32

## **Group Index, Alphabetical**

Section	Section Number
Chalmers 800 Series Suspension	32.06
Freightliner AirLiner Suspension	32.04
Freightliner TufTrac™ Suspension	32.05
Front Suspension	32.00
Hendrickson RT Series Suspension	32.07
Rear Leaf-Spring Suspension, Single Axle	
Rear Leaf-Spring Suspension, Tandem-Axle	
Rough Ride Diagnosis	32.03

32.00

## Front Suspension

### **Contents**

Subject	Subject Number
General Information	
Service Operations	
Leaf Spring and Components Removal, Cleaning and Inspect Installation	tion, and 
Bushing Replacement	
Shock Absorber Replacement	
Troubleshooting	300
Specifications	400

#### **General Information**

Freightliner Business Class M2 front suspensions use either a tapered leaf or a flat leaf assembly. The tapered leaf suspensions are available in varying capacities from 6,000-pound (2 722 kg) to 18,000-pound (8 165 kg). Shock absorbers are standard. The flat leaf suspensions are available in varying capacities from 14,600-pound (6 622 kg) to 18,000-pound (8 165 kg), and shock absorbers are optional.

The spring assemblies are attached to the axle with U-bolts, hardened washers, and high nuts. See Fig. 1 and Fig. 2. The forward end of each spring mounts to a stationary front spring bracket. The rear of each spring mounts to either a spring shackle suspended from a frame-mounted bracket, or fits straight into the frame-mounted bracket, and is locked in place by a carriage bolt. See Fig. 1. The shackle or deflection pad allows for variations in spring length as the spring flexes.

The leaf spring assembly absorbs and stores energy over bumps, releasing it at a controlled rate to smooth the ride. Individual spring leaves are held together by a center bolt. Alignment clips limit the sideways spread and vertical separation of the individual leaves.

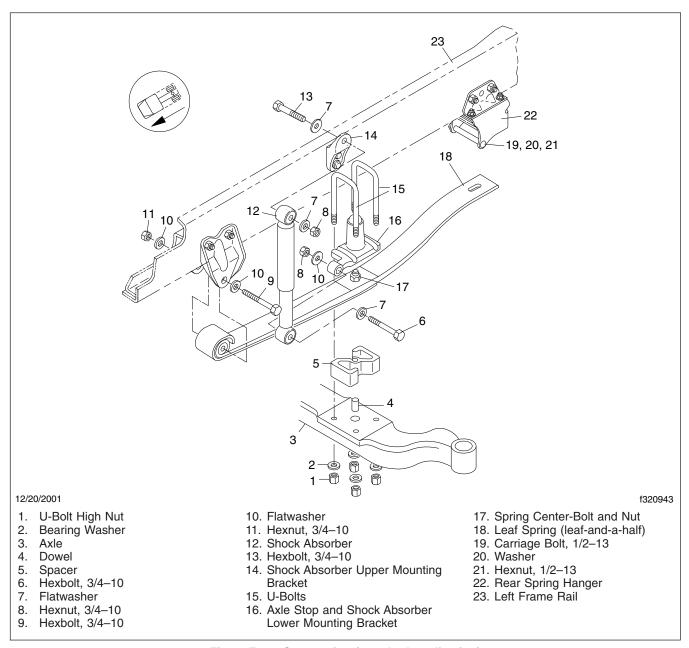


Fig. 1, Front Suspension (standard application)

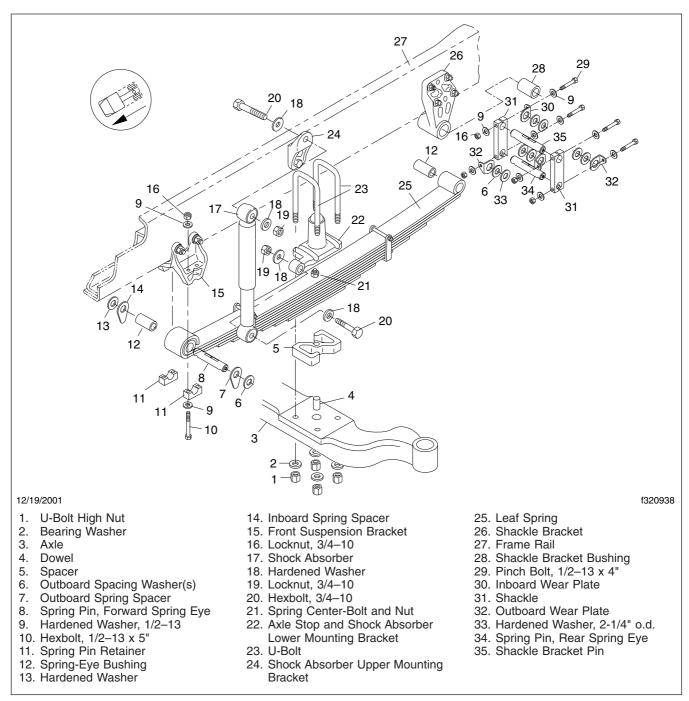


Fig. 2, Front Suspension with Bronze Bushings

Front Suspension 32.00

# Leaf Spring and Components Removal, Cleaning and Inspection, and Installation

#### Removal

- Park the vehicle on a level surface. Shut down the engine, set the parking brakes, and chock the rear tires.
- 2. Tilt the hood.
- Remove the front bumper end cap. For instructions, see Group 31.
- 4. Remove the wheel and tire for access to the leaf spring. For instructions, see **Group 40**.

IMPORTANT: Make sure the frame rails are level and an equal distance off the ground.

- 5. Raise the front of the vehicle until both wheels are off the ground and the frame is supported with safety stands. The axle and leaf springs can then be manipulated with the floor jack.
- 6. Support the frame and axle with safety stands.

### **A** WARNING

Use safety stands to securely support all axle and frame weight during suspension repairs. Unsecured components may drop when fasteners are loosened or removed, causing component damage and serious personal injury.

- 7. Remove the leaf spring assembly.
  - NOTE: Leaf spring assemblies on vehicles with suspensions manufactured at 14,600-pound (6 622 kg) and 18,000-pound (8 165 kg) weight ratings have multiple leaf springs, heavy duty brackets, U-bolts, and other components.
  - 7.1 Remove the U-bolt high nuts and washers; then, remove the U-bolts.
  - 7.2 If so equipped, remove the shock absorber lower mounting bolt. Swing the shock absorber out of the way.
  - 7.3 If so equipped, remove the spring shackle lower bolt. See **Fig. 1**.
    - If equipped with spring pins, remove the lower pinch bolts from the spring shackle.
  - 7.4 Remove the fasteners from forward spring eye.

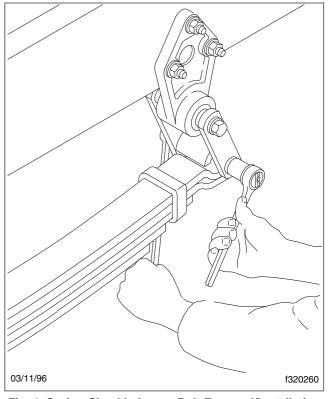


Fig. 1, Spring Shackle Lower Bolt Removal/Installation (typical)

If equipped with spring bolts: Remove the bolt, nuts and washers from the forward spring eye. See Fig. 2.

If equipped with spring pins: Remove the front spring pin by removing the fasteners holding the spring pin retainers in place. Remove the spring pin.

NOTE: If removing the driver's side spring, the steering must be at right full-lock so the bolt can clear the drag link.

7.5 Support the front axle with a jack. Remove the safety stand; then, lower the front axle enough to allow removal of the spring. Note the location of the spring spacer and any caster adjustment shims.



The spring assembly is heavy. To prevent bodily injury, always use two people to remove it.

# Leaf Spring and Components Removal, Cleaning and Inspection, and Installation

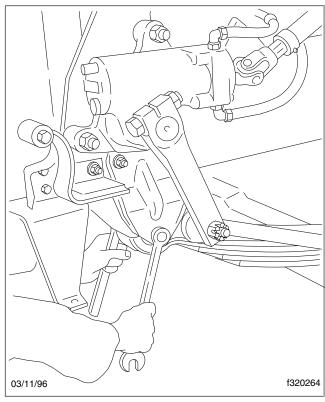


Fig. 2, Forward Spring Eye Bolt Removal/Installation (typical)

- 7.6 Remove the spring by sliding it toward the front of the vehicle. See **Fig. 3**.
- 8. If so equipped, remove the shackle upper bolt and nut. Press out the bushing. Remove the fasteners that hold the shackle bracket to the frame and remove the bracket.

### **Cleaning and Inspection**

 Using a wire brush and solvent or steam cleaning equipment, wash all parts to remove dirt, grease, and scale.

IMPORTANT: When using a solvent, follow all of the solvent manufacturer's warnings, cautions, and instructions.

- 2. Inspect all components for damage.
  - 2.1 If so equipped, inspect the spring shackles and the shackle bracket for cracks, wear, and other damage. Replace any damaged parts.

2.2 Inspect the leaf spring assembly for cracks or corrosion. If any leaves are cracked or broken, replace the *entire* spring assembly.

### **A** WARNING

Do not replace individual leaves of a leaf spring assembly; replace the complete spring assembly. Visible damage (cracks or breaks) to one leaf causes hidden damage to other leaves. Replacement of only the visibly damaged part(s) is no assurance that the spring is safe. On front spring assemblies, if cracks or breaks exist in the two top leaves, a loss of vehicle control could occur. Failure to replace a damaged spring assembly could cause an accident resulting in serious personal injury or property damage.

2.3 If the protective coating is gone from some areas of the spring, paint the cleaned areas with a rust-inhibiting paint. If rusting or corrosion is severe, replace the spring assembly.

### Installation

IMPORTANT: For normal highway operation do not install springs of two different designs or load capacities on the front axle. In order to maintain a balanced front suspension system, install identical spring assemblies.

 If the shackle bracket was removed, install it. Tighten the mounting bolts 135 lbf-ft (183 N·m).

NOTE: All suspension bracket (frame) fasteners require periodic retightening. Refer to Group 00 of the *Business Class M2 Maintenance Manual* for the recommended intervals.

If the spring shackle was removed, install it. Don't tighten the upper bolt in the shackle at this time.

### **WARNING**

The spring assembly is heavy. To prevent injury, always use two people to install it.

3. Install the spring assembly.

NOTE: Leaf spring assemblies on vehicles with suspensions manufactured at 14,600-

# Leaf Spring and Components Removal, Cleaning and Inspection, and Installation

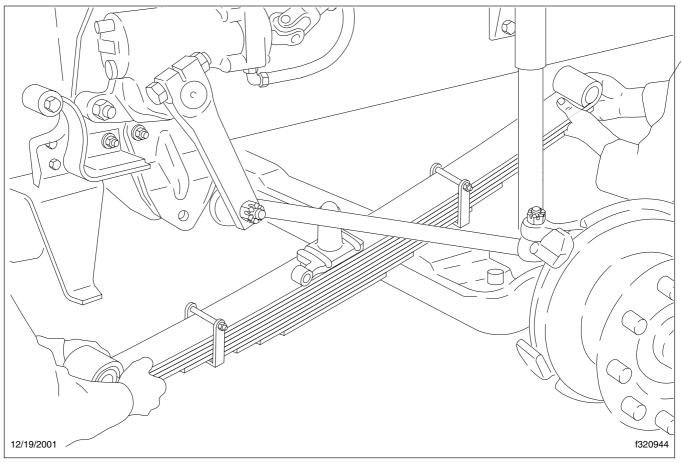


Fig. 3, Spring Removal/Installation (typical)

pound (6 662 kg) and 18,000-pound (8 165 kg) weight ratings have multiple leaf springs, heavy duty brackets, U-bolts, and other components.

- 3.1 Lift the spring into position. See Fig. 3
- 3.2 Install the fasteners into the forward spring eye.

If equipped with spring bolts: Install the mounting bolt and washer into the forward spring eye. Install the other washer and nut. Tighten 240 lbf·ft (325 N·m).

If equipped with spring pins: Install the spring pin into the forward spring eye. Install the spring pin retainers. Tighten the fasteners 250 lbf·ft (339 N·m).

3.3 Install the fasteners into the rear spring eye.

If equipped with spring bolts: Install the lower shackle bolt, nut and washers. Tighten the upper and lower bolts 240 lbf-ft (325 N·m).

If equipped with spring pins: Install the lower spring pin assembly through the spring eye and the lower shackle. Install the pinchbolts into the bottom of the shackle.

Tighten the upper and lower shackle pinch bolts 45 lbf·ft (61 N·m), for aluminum shackles, or 70 lbf·ft (95 N·m) for steel shackles.

# Leaf Spring and Components Removal, Cleaning and Inspection, and Installation

3.4 Apply Alumilastic® or a similar compound to the top and bottom of the spring spacer and any caster adjustment shims.

### **A** CAUTION

Failure to apply Alumilastic compound, or an equivalent, to areas where aluminum and steel parts contact each other, could lead to corrosion of the metals, resulting in damage to suspension parts.

- 3.5 Place the dowel, caster adjustment shim, and the spring spacer on the axle.
- 3.6 Place the axle stop/shock absorber lower mounting bracket in position on the leaf spring.
- 3.7 Using a jack, lift the axle into position.
- 3.8 Install the U-bolts over the shock absorber lower mounting bracket, the spring leaves, spring spacer, caster adjustment shims, and through the front axle.
- Install the high nuts on the U-bolts and tighten them as described in Specifications 400.
- Attach the shock absorber to its lower mounting bracket. Tighten the nut 140 lbf-ft (190 N·m).
- 5. Remove the floor jack and safety stands.
- Install the wheel and tire. See Group 40 for instructions.
- Install the front bumper end cap. See Group 31 for instructions.
- Lower the hood, and remove the chocks from the tires.

32.00

### **Bushing Replacement**

# Shackle Bracket Bushing Replacement

- Park the vehicle on a level surface, shut down the engine, set the parking brakes, and chock the rear tires.
- 2. Tilt the hood.
- Remove the front bumper end cap. For instructions, see Group 31. Remove the wheel and tire for access to the leaf spring. For instructions, see Group 40.
- 4. Remove the shackle bracket from the vehicle.
  - 4.1 Jack up the frame until the shackle lower bolt can be removed. Remove the bolt.
  - 4.2 Remove the shackle upper bolt and the spring shackle.
  - 4.3 Remove the shackle bracket from the frame
- Using a press, remove the bushing from the shackle bracket.
- 6. Inspect the shackle bracket and new bushing.
  - 6.1 With an inside micrometer or bore gauge, check whether the bracket bore is out-of-round. Replace the bracket if the bushing bore is out-of-round.
  - 6.2 Before installing the new bushing, check the shackle bracket bolt for ease of fit in the bushing. There should be an easy slip fit without wobble between the bolt and the bushing.
- Using a press, insert the new bushing into the bracket until the bushing is centered in the bracket.

IMPORTANT: Do not press in the bushing by the center sleeve. This could damage the bushing.

- 8. Check the shackle bracket bolt again for ease of fit in the bushing. It should still fit easily without wobble between the bolt and the bushing. If it binds, the bushing may have been distorted during installation. Replace the bushing and check again for proper fit.
- 9. Install the shackle bracket. Install the fasteners and tighten them 135 lbf-ft (183 N·m).

- 10. Connect the leaf spring.
  - 10.1 Install the spring shackle and the shackle upper bolt.
  - 10.2 Adjust the height of the jack supporting the frame until the bushing at the rear of the leaf spring lines up with the hole for the shackle lower bolt.
  - 10.3 Install the shackle lower bolt. Tighten it 240 lbf·ft (325 N·m).
- 11. Install the wheel and tire. For instructions, see **Group 40**.
- Install the front bumper end cap. For instructions, see Group 31.
- Lower the hood and remove the chocks from the tires.

### **Spring Bushing Replacement**

- Remove the leaf spring from the vehicle. See Subject 100 for instructions.
- 2. Using a press, remove the worn or damaged bushing.
- 3. Using a press, insert the new bushing into the spring eye until the bushing is flush with the edges of the spring eye.

IMPORTANT: Do not press in the bushing by the center sleeve. This could damage the bushing.

 Install the leaf spring. See Subject 100 for instructions.

Front Suspension 32.00

### **Shock Absorber Replacement**

## Replacement

- 1. Apply the parking brake, chock the rear tires, and tilt the hood.
- 2. Remove the shock absorber.
  - 2.1 Remove the locknut from the shock absorber upper mount; then, remove the 3/4–10 hexbolt and washers.
  - 2.2 Remove the locknut from the shock absorber lower mount; then, remove the 3/4–10 hexbolt and washers.
  - 2.3 Remove the shock absorber.
- 3. Install the new shock absorber. Tighten the locknuts 140 lbf·ft (190 N·m).
- Lower the hood, and remove the chocks from the tires.

### **Troubleshooting**

### **Vehicle Lean Inspection**

IMPORTANT: Chassis lean can be caused by several factors such as uneven vehicle weight distribution, mismatched springs, or improper spacer installation. The following instructions detail inspecting for and correcting chassis lean due to improper spring or spacer installation. Additional troubleshooting procedures may also be found at the **Hendrickson** website: www.hendrickson-intl.com/literature/pdfs\_tech\_airtek\_freightliner.asp.

 Park the vehicle on a level surface with the wheels pointing straight ahead. Set the parking brake, turn off the engine, and chock the tires. When exiting the vehicle, try not to rock the vehicle.

NOTE: The vehicle should be unloaded when performing the following inspection.

- Check tire pressure and tire size. Pressures should be within 2 psi of each other. Tire size should be the same on each axle.
- Check that the rear axle alignment and rear suspension ride height are within specification. Refer to the applicable sections in Group 32 or Group 35 in this manual.
- 4. Check the springs, bushings and spring mounting hardware for damage. Replace damaged components before checking for chassis lean.
- Measure the weight of the vehicle at each wheel position. Weight imbalance will cause the vehicle to lean. If the vehicle weight differs from side to side, check the cab alignment and the fuel tank levels, and correct if necessary.
- Measure the distance from the bottom of the lower frame flange to the ground, forward of the front axle center line. This is frame height. See Fig. 1.
- 7. If the frame height differs from side to side by 3/8 inch (9.53 mm) or more, inspect the spring part numbers, and (if present) markings on the top side of the springs with a label marking plus (+) or minus (-). Verify that both spring labels match.

If the labels or part numbers do not match, replace one or both springs so the vehicle has matching springs. See **Fig. 2**.

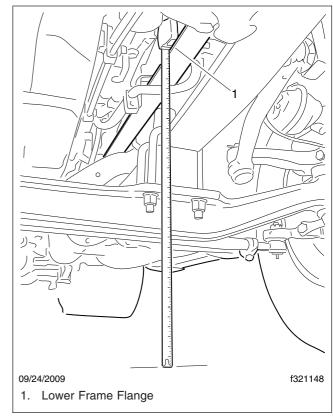


Fig. 1, Measuring Frame Height

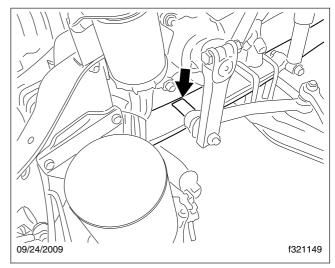


Fig. 2, Spring Label Location

8. Measure the height difference at the end of the frame rails to ground. If this measurement is greater than 3/8 inch (9.53 mm), the front axle

### **Troubleshooting**

spacer adjustments will have minimal effect on lean and other actions are required. If the end of frame to ground measurements are less than 3/8 inch (9.53 mm) difference, correct the lean by increasing the low side front axle spacer thickness by no more than 1/2 inch (13 mm). Use a 45, 55, or 65-mm spacer in place of the existing spacer.

See **Table 1** for parts information.

 Check the frame height again. If the difference between measurements is still equal to or greater than 3/8 inch (9.53 mm), swap springs from side to side and check the measurements again.

If the chassis lean is still the same, the problem is with the vehicle. If the lean has changed sides, replace both springs.

Figure 3 represents a checklist for weak or sagging springs.

Use this checklist as the information may be requested when filing a warranty claim.

Parts Information			
Part Description	Part Number	Quantity	
Axle Spacer, 45 mm	16-15105-040	As Required	
Axle Spacer, 55 mm	16-15105-055	As Required	
Axle Spacer, 65 mm	16-15105-065	As Required	

**Table 1, Parts Information** 

### **Troubleshooting Tables**

#### Problem—Vehicle Wanders

Problem—Vehicle Wanders		
Possible Cause	Remedy	
One or more spring leaves are broken.	Replace the spring assembly.	
The wheels are out of alignment.	Adjust the wheel alignment using the instructions in <b>Group 33</b> of this manual.	
Caster is incorrect.	Install correct caster shims. Refer to <b>Group 33</b> of this manual for specifications.	
Steering gear is not centered.	Adjust steering using the instructions in <b>Group 46</b> of this manual.	
Drive axles are out of alignment.	Align the drive axles using the instructions in <b>Group 35</b> of this manual.	

#### Problem—Vehicle Bottoms Out

	Problem—Vehicle Bottoms Out
Possible Cause	Remedy
Excessive weight on the vehicle is causing an overload.	Reduce the loaded vehicle weight to the maximum spring capacities.
One or more spring leaves are broken.	Replace the spring assembly.
The spring assembly is weak or fatigued.	Replace the spring assembly.

#### Problem—Frequent Spring Breakage

Problem—Frequent Spring Breakage		
Possible Cause	Remedy	
The vehicle is overloaded or operated under severe conditions.	Reduce the loaded vehicle weight to the maximum spring capacities. Caution the driver on improper vehicle handling.	
There is insufficient torque on the U-bolt high nuts.	Torque the U-bolt high nuts to the value listed in the torque table in <b>Specifications</b> , <b>400</b> .	

Front Suspension 32.00

## **Troubleshooting**

Problem—Frequent Spring Breakage		
Possible Cause Remedy		
A loose center bolt is allowing the spring leaves to slip.	Check the spring leaves for damage. If damaged, replace the spring assembly. If not, tighten the center-bolt nut to the value listed in torque table in <b>Specifications</b> , <b>400</b> .	
Worn or damaged spring pin bushings are allowing spring end-play.	Replace the spring pin and bushing.	

#### **Problem—Noisy Spring**

Problem—Noisy Spring			
Possible Cause	Remedy		
A loose U-bolt nut or center bolt is allowing spring leaf slippage.	Inspect the components for damage. Replace damaged components as necessary. Torque the fasteners to the values listed in the torque table in <b>Specifications</b> , <b>400</b> .		
A loose, bent, or broken spring shackle or front suspension bracket is impairing the spring flex.	Inspect the shackles and brackets for damage. Replace damaged components as necessary. Torque the fasteners to the values listed in the torque table in <b>Specifications</b> , <b>400</b> .		
Worn or damaged spring pins are allowing spring end-play.	Replace any worn or damaged spring pins.		

#### Problem—Rough Ride

Problem—Rough Ride		
Possible Cause Remedy		
Refer to the applicable suspension section in this manual.		

## **Troubleshooting**

	The following is a checklist for weak or sagging springs. This information may be equested when filing for warranty.
C	Conditions
	Is the ground level?
	(If ground is not level move the truck to a level location)
	Is the vehicle loaded?
	(Vehicle should be measured unloaded)
	Are the spring part numbers the same?
	(Part numbers should be the same)
	Is there any visible damage to the spring or bushings?
	(Any damage to the springs, bushings, shocks, or suspension brackets should be repaired)
Т	ïres
	Are the tire pressures and sizes the same?
	(Tire pressure should be within 2 psi from side to side)
	Do the tires have the same amount of wear?
	Are the tires the same size?
N	leasurements
	Measure the distance from the floor to the bottom of the frame rail on each side of the truck as close to the front axle as possible.
	Passenger Side
	Driver Side
	(Measurements should be within 3/8" from side to side)
V	Veight
	Measure the weight of the vehicle at each forward axle position.
	Passenger Side
	Driver Side
	(Weight should be equal from side to side. If weight is more on one side, check that the cab is centered on the frame rails, and if equipped with dual tanks, that the fuel level is equal on both sides. Due to the many options available for mounting components, the vehicle may have a weight bias to one side. If the vehicle does have a weight bias to one side, the spring can be shimmed to level the vehicle.)
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Fig. 3, Checklist for Weak or Sagging Springs

Front Suspension 32.00

## **Specifications**

Front Suspension Fastener Torque Values				
Description	Size	Torque: Ibf·ft (N·m)		
Shackle Bracket-to-Frame Locknut	3/4–10	240 (325)		
Caring Chaokle Dinch Polt Leakaute	1/2–13	Aluminum Shackles: 45 (61)		
Spring Shackle Pinch-Bolt Locknuts	1/2-13	Steel Shackles: 70 (95)		
Spring Pin Retainer Hexbolts	1/2–13	60-76 (81-103)		
Forward Spring-Eye Bolt	3/4–10	240 (325)		
Upper and Lower Shackle Bolt	3/4–10	240 (325)		
	5/8–18	Stage 1: Hand tighten		
		Stage 2: 60 (81)		
		Stage 3: 180-230 (245-313)		
		Stage 1: Hand tighten		
	0/4 40	Stage 2: 60 (81)		
Axle U-bolt High Nuts (Tighten in a diagonal pattern as shown in Fig. 1.)	3/4–16	Stage 3: 200 (271)		
		Stage 4: 270–330 (367–449)		
	7/8–14	Stage 1: Hand tighten		
		Stage 2: 60 (81)		
		Stage 3: 200 (271)		
		Stage 4: 420–500 (571–680)		
Shock Absorber Upper and Lower Mounting Locknuts	3/4-10	140 (190)		

**Table 1, Front Suspension Fastener Torque Values** 

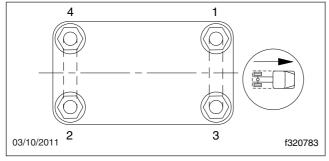


Fig. 1, Tightening Pattern for U-bolt High Nuts

## 32.01

## Rear Leaf-Spring Suspension, Single Axle

### **Contents**

Subject	Subject Numbe
General Information	
Service Operations	
Spring Assembly Replacement	
Shock Absorber Replacement	
Wear Pad Replacement	120
Specifications	400

#### **General Information**

The rear leaf-spring suspension for Business Class M2 vehicles uses either 60-inch taper-leaf or 52-inch multi-leaf springs with varying capacities. See **Fig. 1**, **Fig. 2**, **Fig. 3** or **Fig. 4**.

Taper-leaf springs have shackles and pins to secure the rear spring end, while multi-leaf spring applications use a slip spring design in which the rear spring end rides in a cast iron bracket mounted on the frame rail.

The 52-inch multi-leaf spring suspension is available with a rubber or leaf-spring helper. A rubber helper is standard with the 60-inch taper-leaf spring suspension.

Both types of helper provide additional spring rate for extra load-carrying capacity and increased roll stability.

Both types of spring assemblies are attached to the axle with U-bolt assemblies. Shock absorbers are optional with the 52-inch multi-leaf suspension, and are standard with the 60-inch taper-leaf suspension.

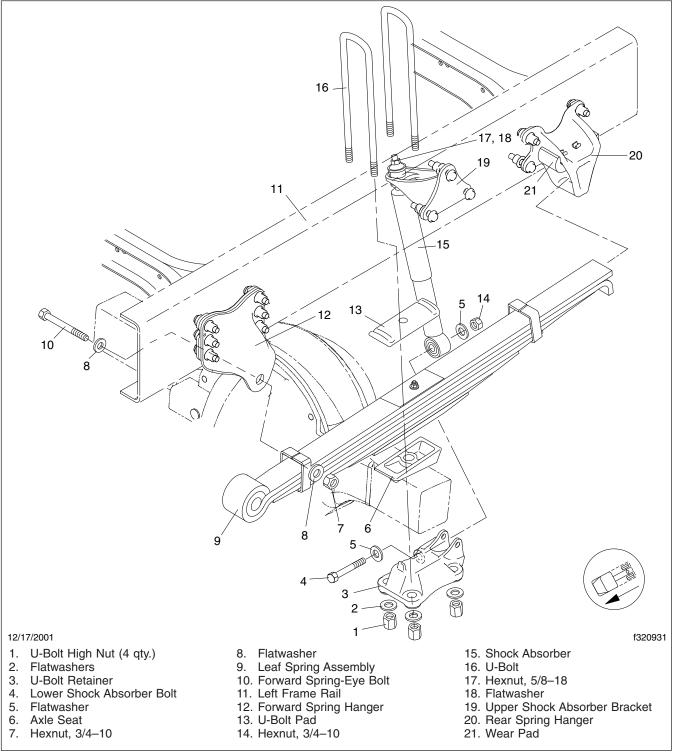


Fig. 1, 52-Inch Multi-Leaf Spring Suspension (with optional shock absorbers)

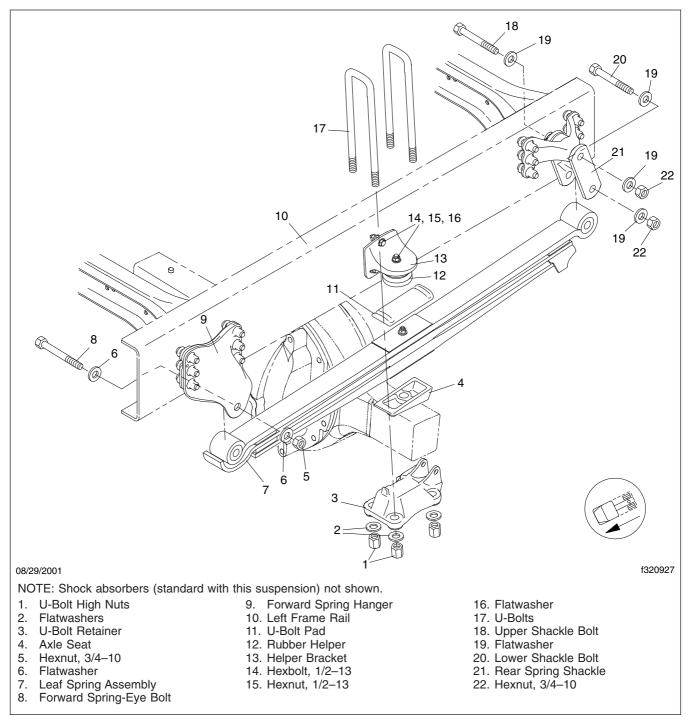


Fig. 2, 60-Inch Taper-Leaf Spring Suspension

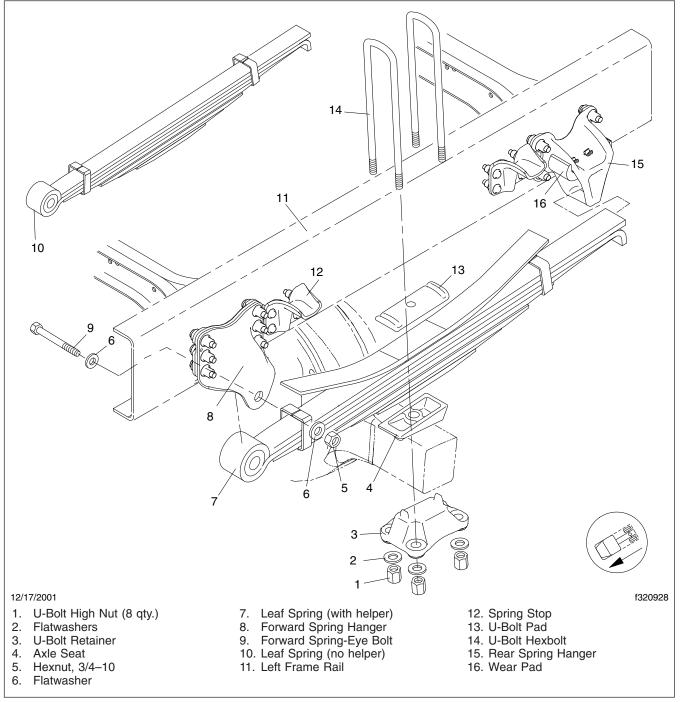


Fig. 3, 52-Inch Multi-Leaf Spring Suspension

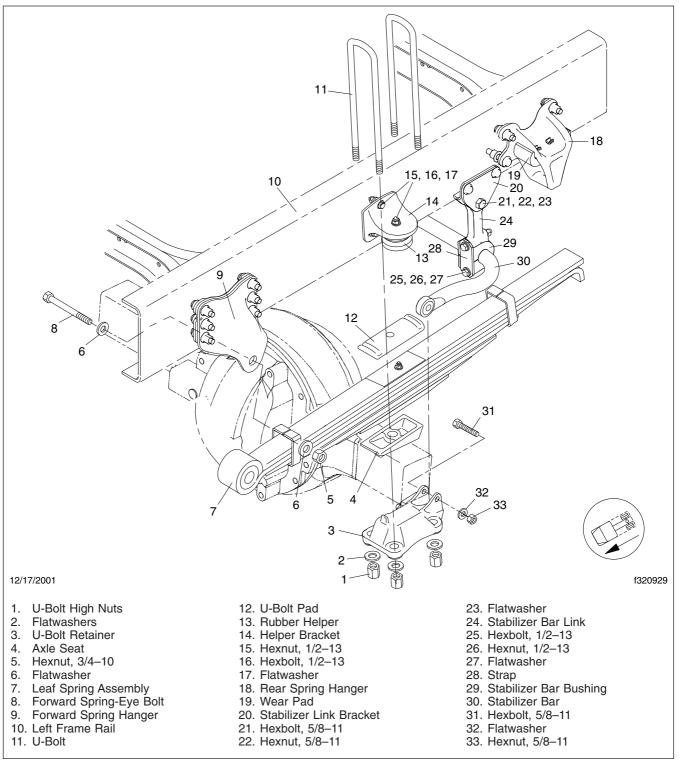


Fig. 4, 52-Inch Multi-Leaf Spring Suspension (with optional rubber helper and stabilizer bar)

### **Spring Assembly Replacement**

### Replacement

- Park the vehicle on a level surface, shut down the engine, set the parking brakes and chock the front tires.
- Remove the rear tires. For instructions, see Group 40.

