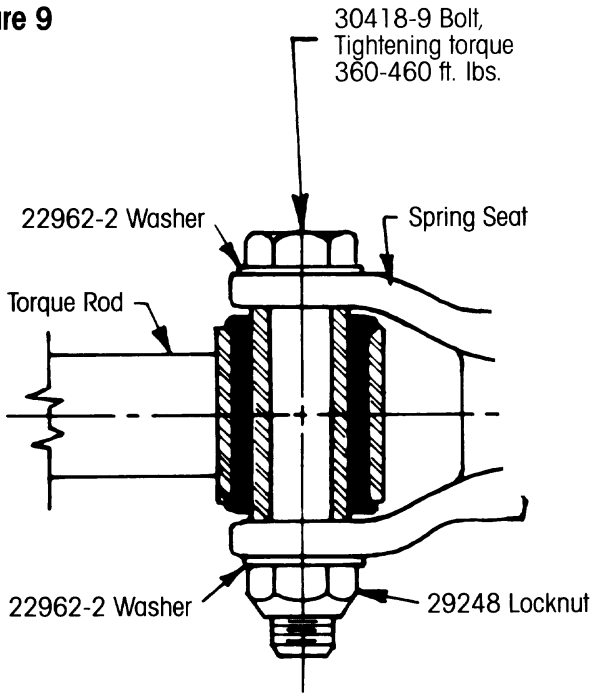
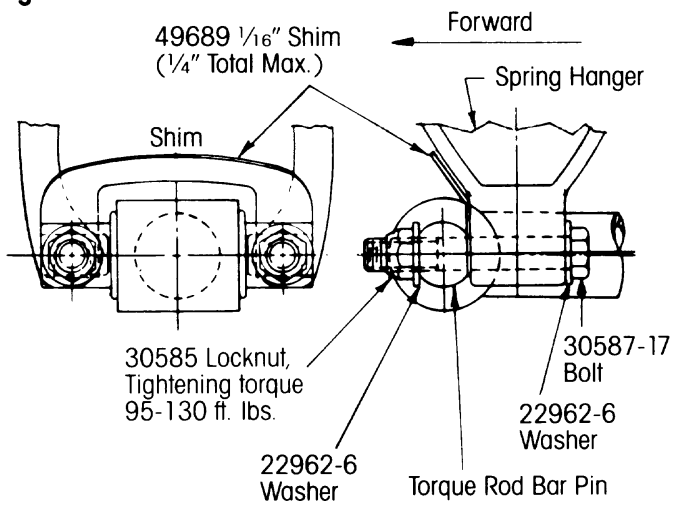


Figure 10



Subject 8 (Continued)
COMPONENT REPLACEMENT

4. If installing straddle mount bar pin end of torque rod to No. 1 spring hanger, tighten rebound bolt locknut to specified torque as shown in figure 11.

Note: The procedure for installing adjustable turnbuckle type torque rods, if the suspension is to be so equipped, is the same as above except for the following to be done before the new torque rod is installed in step 1 of the reassembly procedure.

a. Loosen torque rod clamp bolt locknuts.
b. Adjust length of new torque rod to be equal to that of old torque rod being replaced by rotating turnbuckle.
c. Tighten all torque rod clamp bolt locknuts to 70 to 95 foot pounds torque.

Spring hangers. If the spring hangers require replacement, attachment to the frame should follow the specifications shown in figure 12. Follow the vehicle manufacturer's specifications for hanger to frame fastener tightening torque values.