### **A** WARNING

Use safety stands to securely support all axle and frame weight during suspension repairs. Unsecured components may drop when fasteners are loosened or removed, causing component damage and serious personal injury.

- 3. Lift the rear axle and support it with safety stands. Lift the vehicle frame to take weight off the rear springs.
- 4. Remove the U-bolt high nuts; then remove the U-bolts.
- 5. Remove the spring assembly.
  - 5.1 If the vehicle is equipped with the optional helper spring, lift it off.
  - 5.2 If equipped with rear shackles, remove the lower shackle bolt.
  - 5.3 Remove the front spring-eye bolt.
  - 5.4 Slide the leaf spring assembly forward and remove it from the vehicle.
- 6. For 52-inch multi-leaf suspensions, inspect the wear pads for wear. Replace them if needed. For instructions, see **Subject 120**.
- 7. Install the new spring assembly.
  - 7.1 For 52-inch multi-leaf springs only, slide the rear end of the spring into the rear spring hanger.
  - 7.2 Position the new spring on the axle seat.

NOTE: It may be necessary to raise the frame slightly.

- 7.3 Lower the frame or raise the axle until the front spring eye lines up with the hole in the forward spring bracket.
- 7.4 Install the foward spring-eye bolt, nut and washers. Make sure the bolt is inboard. Tighten 240 lbf·ft (325 N·m).

- 7.5 If equipped with the optional helper leaf spring, place it on the main spring.
- 7.6 For 60-inch taper-leaf springs, raise the spring assembly until the rear spring eye is lined up with the lower shackle holes. Install the shackle fasteners, making sure the bolt head is inboard. Tighten 240 lbf-ft (325 N·m).
- Install the U-bolts and the U-bolt retainer. Make sure the taller end of the retainer is toward the front of the vehicle.
- 9. Install the U-bolt high nuts, but don't tighten yet.
- Tighten the U-bolt high nuts in sequence. See Specifications 400 for complete instructions.
- 11. Install the rear tires. For instructions, see **Group 40**.
- Raise the vehicle, remove the jack or safety stands from the rear axle and the frame, then lower the vehicle
- 13. Remove the chocks from the tires.

### **Shock Absorber Replacement**

### Replacement

- Park the vehicle on a level surface, shut down the engine, set the parking brakes, and chock the tires.
- Remove the locknut, retainers, and bushings (if applicable) from the shock absorber lower mount.
- 3. Remove the fasteners from the shock absorber upper mount.
- 4. Remove the shock absorber.
- 5. Install the replacement shock absorber.
- 6. Install the capscrew and locknut in the upper mount. Hand-tighten them at this time.
- Install the replacement bushings, retainers, and locknut.

### **WARNING**

Use only the retainers included with the replacement shock absorber. Do not use washers. They can be pushed over the nut and be ejected violently, possibly causing personal injury and property damage.

- 8. Tighten the shock absorber upper mounting locknut until the rubber bushings expand to the same size as the retainer washer.
- 9. Tighten the shock absorber lower mounting fasteners to 240 lbf·ft (325 N·m).
- 10. Remove the chocks from the tires.

### **Wear Pad Replacement**

### Replacement

NOTE: Wear pads, used only on 52-inch multileaf suspensions, can be replaced without removing the leaf spring assemblies. They are located on the rear spring hangers.

- Park the vehicle on a level surface, shut down the engine, set the parking brakes, and chock the front tires.
- 2. Using a floor jack or a crane, take the weight off the frame rail so there is no contact between the spring and the wear pad.
- 3. Using a suitable pair of pliers, pinch the tabs of the wear pad together and push them out of the slot in the upper part of the rear spring hanger. Remove and discard the wear pad.
- 4. Install the new wear pad so that the thicker portion of the pad is toward the axle. Pinch the tabs together so they fit through the slot in the spring hanger. Push the wear pad up into place.
- 5. Lower the frame rail.
- 6. Remove the chocks from the tires.

## **Specifications**

Torque Values				
Description	Size	Grade	Torque lbf·ft (N·m)	
Forward Spring Bolt *	3/4–10	_	240 (325)	
Rear Spring Shackle Bolts *	3/4–10	_	240 (325)	
			Stage 1: Hand tighten	
	5/8–18	С	Stage 2: 60 (81)	
	(10 to 16,000-lb. ratings)		Stage 3: 200 (271)	
Axle U-Bolt High Nuts <sup>†</sup>			Stage 4: 180 to 230 (245 to 313)	
Axie O-Boit High Nuts			Stage 1: Hand tighten	
	7/8–14		Stage 2: 60 (81)	
	(18 to 23,000 lbratings)	С	Stage 3: 200 (271)	
			Stage 4: 420 to 500 (570 to 678)	
Helper Bracket Hexbolts	1/2–13	_	68 (92)	
Shock Absorber Lower Locknuts ‡	_	С	240 (325)	

<sup>\*</sup> Cadmium-plated, wax-coated nuts, and grade 8 hexbolts with phosphate- and oil-coated threads; both used with hardened washers.

**Table 1, Torque Values** 

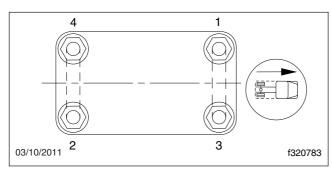


Fig. 1, Tightening Pattern for U-bolt High Nuts

<sup>&</sup>lt;sup>†</sup> Tighten in a diagonal pattern as shown in Fig. 1.

<sup>&</sup>lt;sup>‡</sup> See **Subject 110** for shock absorber upper locknut tightening instructions.

## 32.02

## Rear Leaf-Spring Suspension, Tandem-Axle

## **Contents**

Subject	Subject Number
General Information	
Service Operations	
Radius Rod Removal and Installation	
Equalizer Removal, Inspection, and Installation	
Spring Assembly Replacement	
Spring Bracket and Equalizer Bracket Replacement	
Rear Axle Alignment Adjustment	
Specifications	400

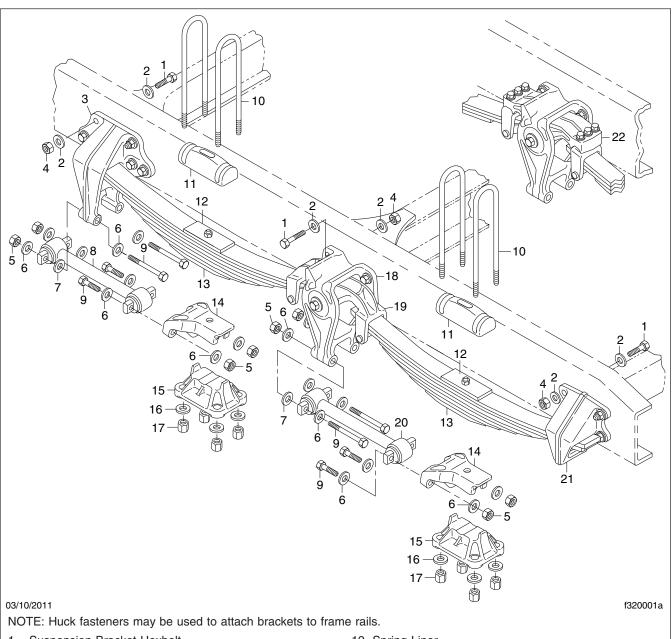
### **General Information**

### **General Information**

The tandem-axle rear spring suspension uses a sixpoint equalizing leaf spring design, which compensates for axle articulation, from side-to-side, and front-to-rear. See **Fig. 1**. Four semi-elliptical spring assemblies are attached to the axles with U-bolts. On both sides of the vehicle, the forward end of the forward spring and the rear end of the rear spring ride in aluminum brackets that are mounted on the frame rails. Steel wear shoes are cast into each bracket.

At the center, between the forward and rear springs, the springs ride on an equalizer, which pivots on a sleeve in the equalizer bracket. Equalizer travel is stopped when the top of the equalizer and the equalizer bracket make contact. Each axle is held in alignment by a pair of radius rods that extend forward from the axle seats to the forward spring brackets for the forward-rear axle, and to the equalizer brackets for the rearmost axle.

### **General Information**



- Suspension Bracket Hexbolt
- 2. Hardened Washer
- 3. Forward Spring Bracket
- 4. Suspension Bracket Hex Locknut
- 5. Radius Rod Hex Locknut
- 6. Hardened Washer
- 7. Axle Alignment Washer
- 8. Forward Radius Rod
- 9. Radius Rod Hexbolt
- 10. U-Bolt
- 11. U-Bolt Pad

- 12. Spring Liner
- 13. Leaf Spring Assembly
- 14. Spring Seat
- 15. U-Bolt Retainer
- 16. Hardened Washer
- 17. U-Bolt High Nut
- 18. Equalizer Bracket
- 19. Equalizer, One-Piece (tandem drive axles)
- 20. Rear Radius Rod
- 21. Rear Spring Bracket
- 22. Equalizer, Three-Piece (tag or pusher axle)

Fig. 1, Tandem-Axle Spring Suspension

### **Radius Rod Removal and Installation**

### Removal

NOTE: See Fig. 1 for this procedure.

- Park the vehicle on a level surface and set the parking brake. Shut down the engine. Chock the tires.
- Note the number of axle alignment washers at the forward end of each radius rod that is being removed.
- 3. Remove the fasteners that attach the radius rod to the forward spring bracket or equalizer bracket, and to the axle seat.
- Remove the radius rod and any axle alignment washers.

### Installation

IMPORTANT: At all points where steel parts (including bolts, washers, and nuts) contact aluminum brackets, apply Alumilastic® compound, or an equivalent, on the mating surfaces.



Failure to apply Alumilastic compound, or an equivalent, to areas where aluminum and steel parts contact each other, could lead to corrosion of the metals, resulting in damage to the suspension.

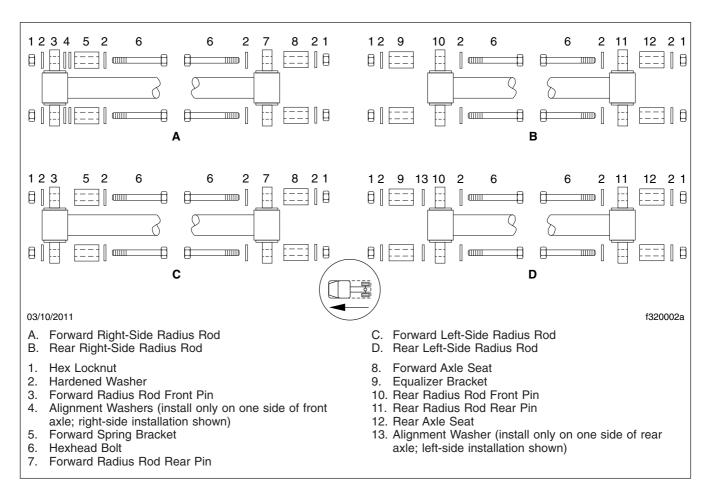


Fig. 1, Radius Rod Attachment (top view)

### **Radius Rod Removal and Installation**

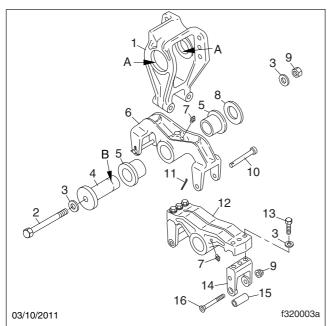
If installing forward and rear radius rods, install the forward radius rod before installing the rear radius rod

- If installing a forward radius rod, place the radius rod front pin on the front side of the forward spring bracket, and place the radius rod rear pin in front of the axle seat.
  - If installing a rear radius rod, place the radius rod pins between the rear side of the equalizer bracket and the front side of the axle seat.
- Install a hexhead bolt with a hardened washer through each end of the radius rod rear pin and the axle seat ears. Install the hardened washers and locknuts.
- If installing a forward radius rod, install any previously removed axle alignment washers between
  the radius rod front pin and the forward spring
  bracket. Install the hexhead bolts, hardened
  washers, and locknuts.
  - If installing a rear radius rod, install any previously removed axle alignment washers between the radius rod front pin and the equalizer bracket. Install the hexhead bolts, hardened washers, and locknuts.
- Tighten the radius rod locknuts to the torque value in **Specifications 400**.
- After all of the radius rods are installed, check the rear axle alignment. For instructions, refer to Group 35. If necessary, adjust the axle alignment, using the instructions in Subject 140.
- 6. Remove the chocks from the tires.

### Equalizer Removal, Inspection, and Installation

### Removal

NOTE: See Fig. 1 for this procedure.



- A. Apply Loctite here.
- B. No grease here.
- 1. Equalizer Bracket
- 2. Hexbolt
- 3. Bearing Washer
- 4. Cap and Tube Assembly
- 5. Equalizer Assembly Bushing
- 6. Equalizer, One-Piece (tandem drive axles)
- 7. Grease Fitting8. Wear Washer(s)
- 9. Locknut
- 10. Spring Retainer Pin
- 11. Cotter Pin
- 12. Equalizer, Three-Piece (tag or pusher axle)
- 13. Capscrew
- 14. Wear-Shoe Side-Restraint
- 15. Side-Restraint Sleeve
- 16. Flathead Bolt

### Fig. 1, Equalizer Assembly

- 1. Park the vehicle on a level surface and set the parking brake. Shut down the engine. Chock the front tires.
- 2. Raise the rear of the vehicle, and block the axles with safety stands. Raise the vehicle frame so that all weight is removed from the leaf springs. Block the frame with safety stands. Make sure

- the stands will securely support the weight of the axles and frame. To allow access to the equalizer, remove the wheel assemblies on that side, using the instructions found in Group 40.
- If removing an equalizer from a vehicle with two drive axles, remove the cotter pin from the outboard end of each spring retainer pin. Remove the retainer pins.
  - If removing an equalizer from a vehicle with a pusher or tag axle, remove the nuts from the flathead bolts in the wear-shoe side-restraints, on each end of the equalizer. Remove the flathead bolts and side-restraint sleeves. Remove the six capscrews and washers, and remove both wearshoe side-restraints from the equalizer.
- Remove the cap and tube assembly locknut, inboard bearing washer, bolt, and outboard bearing washer.
- 5. Insert a bar between the bottom of the equalizer and the equalizer bracket. Gently lever the weight of the equalizer off the cap and tube assembly. Insert a piece of barstock through the inboard cap and tube assembly bolt hole, and lightly tap the cap and tube assembly out of the equalizer.
- 6. Remove the equalizer from the equalizer bracket. Remove the wear washer(s) and equalizer bushings from the equalizer.

### Inspection

1. Thoroughly clean the equalizer with steam or a hot soap solution. Inspect it for wear, cracks, or other damage. Replace the equalizer if any of these conditions are present.

### WARNING

Replace a worn or damaged equalizer. A broken equalizer could cause a loss of vehicle control, resulting in personal injury or property damage.

2. Inspect the equalizer bushings, cap and tube assembly, and the equalizer bracket. If wear, cracks, or other damage are present, replace the bushings, cap and tube assembly, or bracket.

### **Equalizer Removal, Inspection, and Installation**

### Installation

 Apply a thin film of multipurpose chassis grease to the outside of the equalizer bushings. Install the bushings in the equalizer.

NOTE: The equalizer is *not* symmetrical. To ensure that the equalizer is installed in the proper direction, an arrow is cast into its top surface.

Install the equalizer in the equalizer bracket.
 Make sure that the arrow cast into the top of the
 equalizer is pointing toward the frame rail. See
 Fig. 2.

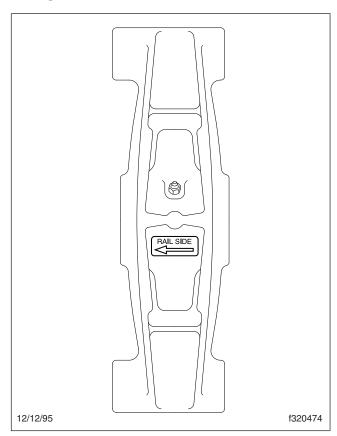


Fig. 2, Equalizer Marking

NOTE: The next four steps must be completed before the Loctite® begins to cure (approximately 5 to 10 minutes).

IMPORTANT: Be careful to prevent grease from contacting the inboard surface of the cap and tube assembly, where the Loctite is applied.

- 3. Apply Loctite 680 to both interior surfaces of the equalizer bracket, where the cap and tube assembly is inserted. Apply multipurpose chassis grease to the cap and tube assembly, except the last inch which connects to the equalizer bracket. See Fig. 1. Start the cap and tube assembly into the equalizer, through the equalizer bracket.
- 4. Push the cap and tube assembly part way through the equalizer. Place the wear washer(s) between the inboard equalizer bushing and the equalizer bracket. Push the cap and tube assembly the rest of the way into the equalizer bracket.
- Place the outboard bearing washer on the equalizer cap and tube assembly bolt, and install the bolt in the cap and tube assembly.
- 6. Install the inboard bearing washer and locknut on the cap and tube assembly bolt. Tighten the locknut to the torque value in **Specifications 400**.
- 7. Lubricate the equalizer assembly by applying multipurpose chassis grease at the grease fitting. Lubricate with a hand gun or pressure gun until grease is forced past the bushing seals, or if equipped with a pressure-relief grease fitting, until grease is forced out from the base of the pressure relief fitting.
- 8. If installing an equalizer on a vehicle with two drive axles, apply Alumilastic® compound, or an equivalent, to the spring retainer pins. Install them from the inboard side. Be sure the hooked ends of the spring leaves are above the retainer pins. Install a cotter pin in the outboard end of each retainer pin, and lock it in place.

If installing an equalizer on a vehicle with a pusher or tag axle, apply Alumilastic compound, or an equivalent, to the surfaces where the wearshoe side-restraints contact the equalizer. Attach the side-restraints to the equalizer, offsetting them toward the inboard side of the equalizer. Tighten the equalizer wear-shoe capscrews to the torque value in **Specifications 400**. Install the side-restraint sleeves and flathead bolts in the wear-shoe side-restraints. Be sure the hooked ends of the spring leaves are above the side-restraint sleeves. Install the nuts, and tighten them to the applicable torque value in **Specifications 400**.

### **Equalizer Removal, Inspection, and Installation**



Failure to apply Alumilastic compound, or an equivalent, to areas where aluminum and steel contact each other, could lead to corrosion of the metals, resulting in suspension damage.

- Install the wheel assemblies, using the instructions found in Group 40. Remove the safety stands from under the frame and axle, and lower the vehicle.
- 10. If the radius rods have been loosened, or the equalizer bracket has been removed, check the rear axle alignment. For instructions, refer to Group 35. If necessary, adjust the axle alignment using the instructions in Subject 140.
- 11. Remove the chocks from the front tires.

### **Spring Assembly Replacement**

### Replacement

NOTE: See Fig. 1 for this procedure.

### **A** WARNING

Do not replace individual leaves of a damaged leaf spring assembly; replace the complete spring assembly. Visible damage (cracks or breaks) to one leaf causes hidden damage to other leaves. Replacement of only the visibly damaged part(s) is no assurance that the spring is safe. Failure to replace a damaged spring assembly could cause an accident resulting in serious personal injury or property damage.

- Park the vehicle on a level surface and set the parking brake. Shut down the engine. Chock the front tires.
- 2. Raise the frame so that all weight is removed from the leaf springs. Block the frame with safety stands. Raise the rear axle until the spring no longer contacts the spring bracket wear shoes and the spring retainer pin (or side-restraint sleeve). Block the axle. Make sure the stands will securely support the weight of the axles and frame. To access the spring assembly, remove the wheel assembly. See Group 40 for instructions.
- 3. If equipped with two drive axles, remove the cotter pin from the spring retainer pin on the end of the equalizer where the spring is being replaced. Drive the spring retainer pin out of the equalizer.
  - If equipped with a pusher or tag axle, remove the nut from the flathead bolt on the end of the equalizer where the spring is being replaced. Remove the bolt and the side-restraint sleeve from the wear-shoe side-restraint.
- 4. Remove the U-bolt high nuts, hardened washers, U-bolt retainer, U-bolts, and upper U-bolt pad.
- 5. Remove the spring assembly by lifting it off the axle seat, then moving it toward the equalizer, out of the forward or rear spring bracket.
- Using chassis grease, lubricate the new spring assembly where the ends will contact the stationary wear shoes in the spring bracket and equalizer.

- Place the new spring assembly in the spring bracket and on the axle seat. Make sure the spring center-bolt head seats in the axle seat hole.
- 8. If the upper U-bolt pad is aluminum, apply Alumilastic® compound, or an equivalent, to those areas of the pad that will come in contact with the U-bolts and with the upper spring leaf.

## - A CAUTION -

Failure to apply Alumilastic compound, or an equivalent, to areas where aluminum and steel contact each other, could lead to corrosion of the metals, resulting in suspension damage.

- Place the upper U-bolt pad on the spring assembly. Place the U-bolts over the upper U-bolt pad and the spring assembly.
- Install the U-bolt retainer, hardened washers, and U-bolt high nuts. Tighten the high nuts until snug.
- 11. If installing a spring assembly on a vehicle with two drive axles, apply Alumilastic compound, or an equivalent, to the spring retainer pins. Install them from the inboard side. Be sure the hooked ends of the spring leaves are above the retainer pins. Install a cotter pin in the outboard end of each retainer pin, and lock it in place.
  - If installing a spring assembly on a vehicle with a pusher or tag axle, install the side-restraint sleeves and flathead bolts in the wear-shoe side-restraints. Be sure the hooked ends of the spring leaves are above the side-restraint sleeves. Install the nuts, and tighten them to the applicable torque value in **Specifications 400**.
- 12. Tighten the axle U-bolt high nuts as described in **Specifications 400**.

## **A** CAUTION

Failure to periodically torque the suspension fasteners can result in abnormal tire wear, and damage to the springs, spring brackets, and frame rail.

IMPORTANT: All suspension fasteners require periodic torquing. For suspension component inspecting and fastener torque checking intervals and instructions, see Group 32 of the Business Class M2 Maintenance Manual.

## **Spring Assembly Replacement**

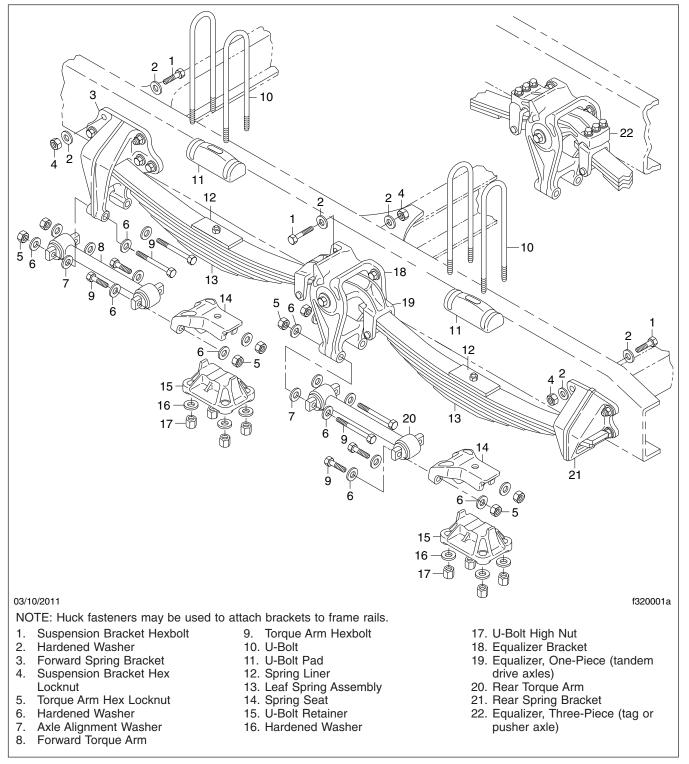


Fig. 1, Tandem-Axle Spring Suspension

### **Spring Assembly Replacement**

- 13. Install the wheel assembly, using the instructions found in **Group 40**. Remove the safety stands from under the frame and axle, and lower the vehicle.
- 14. Check the rear axle alignment. For instructions, see **Group 35**. If necessary, adjust the axle alignment, using the instructions in **Subject 140**.
- 15. Remove the chocks from the tires.

# Spring Bracket and Equalizer Bracket Replacement

### Replacement

NOTE: See Fig. 1 for this procedure.

### **A** WARNING

Failure to replace worn, cracked, or damaged spring brackets or equalizer brackets could result in breakage of the bracket, which could cause a loss of vehicle control, resulting in personal injury or property damage.

IMPORTANT: At all points where steel parts (including bolts, washers, and nuts) contact the aluminum spring brackets, apply Alumilastic® compound, or an equivalent, on the mating surfaces.



Failure to apply Alumilastic compound, or an equivalent, to areas where aluminum and steel parts contact each other, could lead to corrosion of the metals, resulting in damage to the suspension.

- Park the vehicle on a level surface and set the parking brake. Shut down the engine. Chock the front tires.
- Raise the rear of the vehicle, and block the axles with safety stands. Raise the vehicle frame so that all weight is removed from the leaf springs. Block the frame with safety stands. Make sure the stands will securely support the weight of the axles and frame.
- If removing the forward spring bracket or the equalizer bracket, note the number of any axle alignment washers. Remove the fasteners that attach the radius rod to the forward spring bracket or equalizer bracket. Remove any axle alignment washers.
- 4. If removing an equalizer bracket, remove the equalizer. For instructions, see **Subject 110**.
- Remove the fasteners that attach the forward or rear spring bracket, or equalizer bracket, to the frame rail. Remove the bracket.
- Place the new spring bracket or equalizer bracket on the frame rail. Align the mounting holes, and install the fasteners.

NOTE: If installing the forward spring bracket, install the nuts for the top two bolts on the outboard side of the frame rail, and install the nuts for the bottom four bolts on the inboard side of the frame rail. See **Fig. 2**.

NOTE: If installing the equalizer bracket, for clearance, install all of the nuts on the inboard side of the frame rail. See **Fig. 2**.

NOTE: If installing the rear spring bracket, install the nuts for the top two bolts on the outboard side of the frame rail, and install the nuts for the bottom two bolts on the inboard side of the frame rail. See **Fig. 2**.

7. Tighten the bracket mounting locknuts to the applicable torque value in **Specifications 400**.

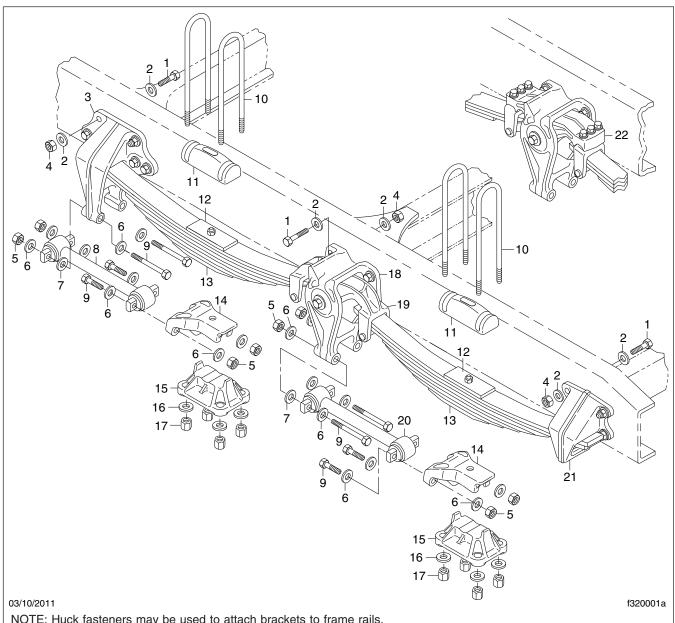


Failure to periodically torque the suspension fasteners can result in abnormal tire wear, and damage to the springs, spring brackets, and frame rail.

IMPORTANT: All suspension fasteners require periodic torquing. For suspension component inspecting and fastener torque checking intervals and instructions, see Group 32 of the Business Class M2 Maintenance Manual.

- 8. When replacing the forward spring bracket or equalizer bracket, install any previously removed axle alignment washers between the forward radius rod front pin and the forward spring bracket, or between the rear radius rod front pin and the equalizer bracket, as applicable. See Fig. 3.
  - Install bolts with hardened washers in the radius rod front pin, and the forward spring bracket or equalizer bracket. Install the hardened washers and locknuts, and tighten the locknuts to the torque value in **Specifications 400**.
- If replacing an equalizer bracket, install the equalizer. For instructions, see Subject 110.
- 10. Remove the safety stands from under the frame and axle, and lower the vehicle.
- 11. Remove the chocks from the tires.
- 12. Check the rear axle alignment. For instructions, see **Group 35**. If necessary, adjust the axle alignment, using the instructions in **Subject 140**.

### **Spring Bracket and Equalizer Bracket** Replacement



NOTE: Huck fasteners may be used to attach brackets to frame rails.

- Suspension Bracket Hexbolt
- 2. Hardened Washer
- 3. Forward Spring Bracket
- 4. Suspension Bracket Hex Locknut
- 5. Radius Rod Hex Locknut
- 6. Hardened Washer
- 7. Axle Alignment Washer
- 8. Forward Radius Rod
- 9. Radius Rod Hexbolt
- 10. U-Bolt
- 11. U-Bolt Pad

- 12. Spring Liner
- 13. Leaf Spring Assembly
- 14. Spring Seat
- 15. U-Bolt Retainer
- 16. Hardened Washer
- 17. U-Bolt High Nut
- 18. Equalizer Bracket
- 19. Equalizer, One-Piece (tandem drive axles)
- 20. Rear Radius Rod
- 21. Rear Spring Bracket
- 22. Equalizer, Three-Piece (tag or pusher axle)

Fig. 1, Tandem-Axle Spring Suspension

# Spring Bracket and Equalizer Bracket Replacement

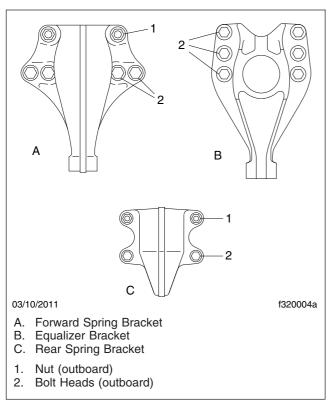


Fig. 2, Frame Brackets

# **Spring Bracket and Equalizer Bracket Replacement**

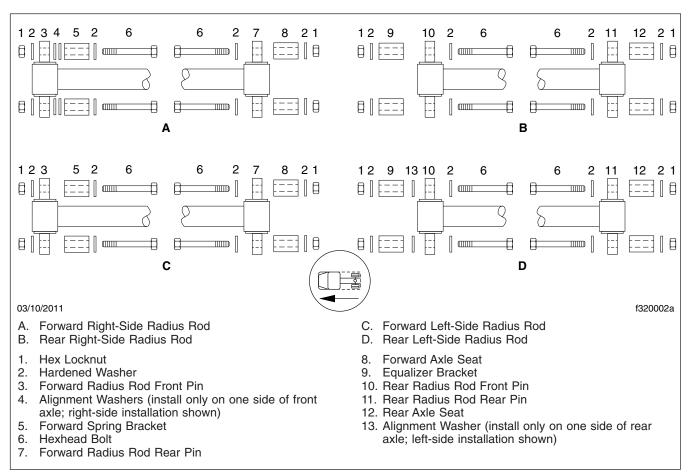


Fig. 3, Radius Rod Attachment (top view)

### **Rear Axle Alignment Adjustment**

### **Adjustment**

- Using a straightedge and a tape measure, determine the amount of adjustment needed to align the forward-rear axle at a right angle to the frame. For instructions, see **Group 35**. The difference in measurements between the sides of the vehicle is the approximate amount that the trailing end of the forward-rear axle will have to be brought forward, or the leading end will have to be moved back to align it at a right angle to the frame. See **Fig. 1**.
  - If the forward-rear axle alignment is within specifications, go to step 12.
- 2. Park the vehicle on a level surface and set the parking brake. Shut down the engine. Chock the front tires.

- 3. On both sides of the forward-rear axle, loosen the axle U-bolts enough to allow the springs to shift on the axle seats.
- 4. On the side of the vehicle that is to be adjusted, remove the fasteners that attach the forward radius rod to the forward spring bracket. Remove any axle alignment washers.

NOTE: To move the leading end of the forwardrear axle rearward, *remove* alignment washers from between the radius rod and the leading end of the forward spring bracket or *add* alignment washers between the radius rod and the forward-rear axle seat.

NOTE: To move the trailing end of the forwardrear axle forward, *remove* alignment washers

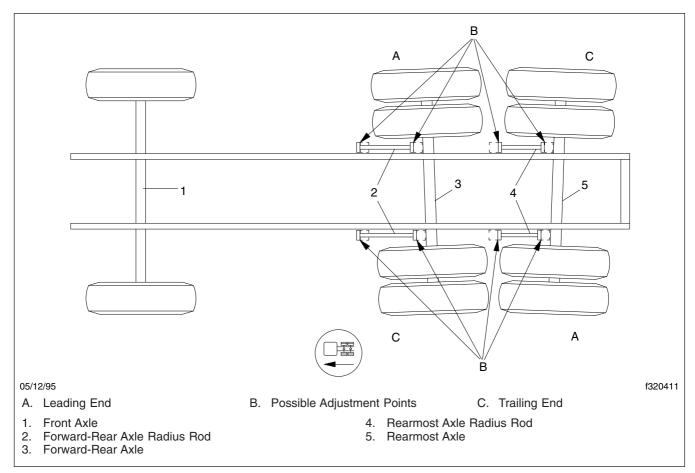


Fig. 1, Tandem Axle, Shown Out of Alignment

## **Rear Axle Alignment Adjustment**

from between the radius rod and the forwardrear axle seat on the trailing end.

NOTE: Whenever possible, alignment washers should be *removed* instead of added.

- Raise the frame just enough to relieve the weight from the springs. Place safety stands under the frame. Make sure the stands will securely support the weight of the frame.
- Rolling the wheels, move the loosened end of the axle forward or backward as needed.
- 7. Insert or remove axle alignment washers at the appropriate location (front or rear of the left-hand or right-hand radius rod) to bring the forward-rear axle into alignment. Install the hexhead bolt, hardened washers, and locknut in the radius rod pin and forward spring bracket or axle seat.
- Place an equal thickness of washers on the other end of the radius rod pin, and install the fasteners.
- Tighten the radius rod locknuts to the torque value in **Specifications 400**.
- 10. Remove the safety stands, and lower the vehicle.
- 11. Check the forward-rear axle alignment with the straightedge and the tape measure. If alignment is within specifications, center the spring in the forward spring bracket, if needed. Tighten the axle U-bolt nuts to the torque value in **Specifica**tions 400.

If not in alignment, repeat all of the steps above.

## CAUTION -

Failure to periodically torque the suspension fasteners can result in abnormal tire wear, and damage to the springs, spring brackets, and frame rail.

IMPORTANT: All suspension fasteners require periodic torquing. For suspension component inspecting and fastener torque checking intervals and instructions, see Group 32 in the Business Class M2 Maintenance Manual.

12. Using a center-point bar, determine the difference between the forward-rear and the rearmost axles' center-to-center measurements on each side of the vehicle. For instructions, see Group 35. This difference is the approximate

distance that the leading end of the rearmost axle will have to be adjusted rearward, or that the trailing end will have to be adjusted forward, to align it at a right angle to the frame, and to align it parallel to the forward-rear axle. See Fig. 1.

- On both sides of the rearmost axle, loosen the axle U-bolts enough to allow the springs to shift on the axle seats.
- 14. On the side of the vehicle that is to be adjusted, remove the fasteners that attach the rear radius rod to the equalizer bracket. Remove any axle alignment washers.
- 15. Raise the frame just enough to relieve the weight from the springs. Place safety stands under the frame. Make sure the stands will securely support the weight of the frame.
- 16. Move the loosened end of the axle forward or backward, by rolling the wheels. Move the axle just enough to provide space to allow installation of alignment washers between the equalizer bracket and the radius rod pin.
- 17. Between one end of the radius rod pin and the equalizer bracket, insert the additional thickness of alignment washers needed to make up for the difference in center-point bar measurements.

For example, if one end of the axle was equipped with a 3/16-inch (4.5-mm) thickness of washers, and the difference in the center-point bar measurements is 1/4 inch (6 mm) less on that side, add an additional 1/4 inch (6 mm) of washers (for a total of 7/16 inch [10.5 mm]) to correct the alignment.

Or, if one end of the axle was equipped with a 1/4-inch (6-mm) thickness of washers, and the difference in center-point bar measurements is 3/16 inch (4.5 mm) more on that side, install a 1/16-inch (1.6-mm) thickness of washers in place of the 1/4-inch (6-mm) thickness.

- 18. Install the bolt, hardened washers, and locknut in the equalizer bracket and the radius rod pin. Place an equal thickness of alignment washers on the other end of the radius rod pin, and install the fasteners at that end.
- 19. Tighten the radius rod locknuts to the torque value in **Specifications 400**.
- 20. Remove the safety stands, and lower the vehicle.

### **Rear Axle Alignment Adjustment**

- 21. Remove the chocks from the front tires.
- 22. Using the center-point bar, check the rearmost axle alignment. If alignment is within specifications, center the spring in the rear spring bracket, if needed. Tighten the axle U-bolt nuts to the applicable torque value in **Specifications 400**.

If not in alignment, repeat the applicable steps above.



Failure to periodically torque the suspension fasteners can result in abnormal tire wear, and damage to the springs, spring brackets and frame rail.

IMPORTANT: All suspension fasteners require periodic torquing. For suspension component inspecting and fastener torque checking intervals and instructions, see Group 32 of the Business Class M2 Maintenance Manual.

## **Specifications**

Torque Values						
Description	Size	IFI Grade	Torque: lbf·ft (N·m)			
Equalizer Bracket-to-Frame Rail Locknut *	3/4–10	С	240 (325)			
Forward Spring Bracket-to-Frame Rail Locknut *	3/4–10	С	240 ( 325)			
Rear Spring Bracket-to-Frame Rail Locknut *	5/8–11	С	135 (180)			
			Stage 1: Hand-Tighten			
	7/8–14	С	Stage 2: 60 (81)			
Axle U-Bolt High Nuts (Tighten in a diagonal pattern as shown in Fig. 1.)			Stage 3: 200 (271)			
			Stage 4: 420 to 500 (571 to 680)			
Radius Rod Locknut *	5/8–18	С	135 (184)			
Equalizer Cap and Tube Assembly Locknut *	3/4–16	С	270 (365)			
Equalizer Wear Shoe Capscrew	5/8–11	8	135 (184)			
Side-Restraint Sleeve Locknut	1/2–13	С	68 (93)			

<sup>\*</sup> Cadmium-plated, wax-coated nuts and grade 8 hexbolts with phosphate- and oil-coated threads; both used with hardened washers.

**Table 1, Torque Values** 

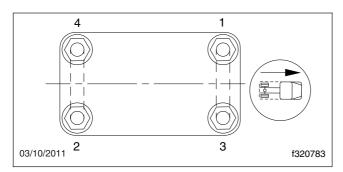


Fig. 1, Tightening Pattern for U-Bolt High Nuts

## Rough Ride Diagnosis

## **Contents**

Subject	Subject Number
General Information	
Service Operations	
Harmonic and Harsh Ride Checks	
Troubleshooting	300

### **General Information**

### **General Description**

There are two terms used to describe rough ride conditions: harmonic and harsh. Harmonic ride problems are those in which the once-per-revolution energy input from such things as bent or imbalanced wheels match the natural frequency of the frame flexing. This produces a fore-and-aft motion in the cab, which continues as long as the critical road speed is maintained. Harmonic ride problems can occur on smooth roads.

Harsh ride problems are those in which the suspension transfers, rather than absorbs, the momentary energy inputs produced when the tires hit bumps or holes in the road. Wavy asphalt, or a series of bumps, may cause repetition of the harsh, jarring motion in the cab, but the motion stops after the tires pass over the bumps. Harsh ride problems occur on rough roads.

This section is designed for use as an aid in locating and correcting rough ride problems. It is not intended for use as a replacement for the detailed service information located in the applicable subjects in this manual, or in the component manufacturer's service manuals.

### Harmonic and Harsh Ride Checks

### **Harmonic Ride Checks**

- 1. Visually check the vehicle for signs of damaged or missing suspension components. Repair or replace the components using the instructions in the applicable sections in this manual.
- 2. Test drive the vehicle.

NOTE: When test driving the vehicle, duplicate as closely as possible the conditions under which the problem occurs. Note the area of the vehicle where the problem seems to be coming from. Pay special attention to this area during the service operations.

## **WARNING**

Use safety stands to securely support all of the wheel and frame weight during suspension repairs. Unsecured components may drop when the fasteners are loosened or removed, causing serious personal injury and component damage.

- Raise the vehicle until the tires are off the ground, and all of the weight is removed from the leaf springs. Block the axle and frame with safety stands. Perform the corrections under "Harmonic Ride, Tires Off the Ground" in Troubleshooting, 300.
- Remove the safety stands from under the frame and axle, then lower the vehicle. Perform the corrections under "Harmonic Ride, Tires On the Ground" in Troubleshooting, 300.

### **Harsh Ride Checks**

- 1. Visually check the vehicle for signs of damaged or missing suspension components. Repair or replace the components using the instructions in the applicable sections in this manual.
- 2. Test drive the vehicle.

NOTE: When test driving the vehicle, duplicate as closely as possible the conditions under which the problem occurs. Note the area of the vehicle where the problem seems to be coming from. Pay special attention to this area during the service operations.

### **A** WARNING

Use safety stands to securely support all of the wheel and frame weight during suspension repairs. Unsecured components may drop when the fasteners are loosened or removed, causing serious personal injury and component damage.

- Raise the vehicle until the tires are off the ground, and all of the weight is removed from the leaf springs. Block the axle and frame with safety stands. Perform the corrections under "Harsh Ride, Tires Off the Ground" in Troubleshooting, 300.
- 4. Remove the safety stands from under the frame and axle, then lower the vehicle. Perform the corrections under "Harsh Ride, Tires On the Ground" in **Troubleshooting**, **300**.
- If the problem persists, perform the harmonic ride checks in this subject. Occasionally, ride problems associated with rough roads are harmonic ride problems masked by the road conditions.

## **Troubleshooting**

## **Troubleshooting Tables**

### Problem—Harmonic Ride, Tires Off the Ground

Problem—Harmonic Ride, Tires Off the Ground			
Possible Cause	Remedy		
Bent, distorted, or out-of-round wheels or rims are causing a rough ride.	Inspect and repair the assemblies using the instructions in Group 40.		
Bent, distorted, or out-of-round brake drums or hubs are causing a rough ride.	Replace damaged components using the instructions in <b>Group 33</b> or <b>Group 35</b> .		
An improperly seated tire-to-rim bead is causing an out-of-round assembly.	Inspect the tires and rims for proper bead seating. Correct the problem using the instructions in <b>Group 40</b> .		
A tire and rim assembly on spoke wheels is improperly installed, causing an out-of-round assembly.	Remove and install the tire and rim assembly using the instructions in <b>Group 40</b> .		
Worn or distorted rim spacers are causing an out-of-round assembly.	Replace damaged spacers using the instructions in <b>Group 40</b> .		
The wheels, brake drums, or hub assemblies are out of balance.	Inspect the components for missing balance weights. Balance, as necessary.		
Radial force variations in the tires are causing a rough ride.	Exchange the tires and wheels with a set that is known to cause no ride problems. If this corrects the problem, discard the old tires. For instructions, see <b>Group 40</b> .		

#### Problem—Harmonic Ride, Tires On the Ground

Problem—Harmonic Ride, Tires On the Ground			
Possible Cause	Remedy		
Worn or loose cab mounts allow the cab to bounce.	With a long bar, lever the cab legs up and down. If there is looseness, replace or tighten the mounts, as necessary.		
Forces from the trailer suspension are pushing on the tractor fifth wheel.	Review the ride problems that apply to the trailer suspension. Contact the trailer manufacturer for instructions. Perform the corrections, as necessary.		

#### Problem—Harsh Ride, Tires Off the Ground

Problem—Harsh Ride, Tires Off the Ground			
Possible Cause	Remedy		
Seized front spring shackle pins are not allowing the springs to flex.	Replace seized shackle pins. For instructions, refer to the applicable suspension section in this group.		

#### Problem—Harsh Ride, Tires On the Ground

Problem—Harsh Ride, Tires On the Ground			
Possible Cause	Remedy		
The tires are improperly inflated.	Adjust the tire pressure using the instructions in Group 40 of the <i>Business Class M2 Maintenance Manual</i> .		

## **Troubleshooting**

Problem—Harsh Ride, Tires On the Ground			
Possible Cause	Remedy		
The frame is bottoming out against the suspension.	Check the suspension for weak or damaged springs or components. Inspect the springs for "gull-winging" when the vehicle is loaded. Replace the spring assembly, as necessary, using the instructions in the applicable suspension section in this group.		
	Reduce the overall loaded weight on each axle to conform with the maximum spring load capacities on the vehicle specification sheet. Do not exceed the maximum spring load capacities.		
	Adjust the air spring height using the instructions in the applicable suspension section in this group.		
The vehicle normal loaded weight is markedly below the spring load capacity.	Contact the Freightliner Service Operations Regional Office for the correct application of a lower rated spring. Replace the spring assembly using the instructions in the applicable suspension section in this group.		
When the vehicle is loaded, the front axle spring shackle angle is not within the rearward 3- to 18-degree angle.	Contact the Freightliner Service Operations Regional Office for shackle angle corrective measures. Refer to the applicable suspension section in this group for service instructions.		
The weight on the tractor fifth wheel is causing overloading on the front axle springs.	If possible, move the fifth wheel toward the rear of the vehicle;otherwise, change the loading pattern on the trailer.		
There is a loaded weight differential between the rear axles greater than 800 pounds (363 kg).	Contact the Freightliner Service Operations Regional Office for corrective measures.		
Forces from the trailer suspension are pushing on the tractor fifth wheel causing a rough ride condition.	Review the ride problems that apply to the trailer suspension. Contact the trailer manufacturer for instructions. Perform the corrections, as necessary.		

## **Contents**

Subject	Subject Number
General Information	
Service Operations	
Suspension Ride Height Adjustment	
Height-Control Valve Checking	
Height-Control Valve Replacement	
Shock Absorber Replacement	
Air Spring Replacement	
Leaf Spring Replacement	
Rear Axle Alignment	
Control Rod Replacement	
Spring Eye Bushing Replacement	
Specifications	400

#### **General Information**

#### **General Information**

The Freightliner AirLiner Suspension is a single axle or tandem axle suspension that uses a combination of air and leaf springs. The suspension is manufactured at numerous weight ratings up to 46,000 pounds (20 865 kg). The top of the air spring is bolted to a bracket on the frame rail or through the bottom flange of the frame rail; the bottom is bolted to the rear end of the tapered leaf spring assembly or, for the 23,000-pound (10 433 kg) and 46,000-pound suspensions, to a cross bar. The axle housing is fastened to the leaf spring assembly by U-bolts. A control rod, mounted between the axle housing and the frame rail, can be used to help locate the assembly laterally.

The air springs compensate for changes in road conditions and vehicle load, maintaining vehicle height. The air springs also absorb road shock.

A height-control valve regulates the air flow into or out of all the air springs; see **Fig. 1**. As the air spring compresses or expands, changes in the clearance between the vehicle frame and the differential housing activate the height-control valve.

The height-control valve is mounted on the frame rail; see Fig. 1 and Fig. 2. A horizontal control lever extends from the end of the valve control shaft to a vertical linkage that connects to the height-control valve linkage bracket welded to the differential housing.

When the load changes, the horizontal control lever turns the height-control valve control shaft, activating either the intake or exhaust function of the height-control valve. This adjusts the volume of air in the air springs, until the frame returns to the normal ride height, and the horizontal control lever returns to the horizontal (neutral) position.

A side-to-side restriction valve inside the heightcontrol valve maintains vehicle roll stability by preventing inflation of the air spring on one side and deflation on the other side during curves.

A pressure holding valve, located in the air line to the height-control valve, is preset to maintain a minimum pressure of 65 psi (448 kPa) in the vehicle secondary air system if a leak should occur in the air suspension system.

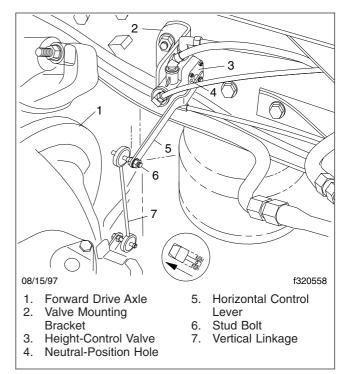


Fig. 1, Barksdale Height-Control Valve Assembly

#### **General Information**

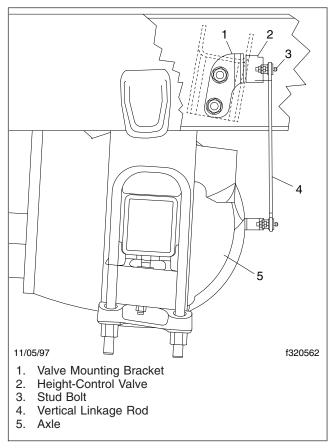


Fig. 2, Barksdale Height-Control Valve Installation, Side View

## **Ride Height Adjustment**

IMPORTANT: Before checking the suspension height, make sure there is no load on the chassis. For tractors, unhitch the trailer. Trucks must be empty.

Vehicles with dual ride height control valves follow the same procedure as single valves, but with two height gauge blocks, and both height control valves adjusted simultaneously. Both linkages should be disconnected when adjusting, and both valves should be repositioned once the correct ride height has been reached on both sides.

- Park the vehicle on a level surface, using a light application of the brakes. Set the parking brake and chock the tires. Put the transmission in neutral. Build the secondary air pressure to at least 100 psi (690 kPa). Shut down the engine.
- 2. Space the tire chocks 2 inches (5 cm) ahead and behind the tire so the vehicle can roll 2 inches in either direction.
- 3. Release the parking brake and verify by hand that the vehicle can roll forward and aft. This should remove any load from the suspension.
- 4. Determine the correct ride height for the suspension:
  - Some common suspensions and ride height dimensions are shown in Table 1, Table 2, Table 3, Table 4, and Table 5.
  - In PartsPro, enter the VIN and Module "622" (Rear Suspension), and retrieve the Parts List. The installation drawing will be listed as a part with a D16 prefix. Use the EZ Wiring icon to view this drawing, which will specify where to measure the ride height and the target ride height distance for that suspension. This dimension is usually labelled the "E" dimension; the target ride height should be in a table on the same page of the drawing.

IMPORTANT: Suspensions with Dual-Leaf Springs, and all Vehicles built before August 24, 2001: Measure between the top of the U-bolt and the bottom of the axle stop (distance A).

Suspensions with Single-Leaf Springs, built after August 24, 2001: Measure between the

top of the U-bolt **pad** and the bottom of the axle stop (distance B).

- Measure the distance between either forwardmost axle stop and the suspension using the dimension indicated in the drawing or figure for the suspension.
- If the distance is within the acceptable range, no adjustment is needed. Apply the parking brakes.
   If the measurement is not within the acceptable range, go to the next step.

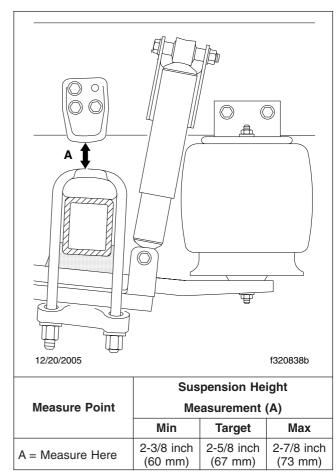
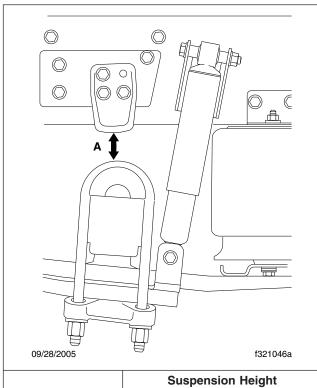


Table 1, Suspension Ride Height Measurement, Dual-Leaf Spring, 20k/40k High Ride

7. Disconnect the height-control valve linkage at the lever stud. (For dual valves, disconnect both.)



	Suspension Height			
Measure Point	Measurement (A)			
	Min	Target	Max	
A = Measure Here	2-3/4 inch (70 mm)	3 inch (76 mm)	3-1/4 inch (83 mm)	

Table 2, Suspension Ride Height Measurement, Dual-Leaf Spring, 23k/46k/69k High Ride

- If there is not enough room for the block between the axle stop and the top pad, lift the valve lever to inflate the airbags enough to fit the block. (For dual valves, lift both levers.) Do not install the block yet.
- 9. Pin the lever in neutral position with a 5/32-inch drill bit or nylon rod to lock the lever in neutral position. See **Figure 1**.
- 10. Install the height gauge block. (For dual valves, install a block on both sides.)
- Unpin the valve lever and use it to lower the suspension until the axle stop rests on the block. (For dual valves, unpin and lower with both valves.)

12. Move the lever to neutral and pin. (For dual valves, pin both.) The vehicle should now be at the target ride height.

#### NOTICE -

When loosening a Barksdale height-control valve from a mounting bracket, always hold the valve-side mounting studs in place with an Allen wrench while loosening or tightening the nuts that attach the valve to the bracket. Because the mounting studs are threaded into the valve body, loosening the nuts without holding the studs can tighten the studs, which can crush the valve body and damage the valve. Conversely, tightening the nuts without holding the studs can back the studs out, causing a separation of the two halves of the valve body, and possibly a leak.

- 13. While holding the height-control valve mounting studs in place with an Allen wrench, loosen the nuts that attach the valve to the mounting bracket. See **Figure 2**.
- 14. Adjust the position of the valve body until the lever—still pinned in neutral position—can connect to the linkage. Attach the linkage. The linkage rod should be vertical, and the valve body should now be in the correct position for the vehicle's ride height. (For dual valves, adjust and connect both.)
  - If the linkage cannot reach the stud, check the surrounding components for bent or damaged parts and remedy as needed.
- 15. While holding the height-control valve mounting studs in place with an Allen wrench, tighten the nuts 95 lbf·in (1100 N·cm). Do not overtighten, as that could damage the valve. (For dual valves, tighten both.)
- 16. Disconnect the linkage from the valve lever stud. (For dual valves, disconnect both.)
- Raise the valve lever to raise the suspension enough to remove the block, then pin the valve lever in neutral position. (For dual valves, raise and pin both valves.)
- 18. Remove the block. (For dual valves, remove both blocks.)
- 19. Remove the pin or drill bit holding the heightcontrol lever in neutral position, then connect the



Fig. 1, Inserting a 5/32-inch drill bit or nylon rod to lock the lever in neutral position.

valve lever to the linkage. (For dual valve, unpin and connect both valve levers.)

- 20. Drive the vehicle unloaded for about 1/4 mile (1/2 km), then park the vehicle on a level surface using a light brake application. Chock the tires on one axle only, and put the transmission in neutral. Do not apply the parking brakes.
- 21. Check the ride height of the vehicle again, measuring where indicated in the drawing or figure for the suspension.



Fig. 2, Holding the height control valve mounting stud in place with an Allen wrench when loosening the nut.

If the distance is within the acceptable range, the ride height is correctly set. Apply the parking brakes.

If the distance is not within the acceptable range, repeat the adjustment procedure.

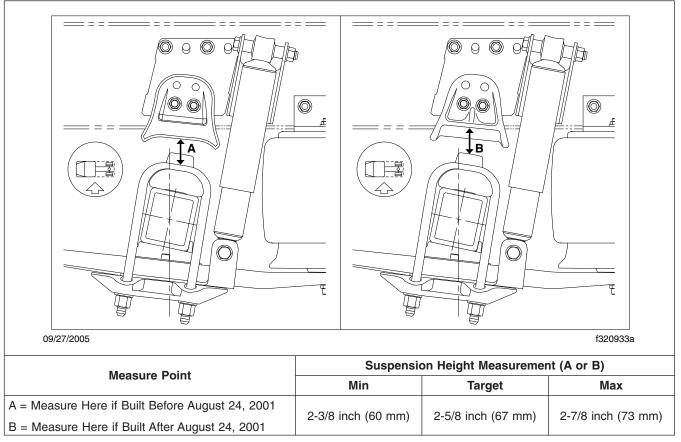


Table 3, Suspension Ride Height Measurement, Single-Leaf Spring, 20k/40k, High Ride Height

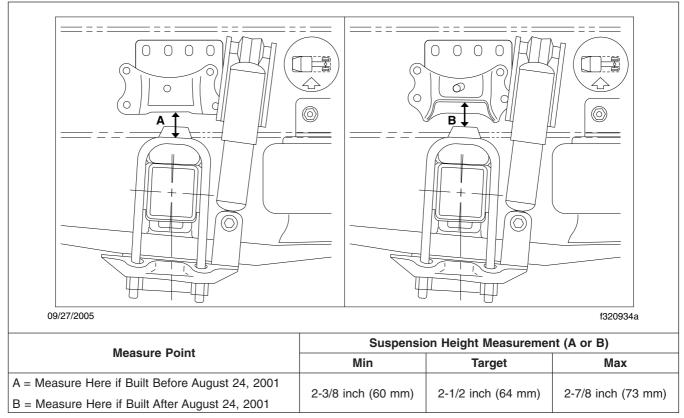


Table 4, Suspension Ride Height Measurement, Single-Leaf Spring, 10k/12k/15k/18k Mid Ride Height and 40k Low and Mid Ride Height

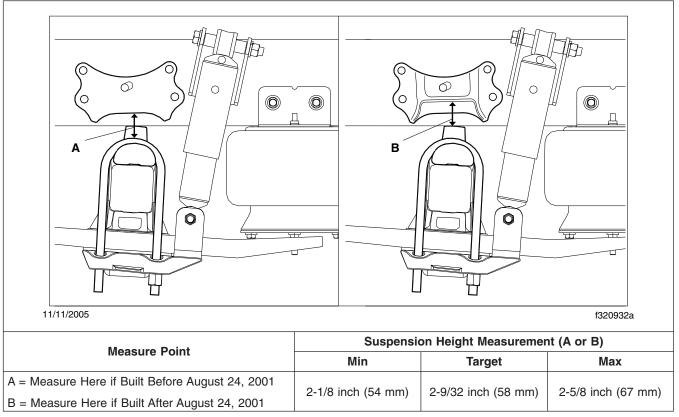


Table 5, Suspension Ride Height Measurement, Single-Leaf Spring, 10k/12k/15k Low or Extra Low Ride Height

## **Height-Control Valve Checking**

It is normal to hear air escaping from the heightcontrol valve for as much as 10 minutes after getting out of the vehicle when it is in an unladen condition. This air "leaking" is just the height-control valve exhausting air from the suspension air springs in order to return to the neutral mode.

The height-control valves used on the Business Class M2 are Barksdale valves. Two methods are available to check the operation of the Barksdale height-control valves. A leak in the valve may be discovered without using a test kit, but a test kit is necessary to determine if the valve has an unacceptable rate of leakage.

Some Barksdale height-control valves have been returned for warranty because the four bolts in the valve housing were overtightened, often, enough to crack the valve housing. These bolts should not be loose, and should not normally require tightening, as there are no serviceable parts in the valve.

IMPORTANT: To prevent voiding the warranty on Barksdale height-control valves, note the following:

- Do not overtighten the bolts in the Barksdale height-control valve housing if you detect leaks in the housing. The bolts should not be loose, and should not require tightening. Only if necessary, tighten the valve housing bolts 45 lbf·in (500 N·cm). Any damage to the valve housing will void the warranty.
- Do not attempt to disassemble the Barksdale valve body or the control lever. There are no serviceable parts in the valve, and any disassembly will void the warranty.

#### NOTICE

When removing or loosening a Barksdale heightcontrol valve from a mounting bracket, always hold the valve-side mounting studs in place with an Allen wrench while loosening or tightening the nuts that attach the valve to the bracket. Because the mounting studs are threaded into the valve body, loosening the nuts without holding the studs can tighten the studs, which can crush the valve body and damage the valve. Conversely,

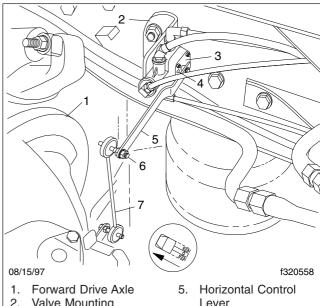
tightening the nuts without holding the studs can back the studs out, causing a separation of the two halves of the valve body, and possibly a leak.

## Checking the Height-Control **Valve Without Using a Test Kit**

- 1. Apply the parking brakes and chock the tires.
- Run the engine to build vehicle air pressure to at least 100 psi (690 kPa).
- Shut off the engine and wait 5 to 10 minutes for the air suspension system to equalize.

NOTE: Normal operation of the height-control valve requires a maximum of 10 minutes to settle. Any air leakage during this time is considered normal, and does not indicate a defective valve.

4. Disconnect the vertical linkage from the control lever; see Fig. 1.



- Valve Mounting Bracket
- Height-Control Valve 4. Neutral-Position Hole
- Stud Bolt
- Vertical Linkage

Fig. 1, Barksdale Height-Control Valve Assembly

5. Pull the control lever up about 45 degrees for 6 to 8 seconds. If air passes through the valve, that section of the valve is working.