Figure 11

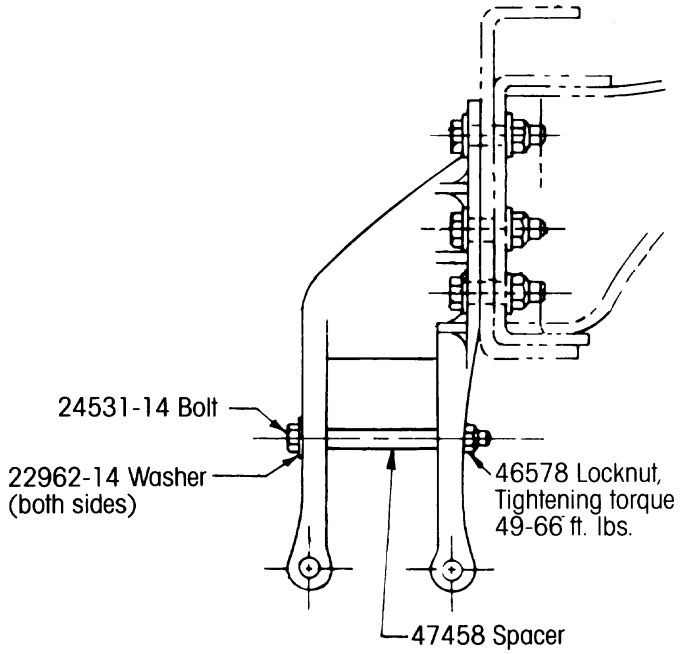
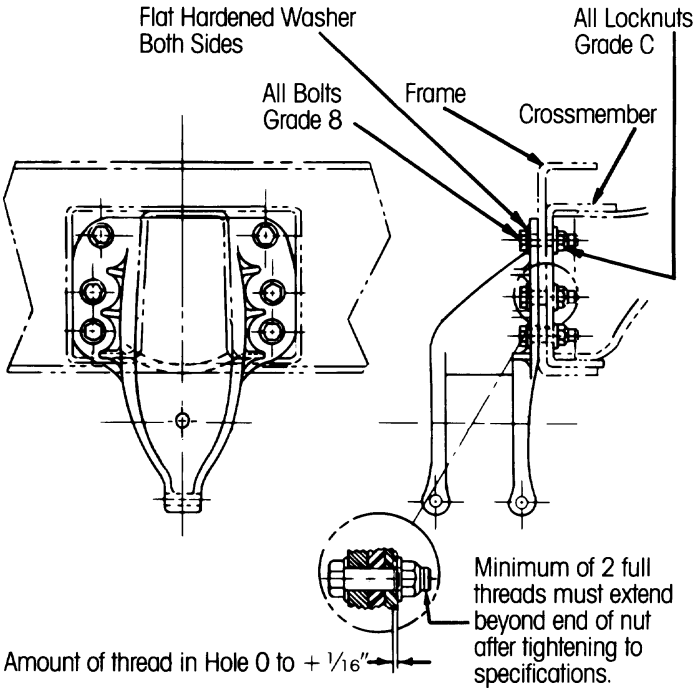


Figure 12



Subject 9
TIGHTENING TORQUE SPECIFICATION CHART

DESCRIPTION	PART NO.	HENDRICKSON THREAD/GRADE	RECOMMENDED TORQUE (FT./LBS.)
Spring Hgr. to Veh. Fr. Bolts, Nuts & Washers	None	Furnished & Installed by Truck Manuf.	Follow Manufacturer Specs.
U Bolt High Locknut	23899	7/8-14 UNF-2B Grade C	325-375
Torque Rod Bar Pin Locknut	30585	5/8-18 UNC-2B Grade C	95-130
Torque Rod Through Bolt	30418-9	7/8-14 UNF-2B Grade 8	360-460*
Rebound Bolt Locknut	46578	1/2-13 UNC-2B Grade C	49-66
Shackle Bolts	48728	7/8-9 UNC-2A Grade 8	300-400
Center Spring Hanger to Equalizing Beam Locknuts	8017	1"- 14 UNS-2B Grade C	400-495
Spring Center Bolt Nut	5070	1/2-13 UNF-2B Grade 5	38-52
Adjustable Torque Rod Clamp Locknut	none	5/8-11 UNC-2B Grade B	70-95

Do not exceed specified torque on U bolt locknuts.

NOTE: Torque values listed above apply only if Hendrickson supplied fasteners are used. If non-Hendrickson fasteners are used, follow torque specifications listed in vehicle manufacturer's service manual.

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.

*Special torque due to torquing bolt head.