- 6. Return the control lever to the neutral position. Air should stop flowing. If so, that section of the valve is working.
- 7. Push the control lever down about 45 degrees for 6 to 8 seconds. If air exhausts from the valve, that section of the valve is working.
- 8. Return the control lever to the neutral position. If the air stops again in the neutral position, the valve is working correctly.
- If the valve works as stated in all of the above steps, then no further checking is necessary.
   Connect the vertical linkage to the control lever, then tighten the linkage nut.

If needed, adjust the ride height or replace the height-control valve. For adjustment of the ride height, see **Subject 110**. For replacement of the height-control valve, see **Subject 130**.

NOTE: If a leak is detected on a Barksdale height-control valve, go to "Checking the Height-Control Valve Using a Test Kit". Barksdale valves have an acceptable leak rate of 3 cubic inches (50 cc) per minute. You can determine if a leak is acceptable only by using the Barksdale test kit.

# Checking the Height-Control Valve Using a Test Kit

IMPORTANT: The procedure described below is for use on Barksdale height-control valves only.

NOTE: The Barksdale field test kit is designed to be used with the height-control valve installed on the vehicle. Refer to **Specifications 400** for information on ordering the Barksdale height-control valve test kit KD2264.

- If not already done, park the vehicle on a level surface, apply the parking brakes, and chock the tires.
- 2. Run the engine to build vehicle air pressure to at least 100 psi (690 kPa).
- 3. Shut off the engine and wait 5 to 10 minutes for the air suspension system to equalize.

NOTE: Normal operation of the height-control valve requires a maximum of 10 minutes to

settle. Any air leakage during this time is considered normal, and does not indicate a defective valve.

4. For valves without an integral dump port, go to the next step.

For valves with an integral dump port, check the rubber exhaust flapper at the back of the valve housing for leaks; see **Fig. 2**. Use a soapy solution.

If a leak is found, there may be contaminants blocking the piston. Cycle the height-control valve switch inside the cab for two-second bursts, four or five times, to clear away any contaminants.

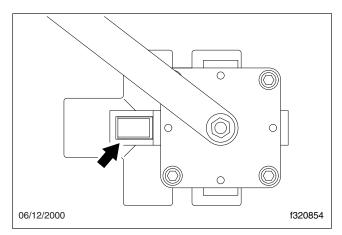


Fig. 2, Exhaust Flap Location (height-control valve with integral dump port)

- Disconnect the vertical linkage from the horizontal control lever.
- Rotate and hold the horizontal control lever down at about 45 degrees to exhaust air from the air springs.
- 7. If equipped with an integral dump port, turn on the quick dump switch on the dash. Leave the switch on until testing is complete.

If not equipped with an integral dump port, disconnect the air lines from the air spring ports on the height-control valve. Leave the elbow fittings (if equipped) in place. Install a Parker plug into each air spring port (or elbow fitting); see Fig. 3.

If a flapper is present on the exhaust port of the height-control valve, remove it using needlenose pliers.

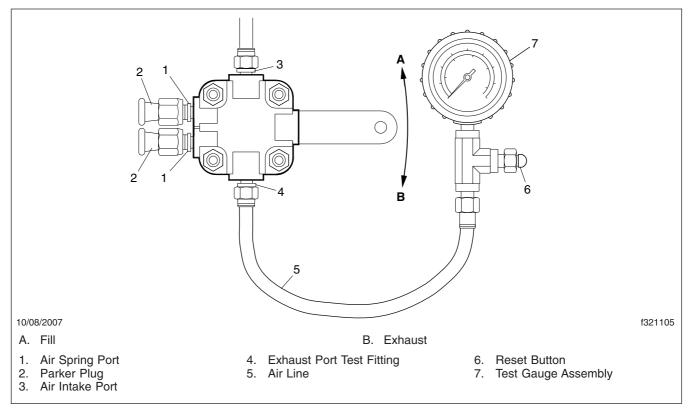


Fig. 3, Test Connections

 Clean the surface around the exhaust port, then install the test fitting into the exhaust port. The centering pin on the fitting must align with the slot on the exhaust port. Rotate the test fitting 45 degrees clockwise to lock it in place; see Fig. 3.

NOTE: It may be necessary to cut the tie straps that hold the chassis wiring running below the height-control valve, in order to access the exhaust port.

- Connect one end of the air hose from the kit to the test connector on the exhaust port, and the other end to the test gauge.
- Check the height-control valve in the fill mode, as follows.
  - 11.1 Rotate the valve control lever up 45 degrees from the horizontal to the fill position.
  - 11.2 Press the reset button on the test gauge.
  - 11.3 Observe the test gauge for 30 seconds. Refer to Fig. 4 for the maximum allowable

exhaust pressure change versus inlet pressure.

The valve is not working correctly if the gauge pressure reading exceeds the maximum allowable within 30 seconds.

If the gauge reads less than the maximum allowable pressure change in 30 seconds, the valve is okay.

NOTE: The test gauge will register the exhausting air. *This does not indicate a defective valve.* 

- 12. Check the height-control valve in the exhaust mode, as follows.
  - 12.1 Rotate the valve control lever down 45 degrees from the horizontal to the exhaust position.
  - 12.2 Press the reset button on the test gauge.
  - 12.3 Observe the test gauge for 30 seconds. Refer to **Fig. 4** for the maximum allowable

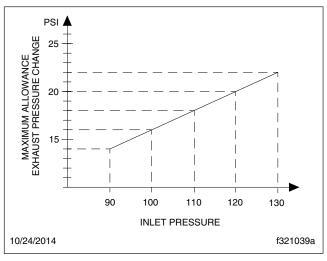


Fig. 4, Inlet Pressure vs. Exhaust Pressure Change in 30 Seconds

exhaust pressure change versus inlet pressure.

The valve is not working correctly if the gauge pressure reading exceeds the maximum allowable within 30 seconds.

If the gauge reads less than the maximum allowable pressure change in 30 seconds, the valve is okay.

NOTE: The test gauge will register the exhausting air. This does not indicate a defective valve.

- Disconnect the test gauge and connector from the valve exhaust port.
- If the height-control valve is defective, replace it; see Subject 130.
- 15. Install the flapper on the exhaust port by pressing it into place.
- 16. For height-control valves with an integral dump port, connect the vertical linkage to the heightcontrol valve control lever. Turn off the quick dump switch on the dash. The ride height will automatically return to the correct position.

For height-control valves without an integral dump port, remove the two Parker plugs from the air spring ports, and connect the air lines to the air spring ports (or elbow fittings). Connect the vertical linkage to the height-control valve control lever. The ride height will automatically return to the correct position.

#### **Height-Control Valve Replacement**

# Barksdale Height-Control Valve Replacement

The Barksdale valve does not use an adjustable linkage rod. To adjust the Barksdale valve, see **Subject 110**.

1. Apply the parking brakes and chock the tires.



Keep your hands and all objects away from the area under and around the slack adjusters and suspension components when removing the pressure from the air system. These parts will move as the air is released and can cause personal injury or damage to any objects that are between the moving parts.

2. Drain all air from the air tanks.

## **WARNING**

Air lines under pressure can whip dangerously if disconnected. Drain all air from the air tanks before disconnecting air lines. Disconnecting pressurized air lines can cause personal injury and/or property damage.

- Remove the nut and washer that attaches the vertical linkage to the horizontal control lever. Disconnect the vertical linkage from the control lever; see Fig. 1.
- 4. Rotate and hold the horizontal control lever down until all air is exhausted from the air springs.
- Disconnect the air lines at the height-control valve, and mark the lines for later reference. Using tape, cover the open ends of the air lines and fittings to prevent dirt or foreign material from entering.

IMPORTANT: For quick-connect tube fittings, do not remove the tube by cutting it close to the fitting. If the remaining part of the tube cannot be pulled from the fitting, the fitting will not be reusable and the warranty on that unit will be void.

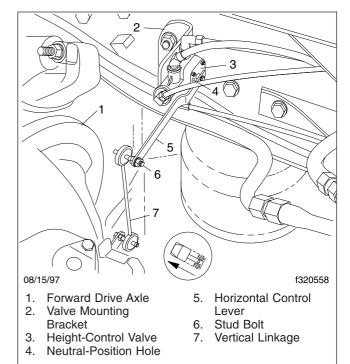


Fig. 1, Barksdale Height-Control Valve

#### NOTICE -

When removing or loosening a Barksdale height-control valve from a mounting bracket, always hold the valve-side mounting studs in place with an Allen wrench while loosening or tightening the nuts that attach the valve to the bracket. Because the mounting studs are threaded into the valve body, loosening the nuts without holding the studs can tighten the studs, which can crush the valve body and damage the valve. Conversely, tightening the nuts without holding the studs can back the studs out, causing a separation of the two halves of the valve body, and possibly a leak.

- While holding the height-control valve mounting studs in place with an Allen wrench, remove the nuts and washers that attach the valve to the mounting bracket. Remove the height-control valve.
- Position the new height-control valve on the height-control bracket. While holding the heightcontrol valve mounting studs in place with an Allen wrench, install the nuts and washers, and

## **Height-Control Valve Replacement**

- tighten the nuts 95 lbf·in (1100 N·cm). Do not overtighten.
- 8. Remove the tape from the air lines and fittings, and connect the air lines to the height-control valve as marked earlier. Tighten nylon tube air fittings until only two threads show on the fitting. On wire-braid hose fittings, tighten the nut with a wrench until there is firm resistance, then tighten one-sixth turn more.
- 9. Close the drain cocks on all reservoirs.
- 10. Build up normal operating pressure in the air system. Check all air lines and connections for leaks. Eliminate all leaks.
- 11. Adjust the height-control valve; see Subject 110.

#### **Shock Absorber Replacement**

## **Shock Absorber Replacement**

- 1. Chock the tires.
- 2. Remove the locknut, bolt, and spacer from the shock absorber lower mounting bracket. See Fig. 1.
- 3. Remove the nut, upper retainer, and upper bushing from the top of the shock absorber.
- Pull the shock absorber out of the upper mounting bracket, and remove the retainer and bushing.
- 5. Install the replacement shock absorber, making sure the new bushings and retainers are correctly positioned. See Fig. 1.



Use only the retainers included with the replacement shock absorber. Do not use washers. They can be extruded over the nut and be ejected violently, possibly causing personal injury and property damage.

- 6. Tighten the shock absorber lower mounting locknut 170 lbf·ft (230 N·m).
- 7. Tighten the shock absorber upper mounting nut to compress the bushings to the dimension as shown in **Fig. 1**.

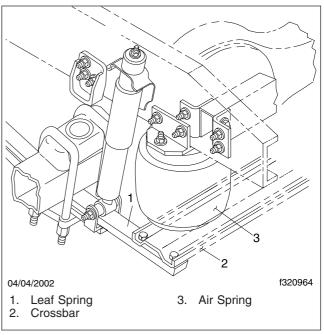


Fig. 1, Shock Absorber Installation

#### **Air Spring Replacement**

## **Air Spring Replacement**

IMPORTANT: Effective March 2011, the steel bead on the inside of the air bag where it attaches to the piston, changed to a square bead to increase the pull-off force between the air bag and piston. The new air bag is stamped "BD8" and "Do Not Re-Assemble Rubber Bellow to Piston." See Fig. 1. With this design change it is not possible to reseat the air bag to the piston. In the event of an air bag failure, or separation from the piston, the complete air-spring assembly must be replaced. For service it is acceptable to have a replacement air-spring assembly on one side of the vehicle, and an older style on the other side.

NOTE: The air-spring-to-frame-rail mounting bracket is not supplied with the air-spring assembly. If it needs to be replaced it must be ordered separately.

Follow these steps to replace the air-spring and piston assembly.

- Chock the front tires. Raise the vehicle frame and support it with safety stands to remove all weight from the air springs. The leveling valve automatically releases air from the air springs when all weight is removed from the suspension.
- Disconnect the air supply line, including the brass tee, from the air spring. Using tape, cover the ends of the air supply line and the fitting to prevent dirt or foreign material from entering.
- 3. Remove the locknuts and washers that connect the air spring to the upper mounting bracket, or to the frame rail flange. See Fig. 2 and Fig. 3.
- 4. Remove the capscrews and lockwashers that connect the air spring to the rear of the leaf spring. Remove the air spring. See **Fig. 4**.

NOTE: Suspensions manufactured to a 46,000(20 865kg) or 23,000-pound (10 433 kg) weight rating have a different leaf spring, and an additional crossbar attached between the air spring and rear of the leaf spring. See **Fig. 5**.

5. Place the new air spring on the rear of the leaf spring (or the crossbar on the 23,000 and 46,000-pound suspensions), and install the washer and locknut that hold the air spring (and

- crossbar) in place. See **Fig. 4**. Tighten the lock-nut 55 lbf·ft (75 N·m).
- For bracket-mounted air springs: Attach the air spring to the upper mounting bracket, using the 1/2–13 locknut on the outside of the frame rail and the 3/4–16 locknut on the inside. See Fig. 2. Tighten the 3/4–16 locknut 45 lbf·ft (61 N·m); tighten the 1/2–13 locknut 23 lbf·ft (31 N·m).
  - For flange-mounted air springs: Attach the air spring to the frame rail flange, using the 3/4–16 locknut on the forward stud of the air spring, and the 1/2–13 locknut on the rear stud. See **Fig. 3**. Tighten the 3/4–16 locknut 45 lbf·ft (61 N·m); tighten the 1/2–13 locknut 23 lbf·ft (31 N·m).
- 7. Remove the tape from the ends of the air supply line, the fitting, and the brass tee. Connect the air supply line to the air spring. Tighten nylon tube air fittings until only two threads show on the fitting. On wire-braid hose fittings, tighten the nut with a wrench until there is firm resistance, then tighten one-sixth turn more.
- 8. Remove the safety stands, and lower the vehicle. Remove the chocks from the tires.

# **Air Spring Replacement**

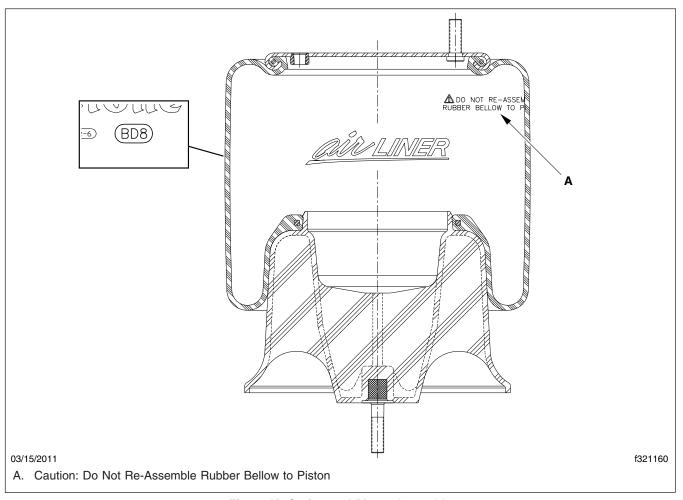


Fig. 1, Air-Spring and Piston Assembly

### **Air Spring Replacement**

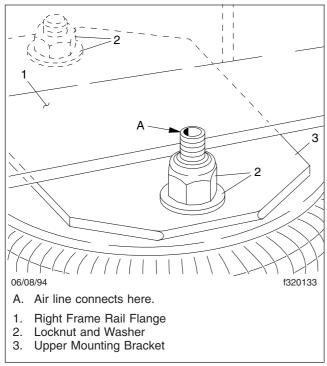


Fig. 2, Bracket-Mounted Air Spring

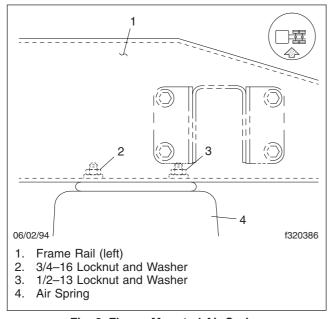


Fig. 3, Flange-Mounted Air Spring

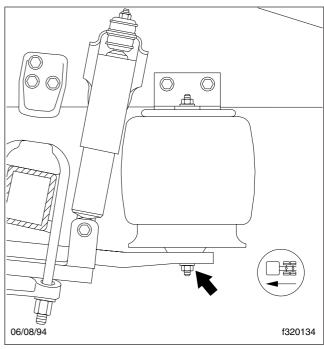


Fig. 4, Capscrew Connecting Leaf Spring and Air Spring

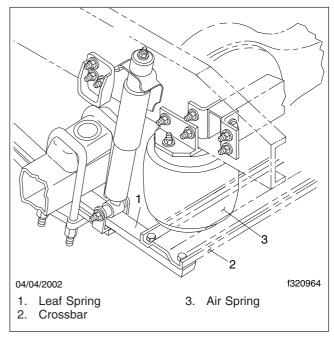


Fig. 5, Leaf Spring and Air Spring Assembly (23,000 and 46,000- pound suspensions)

#### **Leaf Spring Replacement**

## **Leaf Spring Replacement**

NOTE: See Fig. 1 for this procedure.

#### **A** WARNING

Do not replace individual leaves of a damaged leaf spring assembly; replace the complete spring assembly. Visible damage (cracks or breaks) to one leaf causes hidden damage to other leaves. Replacement of only the visibly damaged part(s) is no assurance that the spring is safe. Failure to replace a damaged spring assembly could cause an accident resulting in serious personal injury or property damage.

- 1. Chock the front tires.
- Raise the rear of the vehicle, and support the rear axle(s) with safety stands. Raise the vehicle so that all weight is removed from the leaf springs, then securely support the frame with safety stands. Remove the wheel and tire assembly to easily access the suspension. See Group 40 for instructions.
- 3. Remove the nut, bolt, and washers from the shock absorber lower mounting bracket. Remove the high nuts, flatwashers, and axle clamp from each U-bolt. Support the leaf spring assembly with a jack.
- 4. If the air spring mounts to the leaf spring, disconnect the bottom of the air spring from the leaf spring.
  - If the air spring mounts to a crossbar, disconnect the crossbar from the leaf spring by removing the bolts, nuts, and washers. See **Fig. 1**.
- 5. Note the number and position of the alignment shims on the spring mounting bolt. See Fig. 2.
- 6. Remove the hexnut, washers, alignment shim(s), spring mounting bolt, and wear shoe clip from the spring hanger. See Fig. 2.

## **A** WARNING

The leaf spring assembly is heavy. Use care when handling it to prevent injury.

- 7. Remove and discard the leaf spring assembly.
- 8. While supporting a new leaf spring assembly with a jack, position the assembly on the spring hanger. Install the bolts, wear shoe clips,

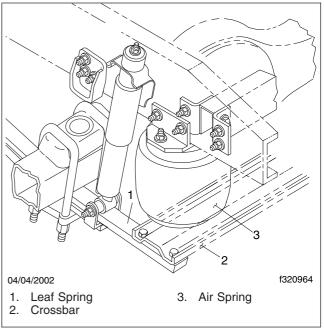


Fig. 1, Leaf Spring and Air Spring Assembly (23,000and 46,000-pound suspensions)

washers, alignment shims, and hexnuts. Tighten the bolts just enough to hold the leaf spring assembly in place.

- 9. If the air spring mounts to the leaf spring, attach the air spring to the leaf spring assembly. Install the washer and locknut. Tighten the locknut 55 lbf·ft (75 N·m).
  - If the air spring mounts to a crossbar, attach the crossbar to the leaf spring assembly. The longer bolts attach in the forwardmost holes; the shorter bolts attach in the aft holes.
- 10. Making sure that the U-bolt pads are in place on the top of the axle, fasten the leaf spring assembly to the axle using the U-bolts, axle clamp, washers, and high nuts making sure the U-bolt pads and axle clamps are positioned correctly.

NOTE: On single-drive axles angled 5 degrees, the arrow on the U-bolt pads must point to the front of the axle housing. See **Fig. 3**. On single-drive axles angled 3 degrees, there is no arrow. Make sure that the axle bump stop on the U-bolt pad is positioned toward the vehicle centerline. See **Fig. 4**.

## **Leaf Spring Replacement**

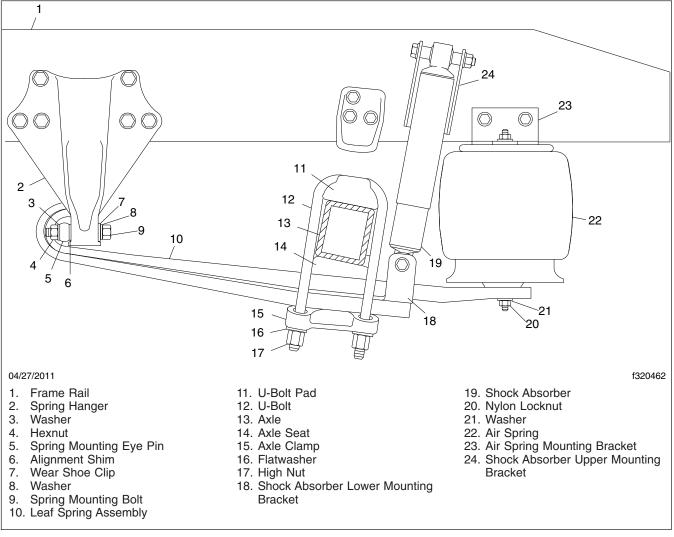


Fig. 2, AirLiner Leaf Spring Assembly

With both 5- and 3-degree single-drive axle angles, the arrow on the bottom of the axle clamp must point toward the rear of the vehicle. See **Fig. 2**.

On tandem axle suspensions, refer to **Table 1** for U-bolt pad orientation. The arrow on the bottom of the axle clamp must point toward the rear of the vehicle on the forward rear axle and toward the front of the vehicle on the rearmost axle.

11. Hand tighten the high nuts. In a diagonal pattern, tighten the axle U-bolt high nuts 60 lbf-ft (81

N·m). Then, in the same pattern, tighten them 200 lbf·ft (271 N·m); then, torque to the final value of 400 to 460 lbf·ft (542 to 624 N·m).

For the 23,000-pound suspensions, tighten the high nuts in a diagonal pattern to a final torque value of 520 to 600 lbf·ft (705 to 813 N·m).

- 12. Install the bolt, washers, and hexnut to connect the shock absorber to its lower mounting bracket. Tighten the hexnut 170 lbf·ft (230 N·m).
- 13. Tighten the locknut on the bottom of the air spring 55 lbf·ft (75 N·m).

## **Leaf Spring Replacement**

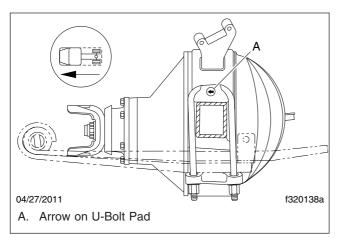


Fig. 3, U-Bolt Pad Arrow Positioning

On 23,000-pound suspensions, tighten the lock-nuts on the bottom of the crossbar 241 lbf-ft (327  $N \cdot m$ ).

- 14. Tighten the hexnuts at the front of the leaf spring 170 lbf·ft (230 N·m).
- 15. Install the wheel and tire assembly. For instructions, refer to **Group 40**. Remove the safety stands, and lower the vehicle.

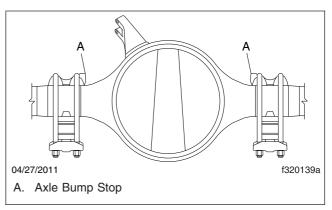


Fig. 4, Axle Bump Stop Positioning

 Check the rear axle alignment. For instructions, refer to the rear axle section in this manual. If necessary, adjust the rear axle alignment using the instructions in Subject 180.

U-Bolt Pad Orientation for Axles				
Interaxle Spacing: inches (cm)	Axle Designation		U-Bolt Pad Orientation	
51 (130)	All	Forward Rear Axle	No arrow; axle bump stop toward vehicle centerline.	
55 (140)		Rearmost Axle	Arrow toward front of vehicle.	
	Meritor RT40-160	Forward Rear Axle	No arrow; axle bump stop toward vehicle centerline.	
		Rearmost Axle	Arrow toward front of vehicle.	
59 (150)	All except Meritor RT46-160	Forward Rear Axle	No arrow; axle bump stop toward vehicle centerline.	
		Rearmost Axle	No arrow; axle bump stop toward vehicle centerline.	

Table 1, U-Bolt Pad Orientation for Axles

#### **Rear Axle Alignment**

## **Rear Axle Alignment Adjusting**

NOTE: See Fig. 1.

Follow the instructions in **Group 35** to see if rear axle alignment adjustment is needed. If adjustment is needed, proceed as follows:

- 1. Loosen the spring pinch bolts so that the forward end of the leaf spring can slide fore and aft in the spring hanger.
- 2. Move the axle forward or backward until it is aligned within the tolerances in **Group 35**.

3. When the axle is in alignment, install alignment shim(s) to take up the slack between the spring hanger and the spring pin.

IMPORTANT: Make sure the same number of shims is installed on both ends of the spring pin.

- 4. Tighten the spring pinch bolts 170 lbf⋅ft (230 N⋅m).
- 5. Check the axle alignment again. If necessary, repeat the above procedure until the alignment is within tolerances.

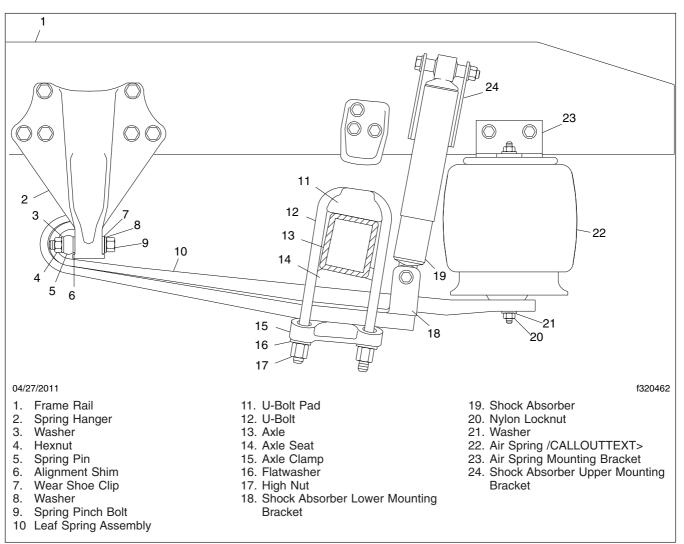


Fig. 1, Rear Axle Suspension

## **Rear Axle Alignment**

## **Rear Axle Tracking Adjustment**

### Single Axle

At the forward edge of the right rear tire, measure the distance from the inner side of the tire to the outer side of the right frame rail. See
Fig. 2.

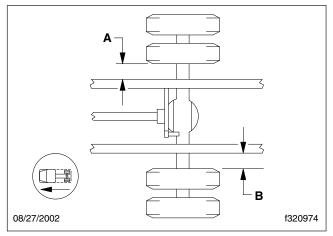


Fig. 2, Rear Axle Tracking Measurements (single axle)

2. At the rear edge of the left rear tire, measure the distance from the inner side of the tire to the outer side of the left frame rail. See **Fig. 2**.

IMPORTANT: Measurement "A" should not vary by more than 1/4-inch (6 mm) from measurement "B."

- 3. If measurements "A" and "B" vary by more than 1/4-inch (6 mm), loosen the fasteners that hold the lateral torque rod to the frame rail. Add or remove torque-rod shims as needed.
- 4. For bar-pin style torque rods, tighten the fasteners 136 lbf·ft (184 N·m).

For taper-pin style torque rods, tighten the fasteners 165 lbf·ft (224 N·m). See **Fig. 3**.

#### **Tandem Axles**

- Check the tracking of the forward-rear axle. For instructions, see "Single Axle" in this subject. Adjust the tracking if needed.
- At the forward-rear drive axle, measure the distance from the inner side of the right rear tire to

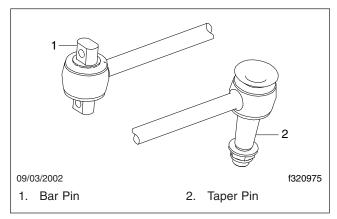


Fig. 3, Control Rod Types

the outer side of the right frame rail. Measure at the forward edge of the tire. See **Fig. 4**.

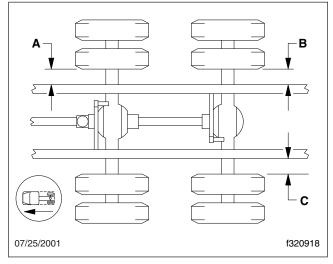


Fig. 4, Rear Axle Tracking Measurements (tandem axles)

 At both sides of the rear-rear drive axle, measure the distance from the inner side of the rear tires to the outer side of each frame rail. Measure at the rear edge of each tire. See Fig. 4.

IMPORTANT: Measurements "B" and "C" should not vary by more than 1/4 inch (6 mm) from measurement "A."

4. If measurements "B" and "C" vary by more than 1/4 inch (6 mm) from measurement "A," loosen the fasteners holding the axle lateral torque rod at the rear-rear drive axle to the frame rail. Add or remove torque-rod shims as needed.

## **Rear Axle Alignment**

For bar-pin style torque rods, tighten the fasteners 136 lbf·ft (184 N·m). For taper-pin style torque rods, tighten the fasteners 165 lbf·ft (224 N·m). See Fig. 3.

#### **Control Rod Replacement**

#### Replacement

- 1. Park the vehicle. Shut down the engine, and apply the parking brakes.
- Chock the tires. Raise the vehicle. Support the frame rails with jack stands.
- Remove the fasteners that hold the control rod to the frame rail bracket. Remove the shims, and set the shims aside.
- 4. Remove the fasteners from the axle end (control rod axle bracket) of the control rod.
- 5. Position the new control rod so that the end with the fasteners angled up at 35 degrees is installed in the axle housing bracket. See Fig. 1.

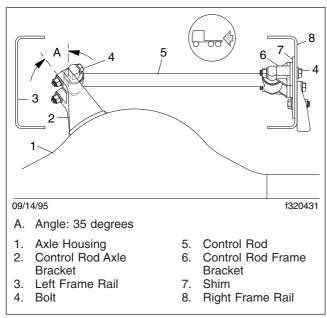


Fig. 1, AirLiner Control Rod Installation

- Install the fasteners with the bolt heads facing up. Tighten the fasteners enough to hold the control rod in place.
- 7. Install the shims that were previously removed.
- Install the other end of the control rod in the frame rail bracket then, install the fasteners. Tighten the fasteners enough to hold the control rod in place.
- 9. Tighten all the fasteners 136 lbf·ft (184 N·m).

10. Remove the jack stands. Lower the vehicle. Remove the tire chocks.

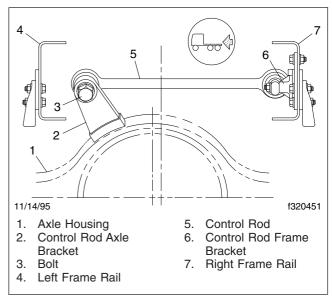


Fig. 2, Control Rod Installation on 23,000 and 46,000pound AirLiner Suspensions

NOTE: Control rods on suspensions manufactured to a 23,000-pound (10 433 kg) or 46,000-pound (20 865kg) weight rating are larger and are attached to the axle bracket with a single bolt. Tighten the fasteners that attach the control rod frame bracket to the frame rail 160 to 170 lbf·ft (217 to 230 N·m), and the bolt that connects the control rod to the axle housing 175 to 225 lbf·ft (237 to 305 N·m). See **Fig. 2**.

## Replacement

## **WARNING**

Do not replace individual leaves of a damaged leaf spring assembly; replace the complete spring assembly. Visible damage (cracks or breaks) to one leaf causes hidden damage to other leaves. Replacement of only the visibly damaged part(s) is no assurance that the spring is safe. Failure to replace a damaged spring assembly could cause an accident resulting in serious personal injury or property damage.

- Park the vehicle on a level surface. Shut down the engine. Set the parking brake and chock the front tires.
- Raise the rear of the vehicle, and support the rear axle(s) with safety stands. Raise the vehicle so that all weight is removed from the leaf springs, then securely support the frame with safety stands.
- Remove the wheel and tire assembly to easily access the suspension. For instructions, see the information in Group 40.
- 4. Remove the leaf spring assembly. See removal information in **Subject 170**.

## **WARNING**

The leaf spring assembly is heavy. Use care when handling it to prevent injury.

Remove the bushing from the leaf spring eye, as follows.

## **WARNING**

Do not use a cutting torch to remove the outer metal of the bushing from the spring eye. Welding, torching or cutting the leaf spring assembly can damage the leaf spring material, which may result in the failure of the components and cause serious personal injury, death, or property damage.

5.1 Using a shop press with a capacity of at least 10 tons (9 072 kg), place the spring assembly in the shop press with the spring assembly squarely supported on the press bed for safety and to avoid bending the spring assembly.

#### **Spring Eye Bushing Replacement**

- 5.2 Center the bushing tool on the outer metal of the bushing and push the bushing from the spring eye.
- 5.3 Remove any burrs or material left behind by the old bushing.
- 6. Install the new bushing in the leaf spring eye.
  - 6.1 Position the bushing on the shop press.
  - 6.2 Apply a bonding agent, either Perma-bond HM–160 or Loctite RC–609 or 680, liberally around the outside surface of the bushing.
  - 6.3 Press the bushing into place.
  - 6.4 Allow the bonding agent to cure for 24 hours.

NOTE: After the curing time, the bushing must resist a minimum 7,700 lb (3 490 kg) pushout force.

- 7. Install the leaf spring assembly. See the information in **Subject 170**.
- 8. Install the wheel and tire assembly. For instructions, see **Group 40** of this manual. Remove the safety stands, and lower the vehicle.
- Check the rear axle alignment. For instructions, see Group 35 of this manual. If necessary, adjust the rear axle alignment using the instructions in Group 35 of this manual.
- 10. Remove the chocks from the tires.

## **Specifications**

## **Torque Specifications**

For fastener torque values, see Table 1.

Torque V	alues for Air	Liner Suspension		
Do a cuitable in	Size	Torque		
Description		lbf⋅ft (N⋅m)	lbf⋅in (N⋅cm)	
Height-Control Valve Housing Bolts*	1/4–20	_	45 (500)	
Height-Control Valve Mounting Locknuts*	1/4–20	_	95 (1100)	
Shock Absorber Mounting Locknuts	3/4–10	165 (220)	_	
Air Caring Upper Mounting Leaknute	3/4–16	45 (61)	_	
Air Spring Upper Mounting Locknuts	1/2-13	23 (31)	_	
Air Spring Lower Mounting Locknuts	1/2–13	55 (75)	_	
Leaf Spring Mounting Eye Bolt Locknuts	3/4–10	241 (327)	_	
Control Rod Mounting Bolt Locknuts	5/8–11	136 (184)	_	
	7/8–14	Stage 1: Hand tighten		
		Stage 2: 60 (81)		
		Stage 3: 200 (271)	_	
Axle U-bolt High Nuts		Stage 4: 420 to 500 (571 to 680)		
Tighten in a diagonal pattern as shown in Fig. 1.		Stage 1: Hand tighten		
		Stage 2: 60 (81)		
	1–14	Stage 3: 200 (271)	_	
		Stage 4: 520 to 600 (707 to 816)		
Air Spring Upper Mounting Bracket	5/8–11	136 (184)	_	
Spring Hanger Mounting Locknuts	3/4-10	240 (325)	_	

<sup>\*</sup> See the cautionary statements below.

**Table 1, Torque Values for AirLiner Suspension** 

IMPORTANT: To prevent voiding the warranty on Barksdale height-control valves, note the following:

- Do not overtighten the bolts in the Barksdale height-control valve housing. The bolts should not be loose, and should not require tightening. Only if necessary, tighten the valve housing bolts 45 lbf·in (500 N·cm). Any damage to the valve housing will void the warranty.
- Do not attempt to disassemble the Barksdale valve body or the control lever. There

are no serviceable parts in the valve, and any disassembly will void the warranty.

#### NOTICE -

When removing or loosening a Barksdale heightcontrol valve from a mounting bracket, always hold the valve-side mounting studs in place with an Allen wrench while loosening or tightening the nuts that attach the valve to the bracket. Because the mounting studs are threaded into the valve body, loosening the nuts without holding the studs can tighten the studs, which can crush the

## **Specifications**

valve body and damage the valve. Conversely, tightening the nuts without holding the studs can back the studs out, causing a separation of the two halves of the valve body, and possibly a leak.

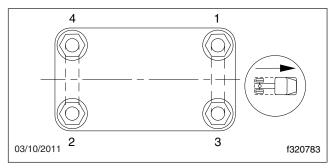


Fig. 1, Tightening Pattern for U-Bolt High Nuts

## **Special Tools**

Use the kit shown in **Fig. 2** to test a Barksdale height-control valve. Test kit BKS KD2264 is available via the Direct Ship program in Paragon.

# **Specifications**

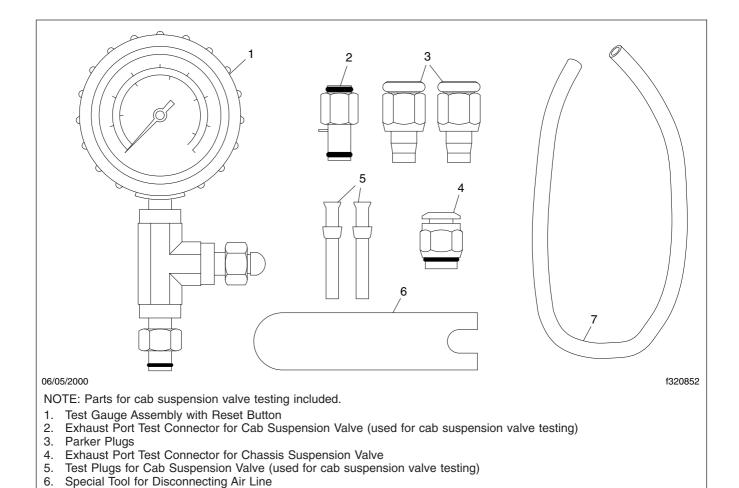


Fig. 2, Barksdale Height-Control Valve Test Kit BKS KD2264

7. Air Line

# **Contents**

Subject	Subject Number
General Information	
Service Operations	
Shock Absorber Replacement	
Center Bearing Replacement	
Spring Assembly Removal, Assembly and Installation	
Lower Control Rod and V-Rod Replacement	
Axle Clamp and Retainer Replacement	
Specifications	400

#### **General Information**

#### **General Information**

The TufTrac Suspension is heavy-duty "six rod" tandem-axle suspension option for trucks built for severe on/off highway work. See **Fig. 1**. The TufTrac design allows a truck to maneuver over bumps, ridges and washboard roads that typically generate high rates of axle articulation, without bottoming out the suspension or losing traction.

The TufTrac suspension is available in two weight ratings: 40,000-, and 46,000-pound (18 144- and 20 865-kilogram) capacities. The 40,000-pound (18 144-kilogram) capacity suspension uses two taper leaf springs and has an axle spacing of 54 inches. The 46,000-pound (20 865-kilogram) capacity suspension has three leaf springs (shown in this section). The 46,000-pound (20 865-kilogram) suspension has a standard axle spacing of 56 inches.

### **Principles of Operation**

Six functional links in the TufTrac suspension maintain the positions of the axles. Side-to-side axle movement is controlled by two V-rods from the frame to the axles at the top of the differentials. Four control rods from the frame to the axles at the bottom control the forces of driving and braking as well as fore-and-aft road shocks. Vertical loads are carried by the rubber-isolated parabolic taper leaf spring packs.

### **General Information**

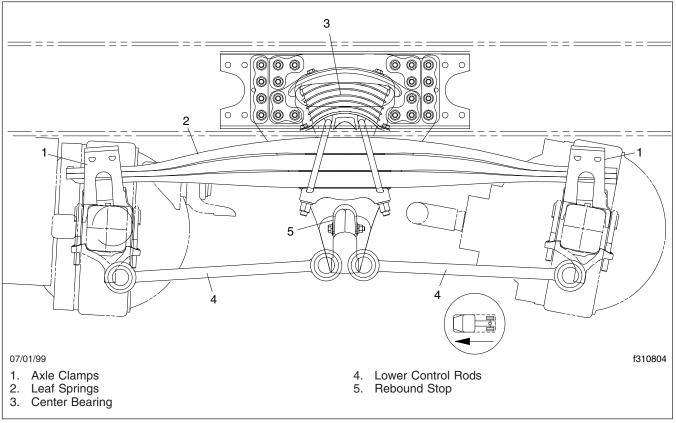


Fig. 1, TufTrac Suspension (46,000-pound [20 865-kilogram] version shown)

### **Shock Absorber Replacement**

# Replacement

NOTE: See Fig. 1 for this procedure.

- 1. Park the vehicle on a level surface, shut down the engine and apply the parking brakes. Chock the tires.
- 2. Remove the lower shock mounting nut and washer.
- Remove the upper shock mounting nut and washer.
- 4. Remove the upper and lower mounting bolts and remove the shock absorber.
- 5. Position the new shock absorber in place and install the mounting bolts.
- 6. Loosely fasten the bolts with the nuts and washers removed from the old shock absorber.
- 7. Torque each mounting nut 241 lbf·ft (327 N·m).
- 8. Remove the chocks from the tires.

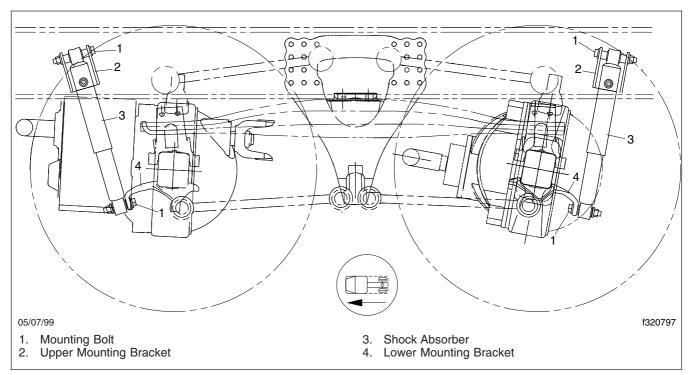


Fig. 1, Shock Absorber Replacement

### **Center Bearing Replacement**

### Replacement

- 1. Park the vehicle on a level surface, shut down the engine and apply the parking brakes. Chock the tires.
- 2. Remove the rebound stop from the suspension. See **Fig. 1**.
  - 2.1 Remove the nut and bolt securing the rebound stop to the mounting bracket.
  - Slide the rebound stop from the mounting bracket.
- 3. Remove the upper two fasteners on the center bearing.
- 4. Jack up the vehicle under the rear axle.
- 5. Support the rear frame rails with jack stands, then lower the jack. This will clear the center bearing from the top of the mounting bracket. See Fig. 2.

- 6. Remove the lower center bearing bolts attached to the spring assembly casting. Discard the bolts.
- 7. Remove the center bearing. See Fig. 3.
- Position the new center bearing in the mounting bracket.
- 9. Install the upper mounting bolts and tighten 68 lbf·ft (92 N·m).
- With the jack, raise the rear axle until bottom of the center bearing meets the mounting bracket on the leaf springs.

IMPORTANT: Be sure to use new bolts with Loctite (p/n 23-12576-125) when attaching the center bearing to the leaf spring casting.

 Install new lower mounting bracket bolts (p/n 23-12576-125). Tighten the bolts 155 lbf-ft (210 N·m).

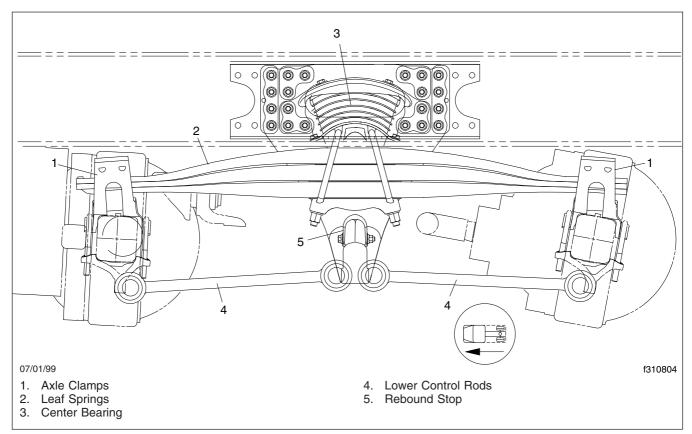


Fig. 1, TufTrac Suspension (46,000-pound [20 865-kilogram] version shown)

# **Center Bearing Replacement**

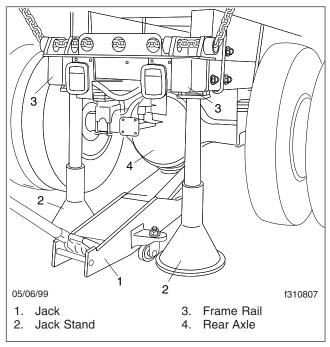


Fig. 2, Jack and Jack Stand Placement

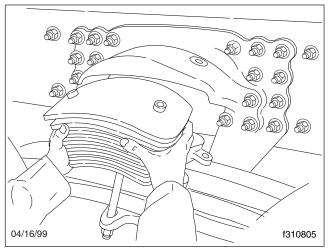


Fig. 3, Center Bearing Removal

- 12. Return the vehicle to its normal operating position.
- 13. Install the rebound stop.
- 14. Remove the chocks from the tires.

# Spring Assembly Removal, Assembly and Installation

IMPORTANT: The spring pack assembly is not available as an assembled unit in the aftermarket. If the spring pack assembly is to be replaced with a new assembly, the springs, center bearing seat and retainer bracket must be assembled before installation on the vehicle.

#### Removal

- Park the vehicle on a level surface. Shut down the engine and apply the parking brakes. Chock the tires.
- Remove the tip pad bolts above each axle on the axle clamp. There are four bolts on each pad. See Fig. 1.

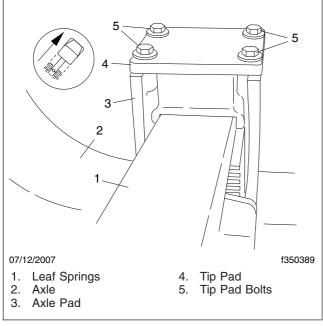


Fig. 1, Tip Pad Installation

- 3. Remove the center bearing. See Subject 110.
- With the vehicle still raised, remove the wheels on both rear axles on the side the spring assembly will be replaced. For instructions, see Group 40.

### **A** WARNING

Do not attempt to remove the spring assembly by hand. The assembly is very heavy and attempting to lift it could result in bodily injury.

5. Using a lift (i.e. engine hoist), remove the leaf spring assembly from the vehicle. See Fig. 2.

# **Assembly**

IMPORTANT: Leaf springs in a spring pack assembly cannot be replaced individually. The entire spring pack assembly must be replaced.

- Support both sides of the new spring pack assembly on jack stands. Make sure all the leaf springs are interlocking with the studs and dimples at the centers of the leaf springs.
- 2. If the assembly contains a spacer, place it on the center of the top leaf spring. Make sure the dimple in the spacer is aligned with the stud in the center of the top leaf spring.
- 3. Place the center bearing seat on the top of the spacer or leaf spring, as applicable. Make sure the dimple in the middle of the center bearing seat aligns with the stud in the middle of the leaf spring or the spacer.
- 4. Install the two 3/4-inch U-bolts over the center bearing seat. Make sure the U-bolts rest in the grooves of the center bearing seat.
- At the bottom of the spring pack, install the U-bolt retainer bracket over the threaded ends of the U-bolts.
- 6. Holding the retainer bracket in place, install a hardened washer and hexnut over the threaded end of each U-bolt.
- 7. Tighten the U-bolts in a diagonal sequence as follows:

• Stage 1: 60 lbf-ft (81 N·m)

• Stage 2: 200 lbf-ft (271 N·m)

Stage 3: 300 lbf-ft (407 N·m)

# **Spring Assembly Removal, Assembly and Installation**

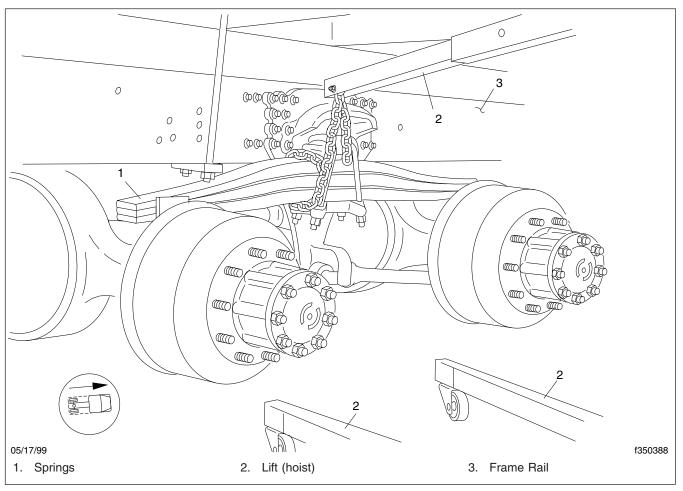


Fig. 2, Leaf Spring Replacement

### Installation

# **A** WARNING

Do not attempt to install the spring assembly by hand. The assembly is very heavy and attempting to lift it could result in bodily injury.

- 1. Place the new spring assembly on the vehicle.
  - 1.1 Attach the new assembly to the lift.
  - 1.2 Using the lift (hoist), lift the assembly into place on the axle clamps.
- Install the center bearing. For instructions, see Subject 110.

- Install the tip pad and bolts on each axle clamp. Tighten the bolts 37 lbf⋅ft (50 N⋅m). See Fig. 1.
- If not already installed, install the rebound stop and mounting bolt. Tighten the nut 68 lbf·ft (92 N·m).
- Install the wheels. For instructions, see Group 40.
- Return the vehicle to its normal operating position.
- 7. Remove the chocks from the tires.

### **Lower Control Rod and V-Rod Replacement**

# Lower Control Rod Replacement

NOTE: See Fig. 1 for this procedure.

Forward axle rods are marked "FDA" and rear axle rods "RDA."

7. Fasten the new control rod to the axle clamp. Tighten the nut 136 lbf·ft (184 N·m).

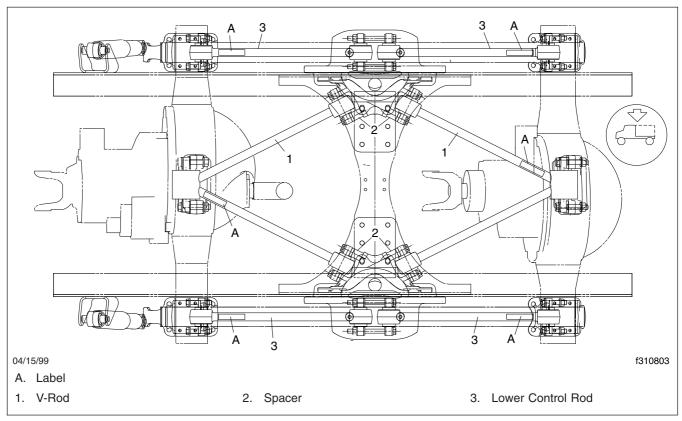


Fig. 1, Control and V-Rod Assembly

- 1. Park the vehicle on a level surface, shut down the engine, and apply the parking brakes. Chock the front tires.
- 2. Raise the rear axle and support the frame rails with jack stands.
- 3. Lower the jack under the axle. See Fig. 2.
- 4. Remove the bolts holding both rods between the rear axles, below the rebound stop. See **Fig. 3**.
- 5. Remove the nut and bolt from the axle clamp.
- 6. Remove the control rod from the vehicle.

IMPORTANT: When installing the rods make sure the labels on the rods are facing upward.

- 8. Fasten the other end of the rod to the bracket below the rebound stop. Tighten the nut 136 lbf·ft (184 N·m).
- 9. Remove the chocks from the tires.

### V-Rod Replacement

- Park the vehicle on a level surface, shut down the engine, and apply the parking brakes. Chock the tires.
- 2. Raise the rear axle and support the frame rails with jack stands.
- 3. Lower the jack under the axle. See Fig. 2.

## **Lower Control Rod and V-Rod Replacement**

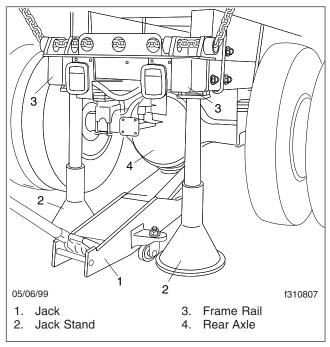


Fig. 2, Jack and Jack Stand Placement

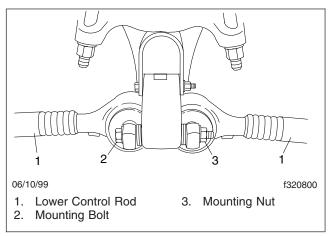


Fig. 3, Lower Control Rods

- Remove all six mounting bolts securing the V-rod to the chassis and axle.
- 5. Remove the V-rod from the chassis.

IMPORTANT: When installing the rods make sure the labels on the rods are facing upward. Forward axle rods are marked "FDA" and rear axle "RDA."

6. Install the V-rod. See Fig. 4.

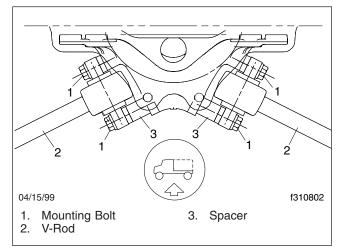


Fig. 4, V-Rod Installation

- 6.1 Place the new rod in position between the frame rails.
- 6.2 Install the bolts and spacers and loosely tighten all connections.
- 6.3 After all fasteners and spacers are installed, torque as follows:
  - Tighten the bolts at the frame bracket 136 lbf-ft (184 N·m).
  - Tighten the bolts at the axle bracket 427 lbf·ft (579 N·m).
- 7. Remove the chocks from the tires.

### **Axle Clamp and Retainer Replacement**

## Replacement

See Fig. 1 for this procedure.

- 1. Park the vehicle on a level surface, shut down the engine and chock the tires.
- 2. Remove the two upper spring tip pads and bolts from the left suspension spring.
- 3. Disconnect the shock absorbers from the lower axle retainer on the left suspension spring.
  - Remove the lower shock mounting nuts and washers.
  - 3.2 Remove the lower shock absorber mounting bolts.
- Disconnect the two lower torque control rods from the lower axle retainers on the left side of the vehicle.
- Loosen and remove the U-bolt nuts and washers, and discard.

- 6. Remove the brake cam tube support bracket from the left rear axle.
- 7. Remove the lower axle retainers from the left forward and left rear drive axles, and discard.
- 8. Remove the axle U-bolts from the left forward drive axle and the left rear drive axle, and discard.
- Jack up the center of the left suspension spring (at the center bearing, between the tandem) and support with the jack stands at the frame. See Fig. 2. Make sure that all of the weight has been relieved from the axle clamp group and that there is sufficient clearance to remove the upper axle clamp.
- 10. Remove the lower spring tip pads from the left forward and left rear drive axles.
- 11. Remove the upper axle clamps from the left forward and left rear drive axles. Discard the clamps.

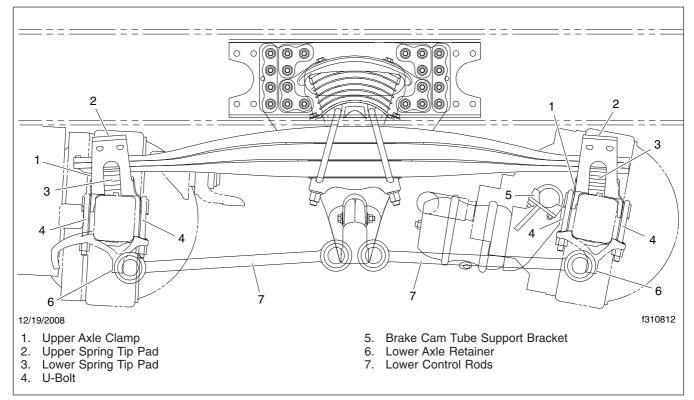


Fig. 1, TufTrac Suspension (left-side view)

# **Axle Clamp and Retainer Replacement**

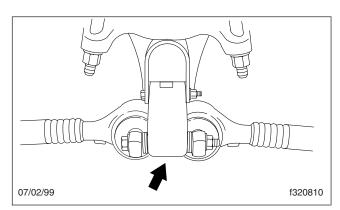


Fig. 2, Jack the Vehicle Here

- 12. Install the new upper axle clamps onto the left forward and left rear drive axles. Locate the dowel pin through the hole in the bottom of each axle clamp to confirm proper alignment
- 13. Install the lower spring tip pads into the left front and rear axle clamps.
- 14. Jack up the left suspension spring, remove the jack stands, and lower the suspension spring. Ensure while the spring is being lowered that it is seated correctly onto the lower spring tip pads.
- 15. Install the new lower axle retainers onto the left forward and rear drive axles.
- 16. Install the brake cam tube support bracket onto the left rear axle.
- 17. Install the U-bolts on the left forward and rear drive axles.
  - 17.1 Install each U-bolt over the U-bolt saddle in the upper axle clamp and through the holes in the lower axle retainer.
  - 17.2 Install the washers and finger-tighten the nuts in the order shown in **Fig. 3**.

Make sure all brackets are snug against the axle housing before proceeding to the next step.

IMPORTANT: U-bolt nuts must be tightened in the order shown in **Fig. 3**.

17.3 Tighten the nuts 60 lbf·ft (81 N·m) and then to 200 lbf·ft (271 N·m) in two separate rotations following the order shown in Fig. 3.

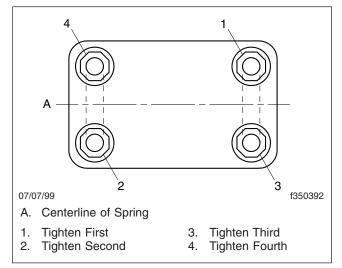


Fig. 3, U-Bolt Nut Tightening Sequence

- Install the lower torque control rods to the lower axle retainers on the left side of the vehicle and tighten 136 lbf-ft (184 N·m).
- Install the shock absorbers to the lower axle retainers.
  - 19.1 Install the lower shock mounting bolts.
  - 19.2 Install the lower shock absorber mounting washers and nuts and tighten by hand.
  - 19.3 Tighten the lower shock absorber mounting nuts to 241 lbf·ft (327 N·m).
- 20. Install the spring tip pads to the left suspension spring.
  - 20.1 Install the spring tip pads to the upper axle clamps.
  - 20.2 Install the bolts to secure each upper spring tip pad and tighten 37 lbf-ft (50 N·m).
- 21. Repeat the above steps for the right suspension spring.
- 22. Remove the chocks from the tires.

# **Specifications**

Torque Specifications			
Description	Torque: lbf·ft (N·m)		
Shock Absorber Mounting Bolt	241 (327)		
Center Bearing Upper Mounting Bolts	68 (92)		
Center Bearing Lower Mounting Bolts	155 (210)		
Tip Pad Bolts	37 (50)		
Rebound Stop Mounting Bolt	68 (92)		
Lower Control Rod Mounting Bolts	136 (184)		
V-Rod Frame Bracket Mounting Bolts	136 (184)		
V-Rod Axle Bracket Mounting Bolts	427 (579)		
	Stage 1: Hand-Tighten		
5/8–18 Axle Clamp U-Bolt Nuts (Tighten as shown in Fig. 1.)	Stage 2: 60 (81)		
	Stage 3: 200 (271)		
	Stage 1: 60 (81)		
3/4-Inch Spring Pack U-Bolt Nuts	Stage 2: 200 (271)		
	Stage 3: 300 (407)		

**Table 1, Torque Specifications** 

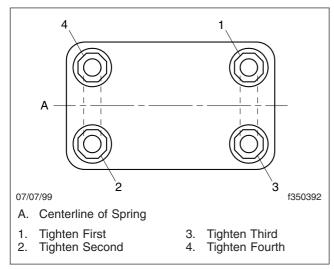


Fig. 1, U-Bolt Nut Tightening Sequence

# **Contents**

Subject	Subject Number
General Information	
Service Operations	
Restrictor Can Removal, Inspection, and Installation	
Rubber Spring Replacement	
Shock Absorber Replacement	
Walking Beam Removal, Inspection, and Installation	
Walking Beam Repair	
Torque Rod Removal and Installation	
Torque Rod Bushing Inspection and Replacement	
Rear Axle Alignment Adjustment	
Specifications	400

#### **General Information**

# **General Description**

The Chalmers 854 rear suspension (**Fig. 1** and **Fig. 2**) is a walking beam-type tandem axle suspension that uses hollow rubber springs instead of leaf springs or air bags. Each hollow rubber spring is mounted between a frame-rail plate and the center (front-to-rear) of the steel walking beam. A sawhorse bracket assembly is attached to the frame and provides mounting points for the lower torque rods that tie the axles to the frame. The upper torque rods are fastened to brackets that bolt to the frame side rails and to tower assemblies that are welded to the top of the differential housings.

there are no lubrication fittings since grease and oil are never needed.

The 854 rear suspension is available in three different maximum load capacities: 40,000 lb. (18 000 kg), 46,000 lb. (21 000 kg), and 52,000 lb. (23 600 kg). The 40,000 lb. (18 000 kg) version is easily distinguished from the other two versions since the upper torque rods do not cross over one another on the 40,000 lb. (18 000 kg) version.

The 854 suspension is available in a 54-inch axle spacing. The axle-to-axle spacing dimension is often included as part of the suspension name, such as "Chalmers 852 Rear Suspension" or "Chalmers 854

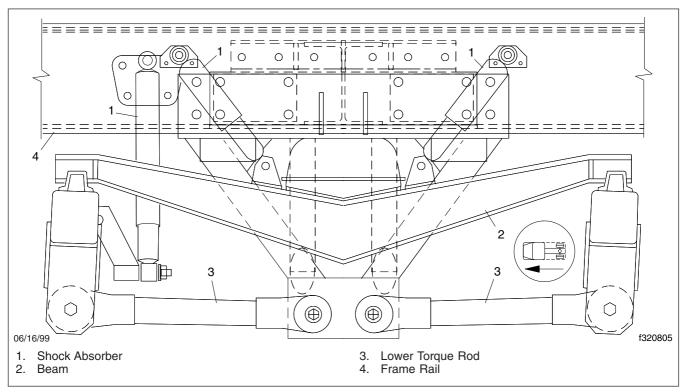


Fig. 1, Chalmers 854 Tandem Axle Suspension

The 854 rear suspension allows a high degree of both parallel and diagonal articulation, while maintaining wheel load equalization to within 3 percent.

The Chalmers suspension design separates the rear suspension's responsibility for supporting/cushioning the load from that of locating/guiding the axles. The suspension is very light, relative to its load carrying capacity, but requires very little maintenance. In fact,

Suspension."

Shock absorbers are included on all versions of the suspension, and are beam-mounted.

The rear suspension may be precision-aligned by adjusting the length of the lower torque rods. These rods have both left- and right-hand threads cut on the same tube so rotating the tube changes the effective length of the tube.

### **General Information**

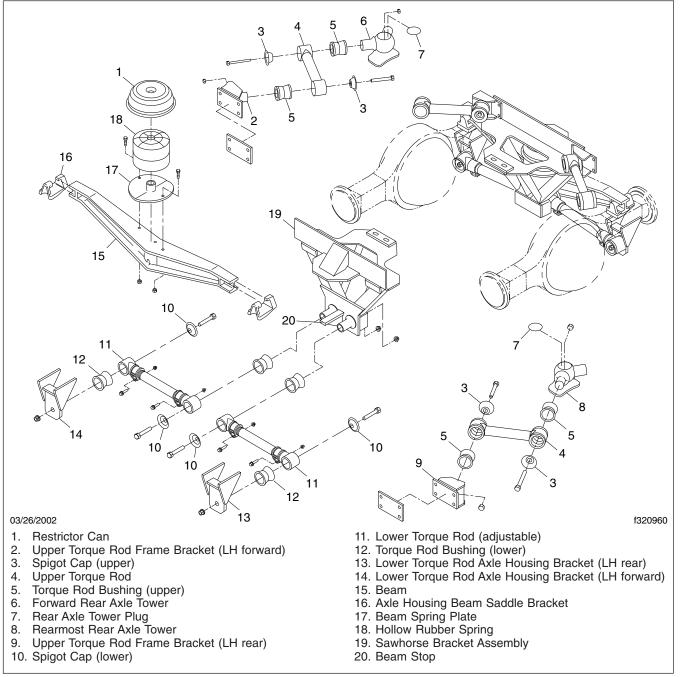


Fig. 2, Chalmers 854 Tandem Axle Suspension (40,000-pound capacity without shock absorbers shown)

# Restrictor Can Removal, Inspection, and Installation

#### Removal

NOTE: See Fig. 1 for this procedure.

1. If necessary, power wash the spring restrictor can area to remove road dirt accumulation.

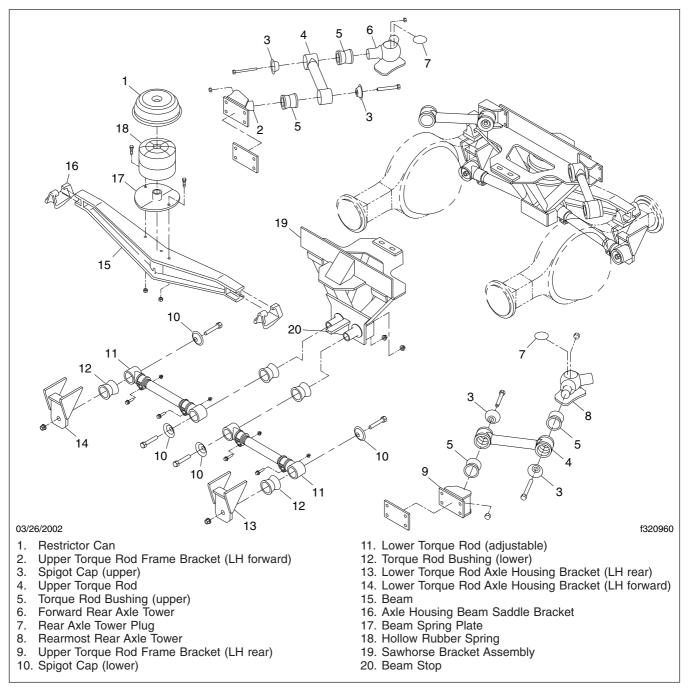


Fig. 1, Chalmers 800 Series Tandem Axle Suspension (40,000-pound capacity without shock absorbers shown)

# Restrictor Can Removal, Inspection, and Installation

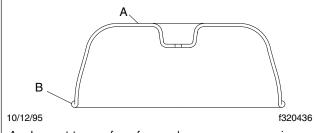
- Chock the front tires to prevent vehicle movement.
- Raise the rear of the vehicle just enough to remove all weight from the rear axles, and place safety stands under the frame to support the vehicle in its raised position.
- Remove the two bolts and nuts that secure the walking beam spring plate (Fig. 1, Ref. 17) to the walking beam assembly. Discard the fasteners.

NOTE: On 54-inch spread suspensions, it may be necessary to remove either the front or rear tires to allow spring assembly removal.

- Pull the lower spring plate, rubber spring, and restrictor can as one assembly outward, off the beam assembly. See Fig. 1, Refs. 1, 17, 18.
- Separate the restrictor can, spring, and spring plate.

## Inspection

 Carefully inspect the restrictor can for cracks or severe corrosion. Pay special attention to the top surface of the can and the can rim. See Fig. 2.



- A. Inspect top surface for cracks or severe corrosion.
- B. Carefully inspect can rim for cracks.

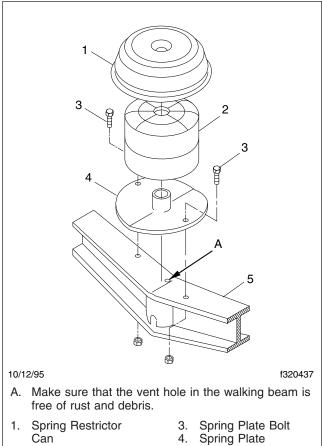
Fig. 2, Restrictor Can Inspection Areas

NOTE: It is recommended that both restrictor cans be replaced at the same time to ensure evenness of ride and handling characteristics.

Replace a cracked or severely corroded restrictor can.

### Installation

 Using a stiff wire brush or gasket scraper, clean rust and road dirt from the spring plate. Also, make sure that the center vent holes in the plate and in the walking beam are free of rust and debris. See Fig. 3.



- 2. Hollow Rubber Spring
- Spring Plate
   Walking Beam

Fig. 3, Spring Assembly Components

Inspect the spring plate for cracks; replace it if any are present.

IMPORTANT: Never use any mineral based oils, greases, jellies, or solvent soaps to aid in the assembly of rubber suspension parts. Use only lubricants specifically designed for use with rubber compounds.

 Position the rubber spring on the spring plate so it is upside down, relative to its original orientation. Make sure that the spring vent hole is centered on the spring plate tube. Place the new restrictor can over the spring; make sure the can is centered on the spring.

# Restrictor Can Removal, Inspection, and Installation

- 4. Slide, as one assembly, the spring plate, spring, and restrictor cap, into position on the walking beam.
- 5. Install and tighten the spring plate fasteners 35 lbf·ft (47 N·m).
- 6. Check the gap between the spring and the restrictor can to make sure it is even, all the way around the can. Rotate the spring and/or can as necessary to make the gap even.
- 7. Remove the safety stands from under the vehicle, then lower the vehicle.
- 8. Remove the chocks from the tires.

### **Rubber Spring Replacement**

#### Removal

NOTE: See Fig. 1 for this procedure.

1. If necessary, power wash the spring restrictor can area to remove road dirt accumulation.

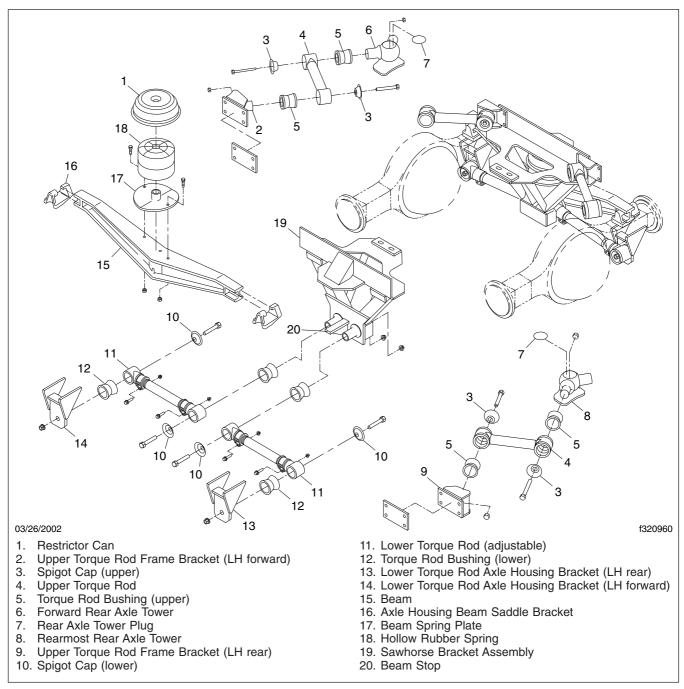


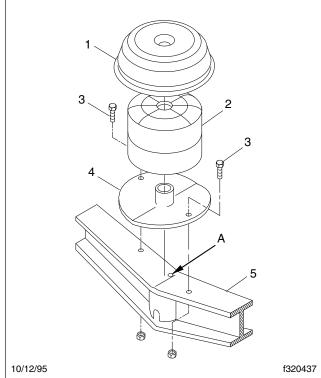
Fig. 1, Chalmers 854 Tandem Axle Suspension (40,000-pound capacity without shock absorbers shown)

### **Rubber Spring Replacement**

- Chock the front tires to prevent vehicle movement.
- 3. Raise the rear of the vehicle just enough to remove all weight from the rear axles, and place safety stands under the frame to support the vehicle in its raised position.
- 4. Remove the two bolts and nuts that secure the walking beam spring plate (Fig. 1) to the walking beam assembly. Discard the fasteners.
- 5. Pull the lower spring plate, rubber spring, and restrictor can as one assembly outward, off the beam assembly. See Fig. 1.
- 6. Separate the restrictor can, spring, and spring plate; discard the spring.
- Using a stiff wire brush or gasket scraper, clean rust and road dirt from the spring plate. Also, make sure that the center vent holes in the plate and in the walking beam are free of rust and debris. See Fig. 2.
- 8. Inspect the spring plate for cracks; replace if it any are present.

IMPORTANT: Never use any mineral based oils, greases, jellies, or solvent soaps to aid in the assembly of rubber suspension parts. Use only lubricants specifically designed for use with rubber compounds.

- Position the new rubber spring on the spring plate, making sure that the vent hole is centered on the spring plate tube. Place the restrictor can over the spring; make sure the can is centered on the spring.
- Slide, as one assembly, the spring plate, spring and restrictor cap, into position on the walking beam.
- 11. Install and tighten the spring plate fasteners 35 lbf·ft (47 N·m).
- 12. Remove the safety stands from under the vehicle, then lower the vehicle.
- 13. Remove the chocks from the tires.



- A. Make sure that the vent hole in the walking beam is free of rust and debris.
- 1. Spring Restrictor Can
- 2. Hollow Rubber Spring
- 3. Spring Plate Bolt
- 4. Spring Plate
- 5. Walking Beam

Fig. 2, Spring Assembly Components

### **Shock Absorber Replacement**

# Replacement

The Chalmers 854 rear suspension is fitted with beam-mounted shock absorbers. See Fig. 1.

Extend or compress the shock absorber as necessary to install the mounting bolts. Install the locknuts and tighten the fasteners 170 lbf-ft (230  $N \cdot m$ ).

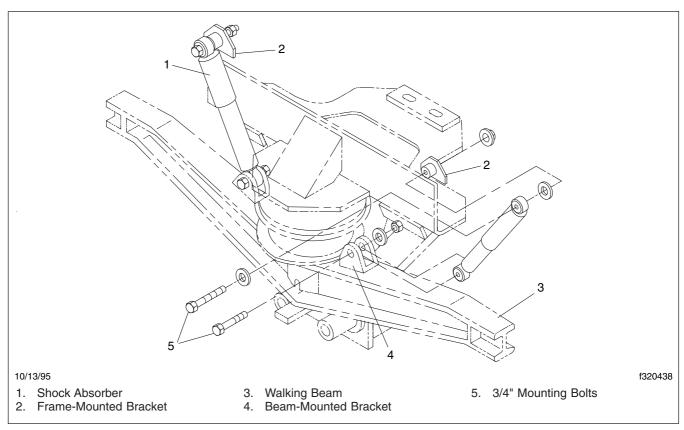


Fig. 1, Beam-Mounted Shock Absorbers

- 1. If necessary, power wash the rear suspension to remove road dirt accumulation.
- Chock the front tires to prevent vehicle movement
- 3. Remove the shock absorber mounting fasteners.
  - 3.1 Remove the upper and lower bolts. See Fig. 1.
  - 3.2 Discard the fasteners.
- 4. Remove and discard the shock absorber.
- 5. Install the new shock absorbers.

6. Remove the chocks from the tires.

# Walking Beam Removal, Inspection, and Installation

#### Removal

NOTE: See Fig. 1 for this procedure.

 If necessary, power wash the walking beams and axle housing ends to remove road dirt accumulation.

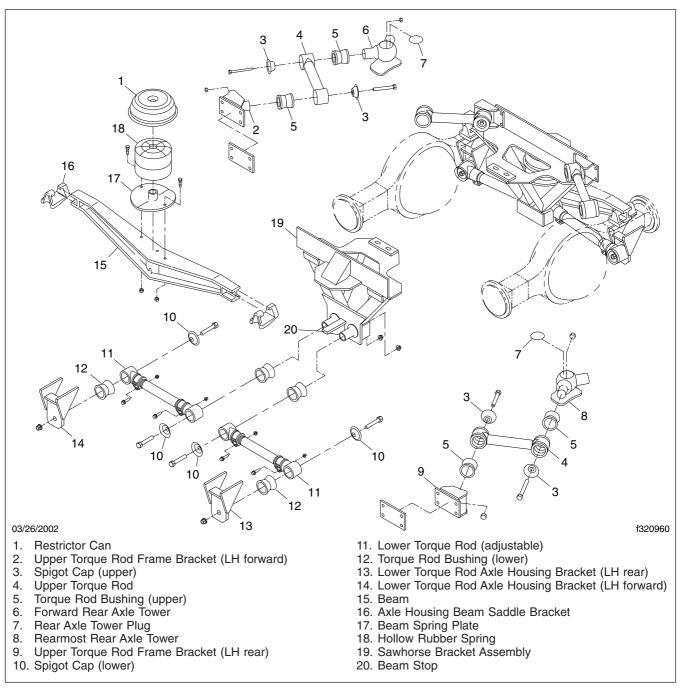


Fig. 1, Chalmers 854 Tandem Axle Suspension (40,000-pound capacity without shock absorbers shown)

# Walking Beam Removal, Inspection, and Installation

- Chock the front tires to prevent vehicle movement.
- 3. Relieve all drive axle brake or wind-up loads by placing the transmission in neutral and releasing the spring or driveline brakes.
- 4. Raise the rear of the vehicle to remove all weight from the rear axles, and place safety stands under the frame to secure the vehicle in its raised position.
- If equipped, disconnect beam-mounted shock absorbers from the walking beam being replaced. See Subject 120, if necessary.
- 6. Remove the two bolts and nuts that secure the walking beam spring plate (**Fig. 1**) to the walking beam assembly. Discard the fasteners.
- 7. Pull the lower spring plate, rubber spring, and restrictor can as one assembly outward, off the beam assembly. See Fig. 1.

NOTE: Tag or otherwise mark each torque rod to ensure that it can be re-installed in the same position and orientation.

- Disconnect the rearmost axle's upper torque rods from the rear axle tower and the lower torque rods from the rear axle housing brackets. See Fig. 1.
- Roll the rear axle rearward just enough to disengage the axle saddles from the walking beam ends
- 10. Lift up the free end of the walking beam and slide the beam rearward to disengage it from the front axle saddle; remove the walking beam.

## Inspection

 Inspect the beam ends carefully, looking for cracks. Cracks along weld lines may be repairable, while cracks in or across the beam flanges require walking beam replacement. See Fig. 2.

NOTE: Take flange thickness measurements at least 1/2" (12 mm) from the flange edges. Measurements taken at the flange edges are not an accurate indication of beam wear and may lead to unnecessary beam repair/replacement.

Check for excessive wear on the beam flanges, where they contact the axle housing saddle brackets.

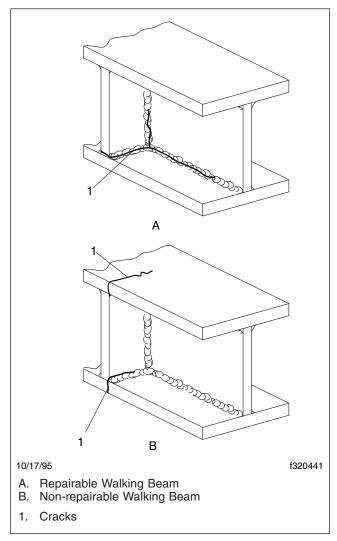
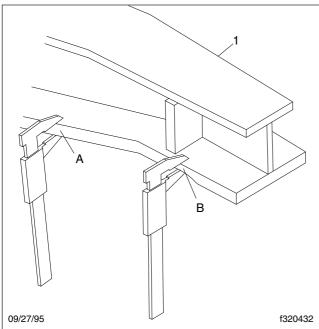


Fig. 2, Repairable/Non-repairable Beam Cracks

If flange wear is significant, use a micrometer or vernier calipers to take measurements at both unworn and worn areas. The maximum allowable difference between unworn and worn areas is 0.062 inch (1.5 mm). See Fig. 3.

 Beams showing excessive wear must be repaired or replaced. See Subject 140 for beam repair information.

# Walking Beam Removal, Inspection, and Installation



- Flange thickness measurement taken at unworn area for reference.
- B. Flange thickness measurement taken at wear area to assess beam condition.
- 1. Walking Beam

Fig. 3, Beam Wear Measurement

### Installation

- 1. Position the new or repaired walking beam over the rearmost rear axle, with the front end of the beam tilted downward.
- 2. Slide the beam forward and downward so the front end of the beam enters the axle housing saddle bracket. See **Fig. 4**. Let the middle of the beam rest on the sawhorse bracket beam stop.
- Carefully roll the rearmost rear axle forward, while lifting the rear end of the walking beam enough so the beam end enters the axle housing saddle bracket.
- Connect the rearmost axle's upper and lower torque rods to the axle housing brackets. Install and tighten the torque rod bushing through-bolts 135 lbf·ft (183 N·m).
- 5. Slide, as one assembly, the spring plate, rubber spring, and restrictor cap, into position on the walking beam.

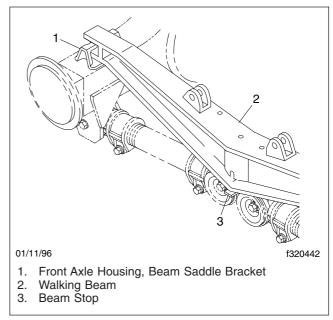


Fig. 4, Beam/Saddle Bracket Alignment

- 6. Install and tighten the spring plate fasteners 35 lbf·ft (47 N·m).
- 7. If so equipped, connect the beam-mounted shock absorbers to the beam brackets and tighten the fasteners 170 lbf·ft (230 N·m).
- 8. Remove the safety stands from under the vehicle, then lower the vehicle.
- 9. Remove the chocks from the tires.

#### **Walking Beam Repair**

# Repair

NOTE: This subject addresses only instances where excessive beam flange wear occurs, but cracks in the web or flange are not present.

Cracked webs and/or flanges require walking beam replacement.

Walking beams with excessive flange wear, however, can be repaired by welding a Chalmers Wear Plate over the worn areas as described below.

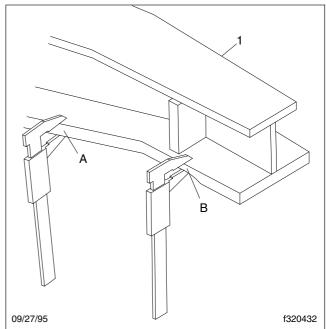
Remove the walking beam assembly. See Subject 130 for information.

NOTE: Take flange thickness measurements at least 1/2 inch (12 mm) from the flange edges. Measurements taken at the flange edges are not an accurate indication of beam wear and may lead to unnecessary beam repair/replacement.

- Confirm that flange wear is severe enough to warrant repairs. Use a micrometer or vernier calipers to take flange thickness measurements at both unworn and worn areas. The maximum allowable difference between unworn and worn areas is 0.062 inch (1.5 mm). See Fig. 1.
- 3. If repair is required, clean the worn area of the beam thoroughly. Make sure that any oil or grease is removed, as well as rust or road dirt accumulation. If necessary, slight grinding of the beam is allowed to smooth raised areas.
- 4. Clamp Chalmers Wear Plate #700313 to the bottom flange of the beam. Make sure the plate is centered and has good surface-to-surface contact with the beam. Slight grinding is allowable to obtain good plate-to-beam contact.
- 5. Tack weld the plate to the beam, welding on the sides of the plate only.



Weld at the sides of the wear plate and beam only. Never weld at the ends of the wear plate. Welding the ends of the wear plate does not allow the wear plate to properly slightly expand nor contract, an action which, if the ends are welded, can cause cracks in the welds.



- A. Flange thickness measurement taken at unworn area for reference.
- Flange thickness measurement taken at wear area to assess beam condition.
- 1. Walking Beam

Fig. 1, Beam Wear Measurement

- 6. Remove the clamps and weld the plate to the beam, again, welding on the sides of the plate only. See Fig. 2.
- 7. Prime and paint the repaired area.
- Install the repaired walking beam assembly. See Subject 130 for information.

# Walking Beam Repair

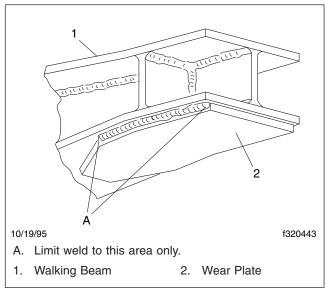


Fig. 2, Chalmers Wear Plate Welding

### **Torque Rod Removal and Installation**

The torque rods hold the rear axles in place, maintaining both axle alignment and pinion nose angle. When servicing the torque rods, it is good practice to remove and install them one at a time to avoid the possibility of mixing them up and affecting the alignment or pinion nose angle.

Several different styles of torque rods and bushing spigots exist. On the 40,000-pound version of the 852 suspension, the torque rods have tubular steel bodies and the upper rods do not cross over one another. On the 46,000- and 52,000-pound versions, the lower torque rods have tubular steel bodies, but the upper torque rods are made of "I-beam" shaped ductile iron. These upper torque rods do cross over one another. See Fig. 1 and Fig. 2.

- 1. If necessary, power wash the rear suspension to remove road dirt accumulation.
- Chock the front tires to prevent vehicle movement.
- 3. Relieve all drive axle brake or wind-up loads by placing the transmission in neutral and releasing the spring or driveline brakes.
- 4. Raise the rear of the vehicle to remove all weight from the rear axles, and place safety stands under the frame to secure the vehicle in its raised position.
- 5. Working on one torque rod at a time, remove the torque rod bolts and spigot caps. Discard th

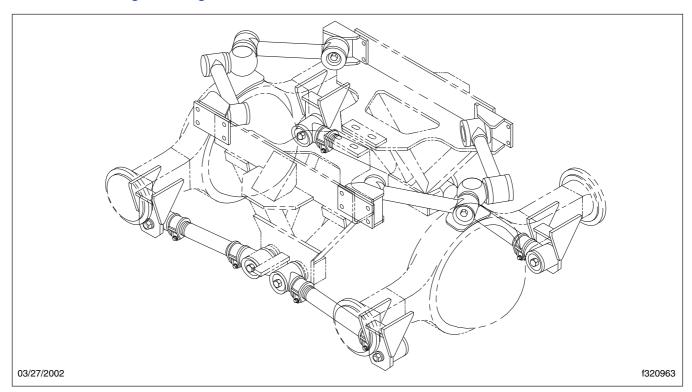


Fig. 1, Torque Rod Arrangement, 40,000-Pound Capacity Suspension

### Removal

NOTE: Inspect torque rod bushings for free play before removing the torque rods. See **Subject 160** for torque rod bushing inspection information.

bolts. Set the spigot caps aside for cleaning and inspection.

Remove the torque rods by prying between the torque rod eye and the spigot base or frame bracket.

NOTE: At the axle housing towers, pry off the tower cap to access the torque rod fasteners.

### **Torque Rod Removal and Installation**

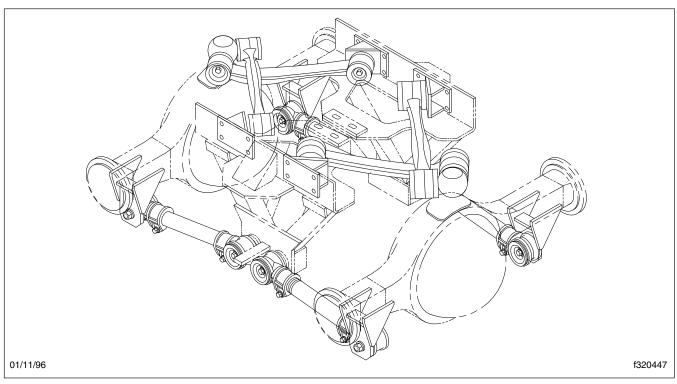


Fig. 2, Torque Rod Arrangement, 46,000- and 52,000-Pound Capacity Suspensions

- Replace worn or damaged bushings following the instructions in Subject 160.
- 7. Inspect the spigots for extensive wear. See Fig. 3 and Table 1.

The smaller of the two measurements should be used as the spigot diameter.

If a spigot is worn, replace the existing torque rod bushings with oversize bushings.

#### Installation

 Check the torque rod bushings to make sure they are properly installed. They must be centered within the torque rod eye. See Fig. 4.

IMPORTANT: Never use any mineral-based oils, greases, jellies, or solvent soaps to aid in the assembly of rubber suspension parts. Use only lubricants specifically designed for use with rubber compounds.

Lubricate the outside of the spigots and the inside of the rubber bushings with a generous

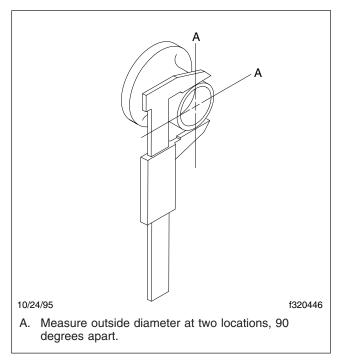
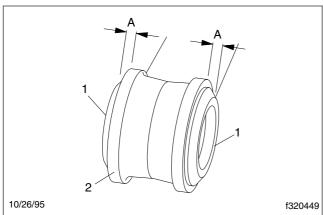


Fig. 3, Spigot Measurement Points

## **Torque Rod Removal and Installation**



- A. The amount of rubber protruding from each side of the torque rod eye must be equal.
- 1. Torque Rod Bushing
- 2. Torque Rod Eye

Fig. 4, Torque Rod Bushing Protrusion

amount of rubber lubricant such as Rimslip® or equivalent.

3. Push the torque rod into position on its spigots. After the torque rod is partially installed, use a heavy soft-faced mallet to drive the torque rod into position until the bushing contacts the spigot bottom face.

NOTE: For easier installation, alternate mallet blows between ends of the torque rod to drive it onto the spigots evenly.

- 4. Install the spigot caps.
- 5. Install and tighten the torque rod bushing through-bolts 135 lbf-ft (183 N·m).
- Remove the safety stands from under the vehicle, then lower the vehicle. Remove the chocks.

	Spigot Wear Limits				
Spigot Size			Minimum Spigot Diameter With Standard Bushing: inch (mm)	Minimum Spigot Diameter With Oversize Bushing: inch (mm)	
1	800200	40,000 lb. capacity—all	2.350 (60)	2.300 (58)	
2	800021	46,000 and 52,000 lb. capacity—all	2.530 (64)	2.500 (63)	

**Table 1, Spigot Wear Limits** 

### **Torque Rod Bushing Inspection and Replacement**

## Inspection

- If necessary, power wash the upper and lower torque rods to remove road dirt accumulation.
- Chock the front tires to prevent vehicle movement.
- 3. Relieve all drive axle brake or wind-up loads by placing the transmission in neutral and releasing the spring or driveline brakes.
- Using your hands only, attempt to move the torque rod ends, checking for free play. Some movement as the bushings "give" is normal, but only free play is cause for bushing replacement.

NOTE: Never use a lever or pry bar to check for torque rod bushing free play. To do so may result in unnecessary bushing replacement.

5. If free play is detected, replace the bushing as described below.

### Replacement

 Remove the torque rod containing the worn out bushing. If necessary, see Subject 150.

NOTE: Remove only one torque rod at a time to avoid mixing-up torque rod positions.

- 2. Place the torque rod on the floor or a workbench with a bushing open end facing upward. Push the tip of a large screwdriver down between the torque rod eye and the bushing and pry out the bushing. Discard removed bushings.
- Use a wire brush and/or scraper to clean the torque rod eyes, removing all rust, scale, and rubber accumulations.
- 4. Inspect the torque rod eyes looking for cracks, distortion, or severe corrosion. Replace torque rods with damaged bushing eyes.

IMPORTANT: Never use any mineral based oils, greases, jellies, or solvent soaps to aid in the assembly of rubber suspension parts. Use only lubricants specifically designed for use with rubber compounds.

 Lubricate both the inside of the torque rod eye and the outside of the new bushing with a generous amount of rubber lubricant, such as Rimslip® or equivalent.

- 6. Place the torque rod on a solid level floor with an open end of the eye facing upward. Position a lubricated bushing on the eye, making sure that the tapered shoulder of the bushing is centered on the eye. See Fig. 1.
- 7. Using a heavy, soft-faced mallet, strike the bushing squarely to drive it into the torque rod eye. Then, flip the torque rod over 180 degrees and tap on the torque rod shaft with the mallet while the bushing rests on the floor.

NOTE: If available, a small press may be used instead of a mallet for bushing installation.

- The bushing is completely installed when it is centered within the torque rod eye. See Fig. 2.
- Install the re-bushed torque rod. See Subject 150, if necessary.

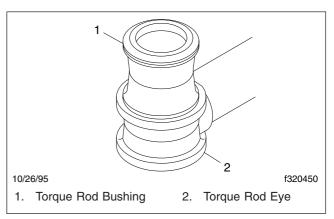


Fig. 1, Torque Rod Bushing Installation

## **Torque Rod Bushing Inspection and Replacement**

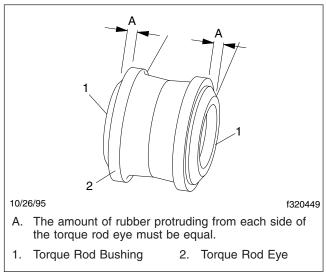


Fig. 2, Torque Rod Bushing Protrusion

## **Rear Axle Alignment Adjustment**

### **Adjustment**

On the Chalmers 854 Rear Suspension, the lower torque rods provide the only means for adjusting rear axle alignment. The upper torque rods play no part in the axle alignment process.

The lower torque rod bodies consist of steel tubes, with fine threads cut into the ends of the tube. Left-hand threads are cut into one end of the tube, right-hand threads into the other end. Therefore, by simply twisting the tube body while restraining the ends, the effective length of the tube is changed.

A single 5/8-inch pinch bolt is used to secure the rod end to the tube. See **Fig. 1**.

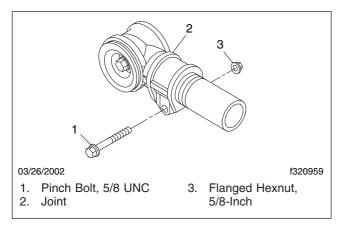


Fig. 1, Adjustable Torque Rod End

- 1. Ensure that the torque rod bushings are in a fully relaxed, neutral state by slowly moving the vehicle back and forth a few times. Apply the service brakes, not the parking brakes.
- Chock the front tires to prevent vehicle movement.
- 3. Relieve drive axle brake or wind-up loads by placing the transmission in neutral and releasing the brakes.
- 4. Using a straightedge and a tape measure, determine the amount of adjustment needed to align the forward-rear axle at right angles to the frame. For instructions, see **Group 35** of this manual. The difference in measurements between the sides of the vehicle is the approximate amount that the trailing end of the forward-rear axle will

have to be brought forward, or the leading end will have to be moved back to align it at a right angle to the frame. See **Fig. 2**.

If the forward-rear axle alignment is within specifications, go to the step that begins "Using a center-point bar, determine...".

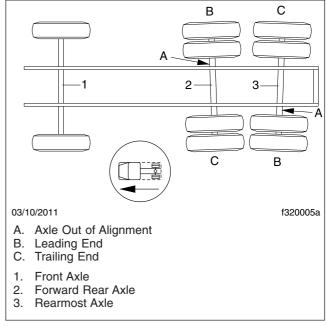


Fig. 2, Tandem Axle, Shown Out of Alignment

5. On the side of the vehicle that is to be adjusted forward or rearward, loosen the torque rod end pinch bolts at both ends of the torque rod.

NOTE: If the pinch bolts are badly corroded or otherwise damaged, remove and discard them. Install new Chalmers fasteners.

 Attach a pipe wrench to the tube body (chain type preferred) and rotate the tube to shorten or lengthen the torque rod. Continue to rotate the tube until the forward-rear axle is square to the frame.

NOTE: If the torque rod tube is difficult to rotate, apply penetrating oil to the tube threads. If this does not help, remove the pinch bolts and drive wedges between the eye lugs to relieve the clamping effect.

## **Rear Axle Alignment Adjustment**

- 7. When the forward-rear axle is square with the frame, tighten the 5/8-inch UNC pinch bolts 135 lbf·ft (183 N·m).
- 8. Using a center-point bar, determine the difference between the forward-rear and the rearmost axles' center-to-center measurements on each side of the vehicle. For instructions, see Group 35 of this manual. This difference is the approximate distance that the leading end of the rearmost axle will have to be adjusted rearward, or that the trailing end will have to be adjusted forward, to align it at a right angle to the frame, and to align it parallel to the forward-rear axle. See Fig. 2.
- 9. On the side of the vehicle that is to be adjusted forward or rearward, loosen the torque rod end pinch bolts at both ends of the torque rod.

NOTE: If the pinch bolts are badly corroded or otherwise damaged, remove and discard them. Install new Chalmers fasteners.

10. Attach a pipe wrench to the tube body (chain type preferred) and rotate the tube to shorten or lengthen the torque rod. Continue to rotate the tube until the rearmost axle is square to the frame

NOTE: If the torque rod tube is difficult to rotate, apply penetrating oil to the tube threads. If this does not help, remove the pinch bolts and drive wedges between the eye lugs to relieve the clamping effect.

- 11. When the rearmost axle is square with the frame, tighten the 5/8-inch UNC pinch bolts 135 lbf·ft (183 N·m).
- 12. Remove the safety stands, and lower the vehicle. Remove the chocks from the front tires.
- 13. Using the center-point bar, check the rearmost axle alignment. If alignment is not within specifications, repeat the applicable steps above.

## **A** CAUTION

Failure to periodically torque the suspension fasteners can result in abnormal tire wear, and damage to the suspension.

IMPORTANT: All suspension fasteners require periodic torquing. For suspension component inspecting and fastener torque checking inter-

vals and instructions, see Group 32 of the Business Class M2 Maintenance Manual.

## **Specifications**

Fastener Torques, 854 Suspension				
Description	Bolt Size	IFI Grade	Torque: lbf·ft (N·m)	
Beam Spring Plate Bolt	3/8 UNC	8	35 (47)	
Torque Rod End Through Bolts	5/8 UNC	8	135 (183)	
Shock Absorber Bolt	3/4	8	170 (230)	
Torque Rod End Pinch Bolts	5/8 UNC	8	135 (183)	

Table 1, Fastener Torques, 854 Suspension

## **Contents**

Subject	Subject Number
General Information	
Service Operations	
Suspension Removal and Installation	
Spring and Saddle Removal and Installation	
Spring Leaf, Spring Pin, and Spring Eye Bushing Replacement	
Equalizer Beam Adapter- and Tube-Type End Support Removal and Installation	
Equalizer Beam End Bushing Removal and Installation	
Equalizer Beam Bar Pin/Bushing Assembly Removal, Installation, and Alignment	
Equalizer Beam Rubber Center Bushing Removal and Installation	
Equalizer Beam Bronze Center Bushing Removal and Installation	
Torque Rod and Bushing Removal and Installation	
Specifications	400

#### **General Information**

## **General Description**

The Hendrickson RT series suspension (see Fig. 1) uses leaf springs to lessen road shocks. The forward and rear ends of the spring assembly ride in hangers. At the forward end, the springs are attached to the hanger with pins. At the rear end, the springs have no rigid attachment to the hangers, and are free to move forward and backward to compensate for spring deflection.

The RTE series suspension (see Fig. 2) is basically the same as the RT suspension. However, the RTE series uses a different spring assembly and a third spring hanger. This design provides a two-stage spring rate, depending on vehicle load condition. When the vehicle is unloaded, a gap exists between the top spring leaf and the no. 2 spring hanger. The weight of the vehicle is then carried through the no. 3 spring hanger, and most of the spring deflection through the top extended leaves (see Fig. 3). When the vehicle is loaded, the top extended leaf contacts the no. 2 spring hanger and the spring weight is carried through the nos. 1 and 2 spring hangers (see Fig. 4).



Failure to apply Alumilastic® compound, or an equivalent, to areas where aluminum and steel parts contact each other, could lead to corrosion of the metals, resulting in damage to the components or parts.

The axles are attached to beam hangers at the ends of the equalizer beams, allowing an articulating action between the axles to lessen road shock. Torque rods, mounted between the axles and frame rails, stabilize axle and vehicle movement caused by accelerating and braking.

All suspension fasteners require periodic tightening. For suspension inspecting, lubricating, and fastener torque checking instructions, see Group 32 of the Business Class® M2 Maintenance Manual.



Failure to periodically torque the suspension fasteners could result in damage to the frame hangers or separation of components. This could cause a loss of vehicle control, resulting in injury or property damage.

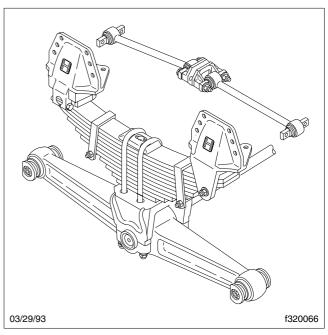


Fig. 1, RT Series Suspension

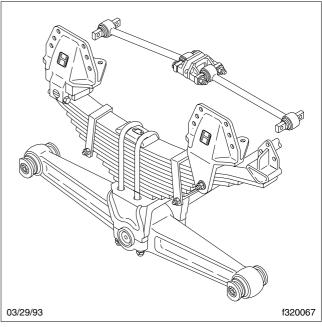


Fig. 2, RTE Series Suspension

### **General Information**

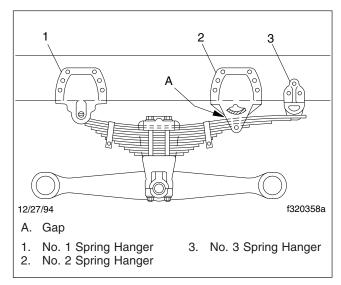


Fig. 3, Unloaded RTE Spring

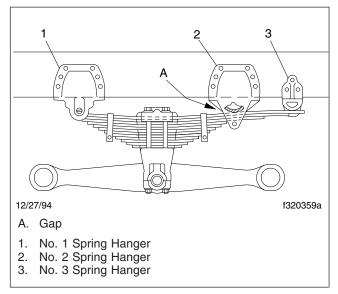


Fig. 4, Loaded RTE Spring

## Suspension Removal and Installation

#### Removal

NOTE: See Fig. 1 for this procedure.

- 1. Chock the front tires.
- 2. Drain the vehicle air system.
- 3. Disconnect all air lines leading to the rear axles, marking the lines for later assembly reference.
  - Plug or cap all lines and fittings to prevent dirt from entering the system.
- Disconnect the driveline rear universal joint from the forward-rear axle. Then remove the interaxle driveline. For instructions, see **Group 41** of this manual.
- 5. Manually release the spring brake chambers. For instructions, see **Group 42** of this manual.

### **A** WARNING

When the torque rods are disconnected from the axle brackets, the axles become free to pivot on the equalizer beam end bushings. Keep clear of the beam hangers and beam ends to avoid possible injury.

- Remove the torque rods. For instructions, see Subject 180.
- 7. Raise the rear of the vehicle so that all weight is removed from the suspension. Then, block the axles and the frame with safety stands. Make sure the stands will securely support the weight of the axles and the frame.

NOTE: Do not raise the vehicle to the point where the weight of the suspension and axles hangs from the vehicle.

8. Remove the saddle cap nuts and washers from each side of the vehicle, and remove the saddle caps.

NOTE: If the saddle cap studs are damaged, replace them.

 Raise the rear of the vehicle frame until there is enough clearance to roll the axles out from under the vehicle. Install safety stands under the frame, then roll the axles—with the equalizer beams attached—out from under the vehicle.

#### Installation

NOTE: See Fig. 1 for this procedure.

- 1. Roll the axles under the vehicle frame. Align the center bushing of each equalizer beam with the center of the saddle legs.
- 2. Raise the vehicle frame off the safety stands, then remove the safety stands.
- 3. Lower the frame, centering the saddles on the beam center bushings.
- 4. Lubricate the saddle cap studs with SAE 20 oil. Install the saddle caps, washers and new self-locking nuts. Do not tighten.
- Install the torque rods. For instructions, see Subject 180.
- 6. Tighten the saddle cap locknuts 225 to 275 lbf-ft (305 to 373 N·m).

NOTE: Maintain an even gap between the saddle cap and the saddle when tightening the self-locking nuts. See **Fig. 2**.

- 7. Remove the safety stands from under the frame and axle, and lower the vehicle.
- Manually reset the spring brake chambers. For instructions, see **Group 42** of this manual.
- Connect the driveline rear universal joint to the forward-rear axle. Connect the interaxle driveline. For instructions, refer to the driveline section of this manual.
- 10. Uncap all air lines and fittings, then connect the lines leading to the rear axles.
- 11. Check the axle pinion angle. For instructions, refer to the driveline section of this manual.

## Suspension Removal and Installation

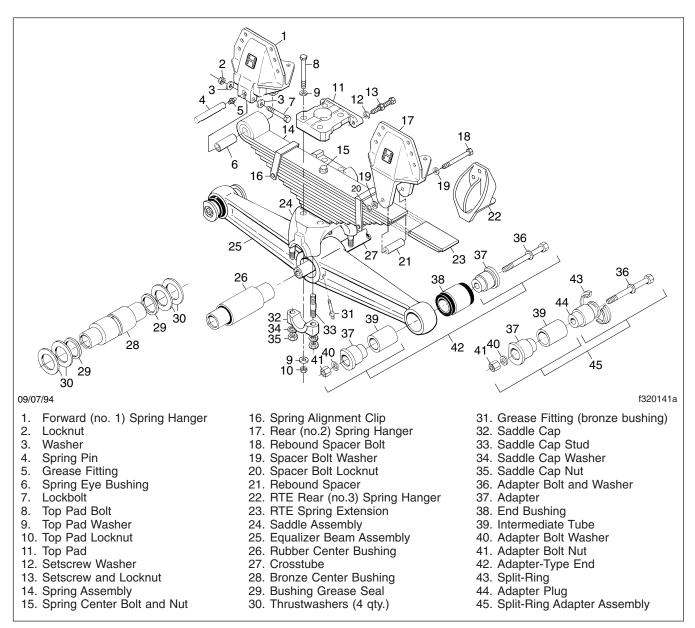


Fig. 1, RT and RTE Series (exploded view)

## **Suspension Removal and Installation**

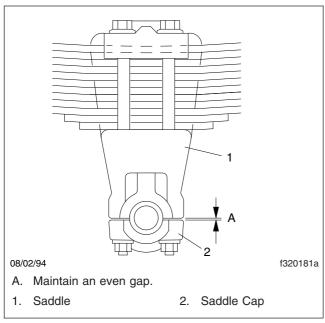


Fig. 2, Side View

### **Spring and Saddle Removal and Installation**

#### Removal

- Remove the suspension. For instructions, see Subject 100.
- 2. Support the spring and saddle assembly with a floor jack.
- 3. Remove the locknuts from the spring pin lockbolts; then remove the lockbolts and washers from the number one spring hanger.
- 4. Using a suitable drift, drive the spring pin through the no. 1 spring hanger and out the inboard side of the spring hanger. See **Fig. 1**.

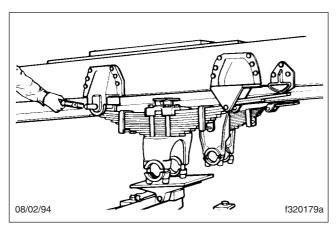


Fig. 1, Driving Out the Spring Pin

 Remove the locknut and lockwasher from the rebound spacer bolt in the no. 2 spring hanger. Remove the rebound spacer bolt and the spacer.

## **WARNING**

The leaf spring assembly is heavy. Use care when handling it to prevent injury.

- 6. Lower the spring and saddle assembly from the spring hangers.
- Loosen the spring alignment setscrews on the top pad. Remove the top pad nuts, washers, and bolts.
- 8. Remove the top pad from the spring assembly, then remove the spring from the saddle.

#### Installation

1. Seat the leaf spring assembly on the saddle.

2. Position the top pad on the spring assembly. Check that the top pad is properly seated.

NOTE: The main leaf has a cup that is forged upward at the center bolt. This cup serves as a pilot when installing the top pad, and ensures correct alignment of the spring assembly.

- Lubricate the threads on the top pad bolts with SAE 20 oil, then install the washers and bolts through the top pad and saddle. Install new nuts and washers finger-tight. Do not tighten at this time.
- 4. Lubricate the threads on the spring setscrews with SAE 20 oil. Hand-tighten the spring setscrews against the leaf springs. Tighten the setscrews 100 to 150 lbf·ft (135 to 203 N·m), then tighten the setscrew locknuts until the lockwasher is locked.
- 5. Tighten the top pad nuts 275 to 400 lbf·ft (373 to 542 N·m). Use the tightening sequence shown in Fig. 2.
- 6. Position the spring and saddle assembly into the no. 1 and no. 2 spring hangers.

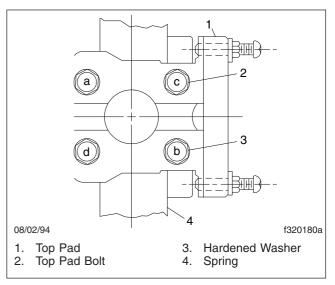


Fig. 2, Top Pad Bolt Tightening Sequence

- 7. Coat the spring pin and the inside diameter of the spring eye bushing with multipurpose chassis grease.
- 8. Align the spring pin with the spring eye bushing in the forward spring hanger.

## **Spring and Saddle Removal and Installation**

- 9. From the outboard side of the spring hanger, tap the spring pin into the bushing with a soft hammer. If necessary, adjust the spring to assist spring pin entry.
- Place washers on the spring pin lockbolts, and insert the lockbolts through the spring hanger. If necessary, use a screwdriver to turn the spring pin until the lockbolts can slide past it.
- 11. Lubricate the lockbolt threads with SAE 20 oil. Install the lockwashers and locknuts. Tighten the locknuts 45 to 63 lbf·ft (61 to 85 N·m).
- 12. Position the rebound spacer in the no. 2 spring hanger leg, then install the rebound spacer bolt, lockwasher, and locknut. Tighten the locknut 38 to 45 lbf·ft (51 to 61 N·m).
- 13. Install the grease fittings in both spring eye pins. Apply multipurpose chassis grease to the grease fittings until grease appears on both sides of the spring eye bushings.
- Install the suspension. See Subject 100 for instructions.

# Spring Leaf, Spring Pin, and Spring Eye Bushing Replacement

### Replacement

- 1. Remove the spring and saddle assembly. For instructions, see **Subject 110**.
- Using a C-clamp to hold the spring leaves together, remove the center bolt and nut, and the spring alignment clips. Remove the C-clamp and separate the leaves.

### **WARNING**

Commercial cleaning solvents are toxic, can cause severe skin irritation, and may be fire hazards. When using solvents, follow the safety precautions recommended by the solvent manufacturer.

- 3. Using a wire brush and solvent, clean all grease, dirt, and rust from the spring leaves. Inspect the spring leaves for cracks, gouges, wear, or abnormal bends. The no. 1 main and no. 2 wrapper spring leaves (the top two spring leaves) may each be replaced; if equipped with the RTE series suspension, the nos. 1, 2, and 3 spring leaves (the top three spring leaves) may each be replaced. If a spring leaf is damaged below these numbers in a pack, replace the spring assembly. Replace both spring assemblies to ensure even spring deflection.
- 4. Inspect the spring pin and spring eye bushing for wear or damage. If the pin diameter is less than 1.367 inch, replace it. If the inside diameter of the spring eye bushing is more than 1.395 inch, replace it.

NOTE: If necessary, press out the bushing with a hydraulic press. Install the new bushing with the split of the bushing positioned at the top (30 degrees) of the spring eye. See **Fig. 1**.

- Position the spring leaves in order, then insert a drift through the center bolt hole to align the leaves.
- Compress the leaves with a C-clamp, then install the spring alignment clips on the spring leaves. Install the spring alignment clip nuts and bolts. Tighten the nuts 15 lbf·ft (20 N·m).
- Remove the drift punch. At the bottom of the spring, insert a new center bolt. Install a new center bolt nut and tighten to the value in the table under **Specifications 400**.

8. Install the spring and saddle assembly. For instructions, see **Subject 110**.

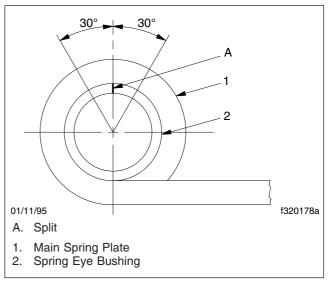


Fig. 1, Installing New Spring-Eye Bushing

### **Equalizer Beam Adapter- and Tube-Type End Support Removal and Installation**

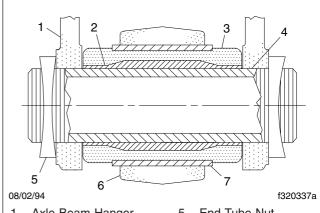
#### Removal

IMPORTANT: To ensure that the required tools are available, see the applicable table under Specifications 400 before beginning these procedures. Special tools are available from the Owatonna Tool Company, Owatonna, Minnesota, or an affiliated dealer. Although these tools are recommended, shop-made adapters can be used if a vertical hydraulic press with a 50-ton capacity is available. Dimensions for the shopmade adapters are provided in Specifications 400.

- 1. Chock the front tires.
- 2. Remove the saddle cap nuts and washers, then remove the saddle cap. Support the equalizer beam with safety stands.
- 3. Raise the rear of the vehicle until the saddle studs clear the equalizer beam. Block the axles and frame with safety stands.
- 4. Remove the wheels and tires. For instructions, refer to the wheels and tires section of this
- 5. Remove the brake shoes, brake spider, and brake backing plate (dust shield). Refer to the brake section of this manual for instructions.
- 6. Apply a penetrating oil to all beam end connec-
- 7. On a tube-type end support, remove the tube nuts from both sides of the beam end tube. See Fig. 1.

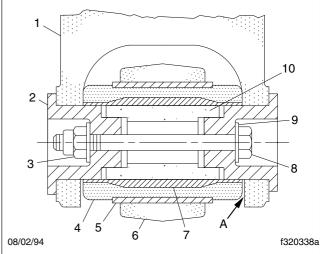
On an adapter-type end support, remove the nut, washers, and the adapter bolt. See Fig. 2.

- 8. If using Owatonna tools, remove the tube-type end supports by positioning the receiving tube over the outboard end of the beam end tube. Position the hydraulic ram, pulling screw, speed nut, and the removing adapter. See Fig. 3. Connect a hydraulic pumping unit to the ram, and apply pressure to remove the beam end tube.
- 9. If using Owatonna tools, remove the adaptertype end supports as follows:
  - 9.1 Using either a 7/8- or 15/16-inch hand-tap, tap the adapter bolt hole (outboard side) to a depth of about 1-1/2 inches (38 mm). See Fig. 4.



- Axle Beam Hanger
- **Bushing Inner** Sleeve
- Rubber End Bushing
- 4. Beam End Tube
- 5. End Tube Nut
- Equalizer Beam
- **Bushing Outer** Sleeve

Fig. 1, Equalizer Beam Tube-Type End Support



- A. The new busing will have a small gap here.
- 1. Axle Beam Hanger
- Adapter
- 3. Adapter Bolt Nut
- Rubber End Bushing
- **Bushing Outer** Sleeve
- 6. Equalizer Beam
- **Bushing Inner** Sleeve
- Adapter Bolt
- Washer (both ends)
- 10. Intermediate Tube

Fig. 2, Equalizer Beam Adapter-Type End Support

NOTE: Determine the correct size of handtap by using the plug gauge. If the gauge

# **Equalizer Beam Adapter- and Tube-Type End Support Removal and Installation**

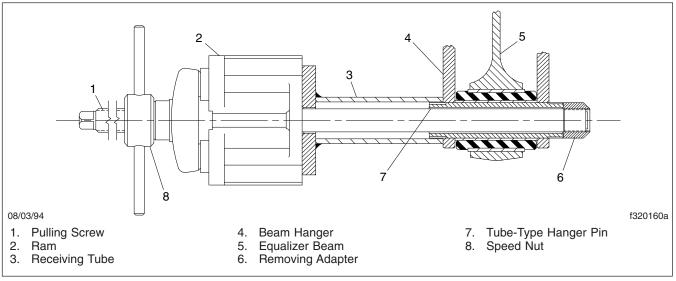


Fig. 3, Tube-Type Beam End Removal

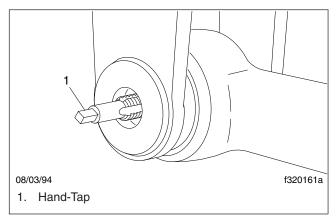


Fig. 4, Tapping the Adapter

passes through the adapter bolt hole, use a 15/16-inch tap; if it doesn't, use a 7/8-inch tap.

9.2 On the outboard side of the axle, thread the removing screw into the tapped hole. Position the receiving cup and hexnut on the removing screw. See **Fig. 5**.

Turn the hexnut until the adapter plug breaks loose and bottoms on the inside of the receiving cup. If needed, add spacers to complete removal of the adapter plug. See Fig. 6.

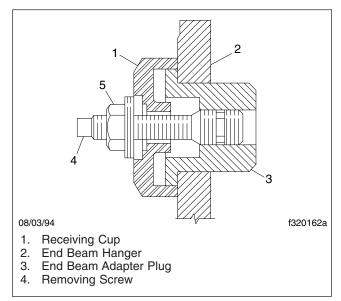


Fig. 5, Cross-Sectional View

- 9.3 On the inboard side of the axle, position the receiving cup over the adapter plug.
  - On the outboard side of the axle, insert the removing screw through the receiving cup and secure it with the hexnut. See Fig. 7.
- 9.4 Hold the removing screw and turn the nut with a 1-1/2 inch open-or box-end wrench.

### Equalizer Beam Adapter- and Tube-Type End Support Removal and Installation

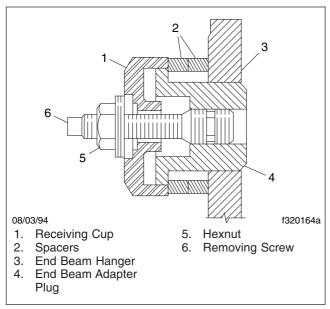


Fig. 6, Adding Spacers

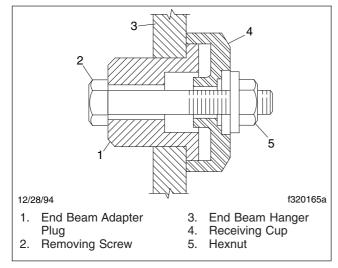


Fig. 7, Outboard View

Turn the nut until the adapter plug bottoms on the inside of the receiving cup.

- 10. If not using Owatonna tools, remove the end supports as follows:
  - 10.1 For tube-type end supports, install a spacer bushing between one end-tube nut and the beam hanger. Tighten the nut to pull the end tube out of the beam end bushing. If the tube doesn't come loose,

use a hacksaw and saw the tube along the inside surface of both axle beam hanger legs.

## **WARNING**

Don't use a cutting torch to remove the equalizer beams from the beam hangers. The equalizer beams are heat-treated, and using a cutting torch could weaken them. This could result in a loss of vehicle control and possible personal injury.

10.2 For adapter-type end supports, a relief is located on each side of the adapter. See Fig. 8. Turn the adapter with an air chisel, then insert a chisel into the relief on the inboard adapter. Drive the chisel in and wedge the adapter out of the beam hanger. Do the same on the outboard adapter.

If a split-ring adapter is used, drive a chisel between the two halves to remove the end support plug. Drive the plug into the equalizer beam end bushing until it is clear of the beam hanger. After the equalizer beam is removed, drive the adapter plug out of the bushing.

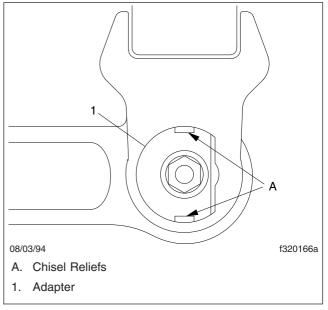


Fig. 8, Chisel Relief Locations

11. Remove the ends of the equalizer beams from the axle beam hangers.

# **Equalizer Beam Adapter- and Tube-Type End Support Removal and Installation**

 Lower the equalizer beams and the crosstube to the ground. Remove the thrustwashers and pull the beams from the crosstube.

#### Installation

 On adapter-type end supports, apply Texaco Compound L or an equivalent rust preventive lubricant to the axle beam hanger eyes, beam end bushing inner sleeve, end support adapters, outside surface of the bushing intermediate tubes, and the ends of the crosstube.

Install the crosstube and thrustwashers in both equalizer beam center bushings.

On tube-type end supports, apply Texaco Compound L, or an equivalent rust preventive lubricant, to the axle beam hanger eyes, beam end bushing inner sleeve, outer surface of the beam end tubes, beam center bushing inner sleeves, and the ends of the crosstube.

Using SAE 20 oil, lubricate the threads of the beam end tube, then install the crosstube and thrustwashers in both equalizer beam center bushings.

 Position the equalizer beam assembly under the axles, then raise the assembly and place the forward ends of each beam in the forward-rear axle beam hangers. Align the beam end bushings with the beam hangers.

On adapter-type end supports, install the intermediate tubes, the adapters, the adapter bolt, washers, and nut in each beam end to hold the beam in the axle beam hangers. Do not tighten.

On tube-type end supports, install the beam end tubes through the beam hangers and the beam end bushings. Hand-tighten both nuts on the beam end tubes.

Place the rear ends of each beam in the rearmost axle beam hangers. Align the beam end bushings with the beam hangers.

On adapter-type end supports, install the intermediate tubes, the adapters, the adapter bolt, washers, and nut in each beam end to hold the beam in the axle beam hangers. Do not tighten.

On tube-type end supports, install the beam end tubes through the beam hangers and the beam

- end bushings. Hand-tighten both nuts on the beam end tubes.
- Position the saddle caps on the saddle cap studs, then install the washers and new selflocking nuts. Tighten the nuts 225 to 275 lbf·ft (305 to 373 N·m).
- Tighten the adapter bolt nuts 210 to 240 lbf·ft (285 to 325 N·m). Make sure the flat section of the adapter flange is in the vertical position. See Fig. 9.
- 6. Tighten the end tube nuts 375 to 425 lbf·ft (508 to 576 N·m).

## **A** WARNING

The adapter bolt nuts and end tube nuts must be tightened to the values in the previous two steps. If not, the metal surfaces of the end support assembly will rub, and excessive wear to the beam hanger legs and end bushing inner sleeves will occur. This could result in separation of suspension components, loss of vehicle control, and possible injury or property damage.

- Install the brake backing plate (dust shield), brake spider, and brake shoes. Refer to the brake section of this manual for instructions.
- 8. Install the wheels and tires. For instructions, see **Group 40** of this manual.

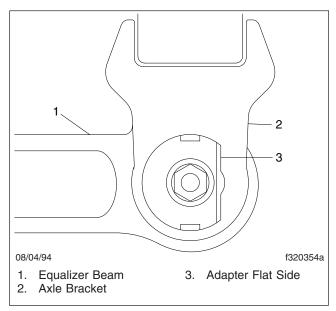


Fig. 9, Tightening the Adapter Bolt Nuts

## Equalizer Beam End Bushing Removal and Installation

#### Removal



Don't use a cutting torch to remove the beam end bushing. Equalizer beams are heat-treated by the manufacturer. Using a cutting torch could weaken the beams, and may result in a loss of vehicle control. This could cause personal injury or property damage.

- Remove the equalizer beam ends from the axle beam hangers. For instructions, see Subject 130.
- 2. Cut off the protruding rubber from one side of each beam end bushing. See Fig. 1.
- 3. If using Owatonna tools, remove the beam end bushings as follows (see Fig. 2):
  - 3.1 Install the receiving adapter on the receiving tube.
  - 3.2 Position the hydraulic ram and slide the pulling screw through the end bushing.
  - 3.3 Install the end bushing removing adapter on the inboard side of the beam end bushing. Check that the cone-shaped surface of the adapter is facing the equalizer beam.

IMPORTANT: Align the receiving tube so that the bushing will clear the edges of the tube when force is exerted against the beam. Align the removing adapter so that force is exerted only on the bushing to ensure a clean pull through the beam.

- 3.4 Install the hexnut on the pulling screw. Full thread engagement is needed.
- 3.5 Connect a hydraulic pumping unit to the ram and apply force until the ram cylinder reaches its stroke limit.
- 3.6 Release the pressure, add spacers, and tighten the speed nut. About three adjustments are needed to completely remove the end bushing.

NOTE: If the pressure gauge on the hydraulic pumping unit reads 10,000 psi (68 950 kPa) and the bushing has not broken loose, stop and check the alignment of the receiv-

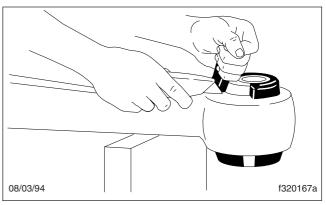


Fig. 1, Cutting Off the Protruding Rubber

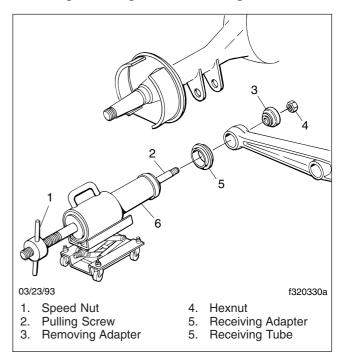


Fig. 2, Removing The Beam End Bushing

ing tool and removal adapter. If both tools are aligned correctly, attach a sledging adapter on the speed nut end of the pulling screw. Maintaining hydraulic pressure, strike the sledging adapter with a heavy hammer. A loud noise followed by a sudden drop of the pressure gauge reading indicate the bushing has broken loose.

4. If using shop-made adapters, remove the beam end bushings as follows:

## **Equalizer Beam End Bushing Removal and Installation**

- 4.1 Remove the equalizer beams. For instructions, see **Subject 130**.
- 4.2 Position the equalizer beam on a 50-ton vertical hydraulic press.
- 4.3 Center the shop-made adapter (refer to the applicable table under **Specifications 400**) on the trimmed end of the equalizer beam bushing. Press the end bushing from the beam eye.

#### Installation

- Using emery cloth, remove all scale, rust, or corrosion from the beam eyes. Inspect the equalizer beam eyes for cracks, gouges, or damage. Replace the equalizer beam if any of these conditions exist.
- Using emery cloth, clean the outer sleeves of the new equalizer beam end bushings. Apply a thin coating of Texaco Compound L, or an equivalent rust preventive lubricant, to the surface of the outer sleeves on the new bushing.
- 3. If using Owatonna tools, install the beam end bushings as follows (see Fig. 3):
  - 3.1 Fit the adapter clamp over the exposed rubber on the new bushing. Tighten the clamp nuts until the clamp is flush against the bushing outer sleeve.
  - 3.2 Install the receiving adapter on the receiving tube.
  - 3.3 Position the hydraulic ram and slide the pulling screw through the end bushing.
  - 3.4 Center the adapter clamp and bushing on the inboard side of the beam end.
  - 3.5 Install the adapter plate and secure it with the hexnut.

IMPORTANT: Check that the new bushing and the installation tools are centered so that the bushing will clear the receiving tube when force is exerted against the beam.

- 3.6 Tighten the speed nut and remove any slack in the assembly.
- 3.7 Connect a hydraulic pumping unit to the ram and apply force until the ram cylinder reaches its stroke limit.

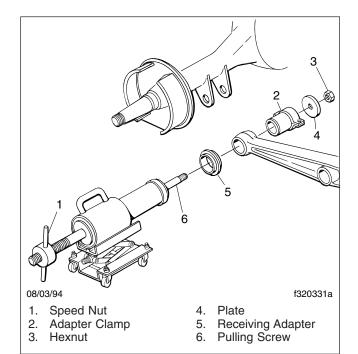


Fig. 3, Installing the Beam End Bushing

3.8 Release the pressure, add spacers, and tighten the speed nut. About three adjustments are needed to completely install the end bushing.

NOTE: The pressure gauge on the pumping unit should read 4,000 to 5,500 psi (27 580 to 37 920 kPa) during installation. If the reading reaches the operating limit of 10,000 psi (68 950 kPa) and the bushing is not going into the beam end, check the alignment of the bushing, tooling, and hydraulic equipment. Installation is complete when the adapter clamp is flush against the beam.

- 3.9 Install the equalizer beam ends on the axle beam hangers. For instructions, see **Subject 130**.
- 4. If using shop-made adapters, install the beam end bushings as follows (see Fig. 4):
  - 4.1 Position the equalizer beam on a 50-ton hydraulic press.
  - 4.2 Using a sheave puller, compress the exposed rubber of the bushing until the puller jaws are flush against the end of the bushing outer sleeve.

# **Equalizer Beam End Bushing Removal and Installation**

- 4.3 Position the shop-made adapter (refer to the table under **Specifications 400**) against the jaws of the sheave puller. Press the new bushing into the beam eye.
- 4.4 Install the equalizer beam. For instructions, see **Subject 130**.

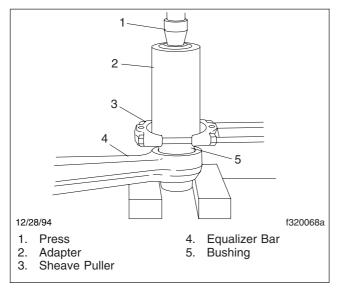


Fig. 4, Removing the End Plug

# Equalizer Beam Bar Pin/Bushing Assembly Removal, Installation, and Alignment

#### Removal

NOTE: Most Hendrickson suspensions are manufactured with a bar pin-type bushing assembly that connects the equalizer beam to the axle. The bar pin/bushing assembly can be serviced without removing the brake assembly.

## **WARNING**

Do not use a cutting torch to remove the equalizer beams from the beam hangers. The equalizer beams are heat-treated, and using a cutting torch could weaken them. This could result in a loss of vehicle control, possible personal injury, or property damage.

- 1. Shut down the engine and set the parking brake.
- 2. Chock the front tires.
- 3. Support the equalizer beams with jack stands.
- Remove the four bolts attaching the equalizer beam to the saddle.
- 5. Apply a penetrating oil to the threads of the two 1-inch (25 mm) bolts and locknuts attaching each bar pin/bushing assembly to the axle brackets.
- 6. Remove the bolts. If the fasteners are rusted in place, an air hammer chisel may be used to loosen the bolts attaching the bar pin/bushing assembly to the axle brackets.

NOTE: The upper torque rods may have to be disconnected at the top of the axle, and the axle rotated to a more vertical position to assist in the removal of the equalizer beam from the axle bracket.

- 7. Remove the equalizer beam from the axle beam hangers.
- The bar pin/bushing assemblies can be removed from the equalizer beams with Owatonna tools.
   To do so, follow Owatonna recommendations.
- If shop-made tools are used, remove the bar pin/ bushing assemblies from the beam ends as follows:
  - 9.1 Position the equalizer beam on a 50-ton vertical hydraulic press.
  - 9.2 Center the shop-made tool, and press the bar pin/bushing assembly from the beam end eye.

#### Installation

IMPORTANT: Do not reuse the old fasteners. Replace them during installation.

- Using emery cloth, remove all scale, rust, or corrosion from the beam eyes. Inspect the equalizer beam eyes for cracks, gouges, or damage. Replace the equalizer beam if any of these conditions exist.
- 2. The outer metals of some Hendrickson rubber bushings are covered with a phosphate coating that acts as a rust preventive. This coating must be removed with emery cloth before installation. Also apply a coating of grease to the cleaned outer metals of the bar pin/bushing assembly, and to the beam end eyes to help when pressing the bar pin/bushing assembly into the beam end eye.
- If using Owatonna tools, install the bar pin/ bushing assemblies using Owatonna recommendations.
- 4. If using shop-made tools, create the needed assembly tool from a 5-inch (127 mm) length of 5-inch (127 mm) O.D. steel tubing with 1/2-inch (13 mm) wall thickness. See Fig. 1. The assembly tool must be split in half, then clamped or bolted together to compress the rubber to allow contact with the bushing outer metal.
  - 4.1 Position the equalizer beam on a 50-ton hydraulic press with the beam end bore squarely supported on the bed for safety and to avoid bending the equalizer beam.
  - 4.2 Before pressing the bar pin/bushing assembly, align the holes in the end of the bar pin/bushing assembly with the center line of the equalizer beam. This will help assembly into the axle brackets. Care should be taken during the assembly process to ensure the orientation of the bar pin/bushing assembly in the beam eye.

NOTE: After installation, verify that the bar pin/bushing assembly is centered in the end of the beam.

- 5. Install the equalizer beam on the axle hangers.
- 6. Attach the bar pin/bushing assembly to the axle brackets. Tighten the 1-inch (25 mm) bolts 450 to 600 lbf·ft (610 to 813 N·m).

# **Equalizer Beam Bar Pin/Bushing Assembly Removal, Installation, and Alignment**

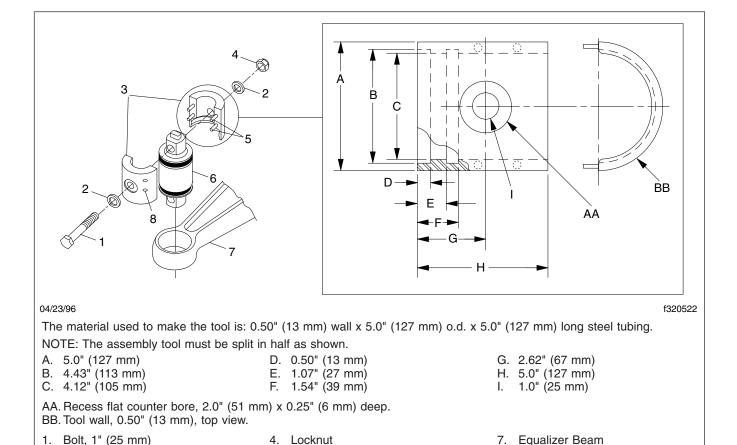


Fig. 1, Assembly Tool (exploded view, with manufacturing information)

6. Bar Pin/Bushing Assembly

5. Alignment Pins

NOTE: Bar pin/bushing assembly kits are available with or without alignment shims.

- 7. Install the four bolts attaching the equalizer beam to the saddle. Tighten 225 to 275 lbf·ft (305 to 375 N·m).
- 8. Remove the jack stands.

Washer, 1" (25 mm) o.d.

3. Assembly Tool

9. Remove the chocks from the tires.

### Alignment

For a detailed adjustment procedure, refer to Hendrickson's service literature, *Bar Pin Alignment Instructions*, *Technical Publication No. 17730-213*.

The instruction publication may be obtained from:

Hendrickson Truck Suspension Systems 1-630-910-2800 1-800-973-0360 (fax) 1-630-378-4849 800 South Frontage Road Woodridge, IL 60517-4904

8. Alignment Pin Hole

## Equalizer Beam Rubber Center Bushing Removal and Installation

#### Removal

NOTE: If using Owatonna tools, it is not necessary to remove the equalizer beam to remove or install the rubber center bushing.

- 1. Chock the front tires.
- Raise the rear of the vehicle so that all weight is removed from the suspension. Block the axles and the frame with safety stands. Make sure the stands will securely support the weight of the axles and the frame.

NOTE: Do not raise the vehicle to the point where the weight of the suspension and axles hangs from the vehicle.

- 3. Remove the saddle cap nuts and washers from each side of the vehicle, and remove the saddle caps.
- Raise the rear of the truck frame until the saddle studs clear the equalizer beam. Install safety stands under the frame.
- Using a 2-1/2 inch diameter hole saw (see Fig. 1), cut out the end plug from the center bushing on each side of the suspension, and remove the crosstube.



Do not use a cutting torch to burn out the end plugs. The equalizer beams are heat-treated, and the use of a cutting torch could weaken the beam.

- On the inboard side of the equalizer beam, inspect the exposed edge of the bushing's outer sleeve.
- 7. Chisel or grind off any portion of the outer sleeve that has flared over the surface of the equalizer beam.
- 8. If using Owatonna tools, remove the rubber center bushings as follows (see Fig. 2):
  - 8.1 Position the hydraulic ram and slide the pulling screw through the center bushing.
  - 8.2 Install the center bushing removing adapter on the inboard side of the beam eye.

IMPORTANT: Align the receiving tube so that the bushing will clear the edges of the tube when force is exerted against the beam. Align the removing adapter so that force is exerted only on the bushing to ensure a clean pull through the beam.

8.3 Install the hexnut on the pulling screw. Full thread engagement is needed.

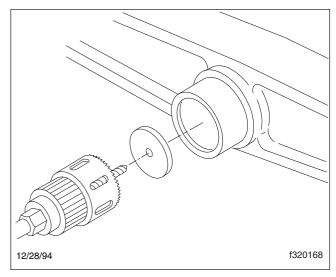


Fig. 1, Removing the End Plug

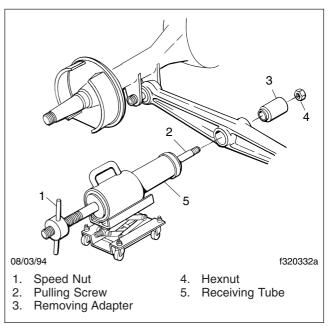


Fig. 2, Removal of the Rubber Center Bushing

## **Equalizer Beam Rubber Center Bushing Removal** and Installation

- 8.4 Install spacers between the ram cylinder and the speed nut. Tighten the speed nut and remove any slack in the assembly.
- 8.5 Connect a hydraulic pumping unit to the ram and apply force until the ram cylinder reaches its stroke limit.
- 8.6 Release the pressure, add spacers, and tighten the speed nut. About three adjustments are needed to completely remove the bushing.

NOTE: If the pressure gauge on the hydraulic pumping unit reads 10,000 psi (68 950 kPa) and the bushing has not broken loose, stop and check the alignment of the receiving tool and removal adapter. If both tools are aligned correctly, attach a sledging adapter on the speed nut end of the pulling screw. Maintaining hydraulic pressure, strike the sledging adapter with a heavy hammer. A loud noise followed by a sudden drop of the pressure gauge reading indicate that the bushing has broken loose.

- If using shop-made adapters, remove the equalizer beams. For instructions, see Subject 130.
  - 9.1 Position the equalizer beam on a 50-ton vertical hydraulic press.
  - 9.2 Center the shop-made adapter (refer to the applicable table under **Specifications 400**) on the trimmed end of the equalizer beam bushing. Press the center bushing from the beam eye.

### Installation

- Using emery cloth, remove all scale, rust, or corrosion from the beam eyes. Inspect the equalizer beam eyes for cracks, gouges, or damage. Replace the equalizer beam if any of these conditions exist.
- Using emery cloth, clean the outer sleeves of the new equalizer beam center bushings. Apply a thin coating of Texaco Compound L, or an equivalent rust preventive lubricant, to the surface of the outer sleeves on the new bushing.
- 3. If using Owatonna tools, install the rubber center bushings as follows (see Fig. 3):

- 3.1 Center the hydraulic ram and slide the pulling screw through the beam eye.
- 3.2 Position the bushing on the inboard side of the beam eye.

IMPORTANT: Center the new bushing to ensure a clean pull through the beam eye.

- 3.3 Fit the installing adapter over the inner sleeve and against the outer sleeve of the bushing.
- 3.4 Install the hexnut on the pulling screw. Full thread engagement is needed.
- 3.5 Install spacers between the ram cylinder and the speed nut. Tighten the speed nut and remove any slack in the assembly.
- 3.6 Connect a hydraulic pumping unit to the ram and apply force until the ram cylinder reaches its stroke limit.
- 3.7 Release the pressure, add spacers, and tighten the speed nut. About three adjustments are needed to completely install the center bushing.

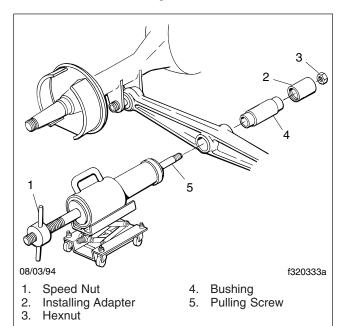


Fig. 3, Installing the Rubber Center Bushing

NOTE: The pressure gauge on the pumping unit should read 4,000 to 5,500 psi (27 580

## Equalizer Beam Rubber Center Bushing Removal and Installation

to 37 920 kPa) during installation. If the reading reaches the operating limit of 10,000 psi (68 950 kPa) and the bushing is not going into the beam, check the alignment of the bushing, tooling, and hydraulic equipment. Installation is complete when the installing adapter is flush against the beam.

3.8 Position the crosstube in the center bushings.

### **A** WARNING

Wear protective welding masks and gloves when welding. Failure to do so could result in personal injury due to the intensity of heat, sparks, and flying debris from the welding process.

3.9 Arc weld new end plugs to the tire side of each center bushing inner sleeve.

NOTE: Heat from welding the end plugs will not affect the beam or the new rubber bushings because of their distance from the point of welding.

- Position the saddle caps on the saddle cap studs, then install the washers and new selflocking nuts. Tighten the nuts 225 to 275 lbf·ft (305 to 373 N·m).
- 5. If using shop-made adapters, position the equalizer beam on a 50-ton hydraulic press.
  - 5.1 Using standard center bushings with the end plugs welded in place, position the shop-made adapter (refer to the applicable table under **Specifications 400**) over the inner sleeve of the bushing. Check that the adapter bottoms against the bushing outer sleeve, then press the new bushing into the beam eye.
  - 5.2 Install the equalizer beams. For instructions, see **Subject 130**.

## Equalizer Beam Bronze Center Bushing Removal and Installation

#### Removal

NOTE: If using Owatonna tools, you can remove or install the bronze center bushing without removing the equalizer beam.

- 1. Chock the front tires.
- Raise the rear of the vehicle so that all weight is removed from the suspension. Block the axles and the frame with safety stands. Make sure the stands will securely support the weight of the axles and the frame.

NOTE: Do not raise the vehicle to the point where the weight of the suspension and axles hangs from the vehicle.

- 3. Remove the saddle cap nut and washers from each side of the suspension, and remove the saddle caps.
- Raise the rear of the truck frame until the saddle studs clear the equalizer beam. Install safety stands under the frame.
- 5. Using a 2-1/2 inch diameter hole saw, cut out the retaining disk from the center bushing on each side of the suspension, and remove the crosstube.

## **A** CAUTION -

Do not use a cutting torch to burn out the retaining disk. The equalizer beams are heat treated, and the use of a cutting torch could weaken the beam.

- 6. If using Owatonna tools, remove the bronze center bushing as follows (see Fig. 1):
  - 6.1 Position the hydraulic ram and slide the pulling screw through the center bushing.
  - 6.2 Install the center bushing removing adapter on the inboard side of the beam eye.

IMPORTANT: Align the receiving tube so that the bushing will clear the edges of the tube when force is exerted against the beam. Align the removing adapter so that force is exerted only on the bushing to ensure a clean pull through the beam.

6.3 Install the hexnut on the pulling screw. Full thread engagement is needed.

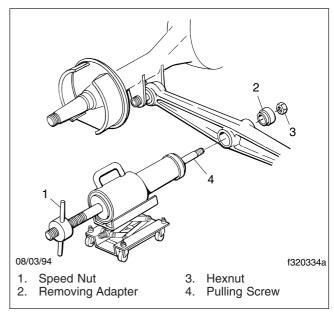


Fig. 1, Removal of Bronze Center Bushing

- 6.4 Install spacers between the ram cylinder and the speed nut. Tighten the speed nut and remove any slack in the assembly.
- 6.5 Connect a hydraulic pumping unit to the ram and apply force until the ram cylinder reaches its stroke limit.
- 6.6 Release the pressure, add spacers, and tighten the speed nut. About three adjustments are needed to completely remove the center bushing.

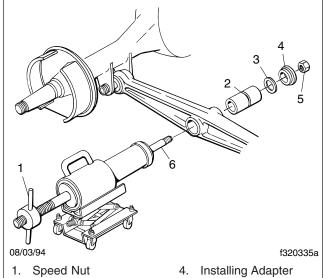
NOTE: If the pressure gauge on the hydraulic pumping unit reads 10,000 psi (68 950 kPa) and the bushing has not broken loose, stop and check the alignment of the receiving tool and removal adapter. If both tools are aligned correctly, attach a sledging adapter on the speed nut end of the pulling screw. Maintaining hydraulic pressure, strike the sledging adapter with a heavy hammer. A loud noise followed by a sudden drop of the pressure gauge reading indicate that the bushing has broken loose.

#### **Equalizer Beam Bronze Center Bushing Removal** and Installation

- If using shop-made adapters, remove the equalizer beams. For instructions, refer to Subiect 130.
  - 7.1 Position the equalizer beam on a 50-ton vertical hydraulic press.
  - 7.2 Center the shop-made adapter (refer to the applicable table under Specifications 400) on the center bushing. Press the bushing from the beam eye.

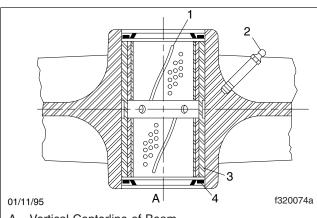
#### Installation

- Using emery cloth, remove all scale, rust, or corrosion from the beam eyes. Inspect the equalizer beam eyes for cracks, gouges, or damage. Replace the equalizer beam if any of these conditions exist.
- 2. Using emery cloth, clean the outer sleeves of the new equalizer beam center bushings. Apply a thin coating of Texaco Compound L, or an equivalent rust preventive lubricant, to the surface of the outer sleeves on the new bushing. and to the inside surface of the beam eye.
- Position the bushing on the equalizer beam eye.
- If using Owatonna tools, install the bronze center bushings as follows (see Fig. 2):
  - Center the hydraulic ram and slide the 4.1 pulling screw through the beam eve.
  - 4.2 Position the bushing on the inboard side of the beam eye. Check that the grooves of the bushing are aligned with the vertical centerline of the equalizer beam. See Fig. 3.
  - 4.3 Fit the installing adapter and the removing/installing adapter against the outer sleeve of the bushing. Make sure the deep ridge on the installing adapter is positioned against the bronze bushing. See Fig. 4.
  - 4.4 Install the hexnut on the pulling screw. Full thread engagement is needed.
  - Install spacers between the ram cylinder 4.5 and the speed nut. Tighten the speed nut and remove any slack in the assembly.



- 2. Bushing
- Installing Adapter
- 5. Hexnut
- 6. Pulling Screw

Fig. 2, Installing the Bronze Center Bushing



- A. Vertical Centerline of Beam
- Bushing Lube Grooves
- Grease Fitting
- Center Bushing Assembly
- 4. Seal
- Fig. 3, Check Bushing Grooves
- 4.6 Connect a hydraulic pumping unit to the ram and apply force until the ram cylinder reaches its stroke limit.
- 4.7 Release the pressure, add spacers, and tighten the speed nut. About three adjustments are needed to completely install the center bushing.

## Equalizer Beam Bronze Center Bushing Removal and Installation

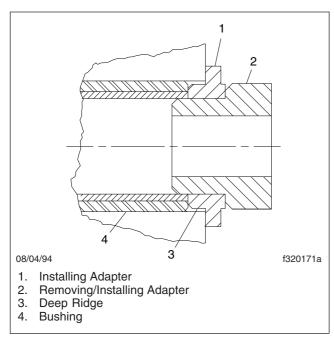


Fig. 4, Position of Adapter

NOTE: The pressure gauge on the pumping unit should read 4,000 to 5,500 psi (27 580 to 37 920 kPa) during installation. If the reading reaches the operating limit of 10,000 psi (68 950 kPa) and the bushing is not going into the beam, check the alignment of the bushing, tooling, and hydraulic equipment. Installation is complete when the installing adapter is flush against the beam.

- 4.8 On the inboard side of the beam, position a grease seal and installing adapter against the center bushing. Make sure the shallow end of the adapter is against the grease seal. See Fig. 5. Using a hammer, tap the installing adapter until it is flat against the beam. Using the same procedure, install a grease seal on the outboard side of the beam.
- 5. If using shop-made adapters, position the equalizer beam on a 50-ton hydraulic press.
  - 5.1 Center the new bushing in the beam eye. Using a standard bushing driver, press the bushing in until there is equal spacing between both bushing ends and the sides of the beam eye.

5.2 Install the new grease seals (with the seal lips facing out).

NOTE: Check that the new seals are 1/6 inch (4 mm) inside the beam hub surface to ensure clearance and protection of the seals when the saddle cap is installed.

- Apply a thin coating of multipurpose chassis grease to the inside surface of the center bushing. Slide the bushing center sleeve into the bushing.
- Install the grease fitting into the beam hub. Rotate the center sleeve and apply multipurpose chassis grease in the grease fitting. Lubricate until clean grease appears at both ends of the grease seals.
- 8. Install the crosstube.
- Install the saddle caps or the equalizer beam (if removed) on the axle beam hangers. For instructions, see Subject 130.

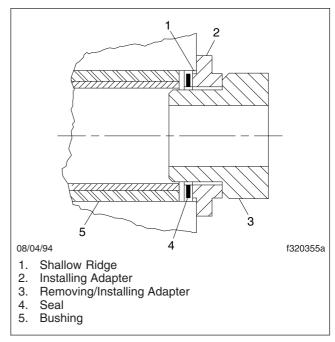


Fig. 5, Seating Adapter and Seal

#### Removal

IMPORTANT: To ensure that the required tools are available, see the applicable table in **Specifications 400**, before beginning these procedures. Special tools are available from the Owatonna Tool Company, Owatonna, Minnesota, or an affiliated dealer.

### **WARNING**

When the torque rods are disconnected from the axle brackets, the axles become free to pivot on the equalizer beam end bushings. Keep clear of the beam hangers and beam ends to avoid possible injury.

 On fore-and-aft torque rods, remove the flanged bolts and nuts from the torque rod axle brackets, and the crossmember mounting brackets. Remove the torque rods. See Fig. 1.

On transverse torque rods, remove the nuts and washers from the axle brackets, and remove the flanged bolts and nuts from the frame rail mounting brackets. Remove the torque rods. See Fig. 1.

NOTE: If necessary, use an impact hammer and tap the top of the axle bracket to disengage the rod stud from the axle bracket.

- Inspect the torque rods. If bent or cracked, replace. Check the torque rod bushings. If one of the bushings is loose or damaged, replace both of the bushings.
- 3. Position the press plate on the hydraulic press. Check that the small counterbore of the plate hole is facing up.

NOTE: Some tapered stud torque rod bushings have a large non-removable washer on the stud that will not fit though the press plate hole. Loosen the press plate capscrews and separate the halves (see Fig. 2) until the washer clears the counterbore, and the torque rod sets on the press plate. Tighten the capscrews until the press plate halves are closed.

4. Position the tapered stud removal tool (using the end with the larger inside diameter) on the torque rod stud. Apply lubricating oil (see Fig. 3), then press the stud out of the bushing.

- Position the bushing remover/replacer tool (using the end with the larger outside diameter) on the bushing. Install the cap, then apply lubricating oil to the torque rod bushing.
- Press the rubber bushing out of the torque rod eye.
- 7. Position the straddle mount end of the torque rod into the hole of the press plate. Tighten the press plate capscrews.
- 8. Position the straddle mount pin remover on the straddle mount pin. See **Fig. 4**.
- 9. Apply lubricating oil to the straddle mount pin. Press the straddle mount pin out of the bushing.
- Position the end of the rubber bushing remover/ replacer tool (using the end that has the larger outside diameter) on the bushing. Install the cap, then apply lubricating oil to the torque rod bushing.
- 11. Press the rubber bushing out of the torque rod eye.

#### Installation

- 1. Remove all dirt and grease from the torque rod ends. Apply lubricant on the new bushings and in the torque rod eyes.
- Position the press plate on the hydraulic press. Check that the small counterbore of the plate hole is facing up.
- Position the new bushing on the tapered stud of transverse torque rods. Position the clamp and tighten it to compress the rubber. See Fig. 5.
- 4. Place the torque rod end, the bushing, and the clamp on the press plate.
- Place the remover/replacer tool (see Fig. 6) and cap on top of the clamping tool and press the bushing in the torque rod end. Check that the bushing sleeve protrudes equally on each side of the torque rod end.
- On straddle mount end assemblies, align the clamping tool on the bushing. See Fig. 7.
   Tighten the clamp to compress the rubber of the new straddle mount bushing.

NOTE: When tightening the clamp, make sure that the position of the bushing pin is at a right

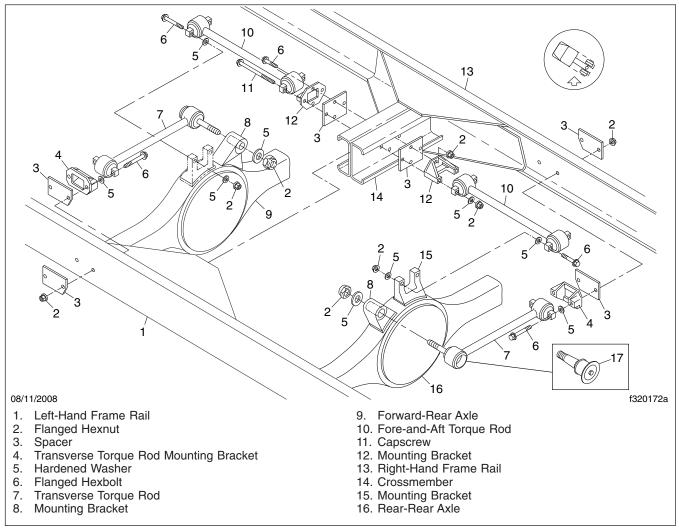


Fig. 1, Torque Rods Mounting

angle to the center line of the torque rod shank. See **Fig. 8**.

- 7. Place the torque rod end, the bushing, and the clamp on the press plate.
- 8. Using the larger end of the remover/ replacer tool, position the tool and cap on top of the clamp assembly.
- Press the bushing in the torque rod end. Check that the bushing's outer sleeve protrudes equally on each side of the torque rod end.
- 10. Install the fore-and-aft torque rods as follows (see Fig. 1):

- 10.1 Position a torque rod straddle mount pin in the forward-rear axle bracket. Install the flanged bolts through the axle bracket and the straddle mount pin. Install a spacer and nut on each bolt, and tighten 190 lbf-ft (260 N·m).
- 10.2 Position a torque rod straddle mount pin in the rearmost axle bracket. Install the flanged bolts through the axle bracket and the straddle mount pin. Install a spacer and nut on each bolt, and tighten 190 lbf·ft (260 N·m).

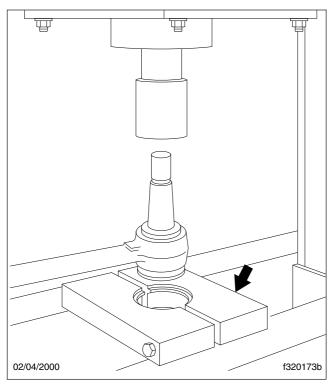


Fig. 2, Separating the Halves

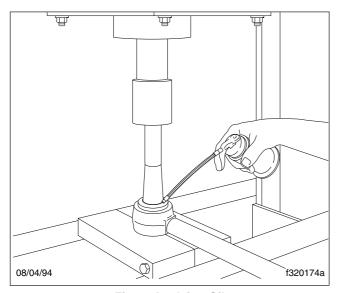


Fig. 3, Applying Oil

10.3 Position a torque rod spacer and straddle mount bracket on each side of the crossmember. Insert bolts through the upper and lower holes of the forward mounting

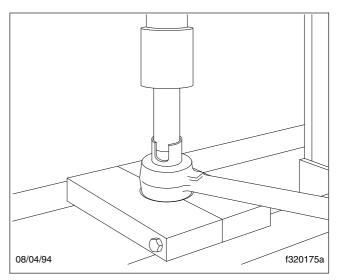


Fig. 4, Positioning the Pin Remover

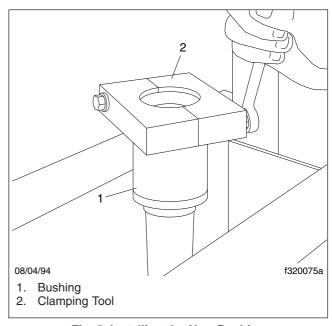


Fig. 5, Installing the New Bushing

bracket. Install nuts and tighten 95 lbf-ft (130 N·m).

10.4 Position the straddle mount pin of the forward torque rod in the mounting bracket. Insert bolts through the forward pin, both bracket assemblies, and the straddle mount pin of the rear torque rod. Install

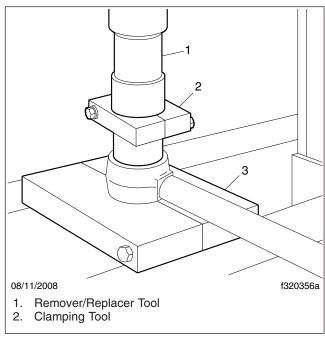


Fig. 6, Pressing In the New Bushing

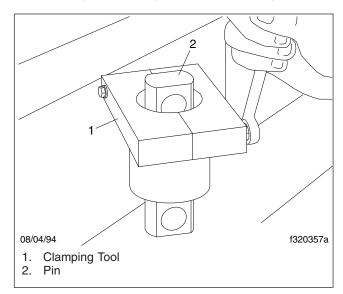


Fig. 7, Aligning the Clamping Tool

the nuts and bearing washers. Tighten the nuts 190 lbf·ft (260 N·m).

11. Install the transverse torque rods as follows (see Fig. 1):

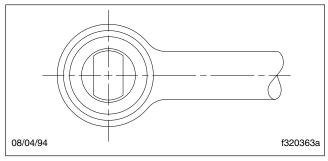


Fig. 8, Correct Bushing Pin Position

- 11.1 Check that the tapered stud end and the tapered stud bracket hole are clean. Lubricate the tapered stud ends with SAE 20 oil
- 11.2 Install the tapered stud in the axle bracket. Install a washer and nut. Tighten the nut 175 to 225 lbf·ft (235 to 305 N·m).
- 11.3 Align the straddle mount end, the mounting bracket, and the spacer against the inside frame rail.
- 11.4 On the inboard side of the frame rail, install the bolts through the mounting assembly and the frame rail.
- 11.5 On the outboard side of the frame rail, install a spacer over the mounting bolt studs. Install the nuts and tighten them 190 lbf·ft (260 N·m).
- 12. Check the axle pinion angle. For instructions, see **Group 41** of this manual.

## **Specifications**

	Special Tools (Owatonna Tool Company)			
Part Number	Tool	Usage		
1745	Adapter Puller Set	Adapter-Type End Support Removal		
1761	Torque Rod Set	Torque Rod Bushing Removal and Installation		
28536	Installing Adapter (5-3/4" o.d.)	Bronze Center Bushing and Seal Removal and Installation		
44119	Receiving Tube	Center and End Bushing Removal and Installation		
45052	Adapter Clamp	End Bushing Installation		
51678	80-Ton Hydraulic Ram	All Operations		
51695	Jack	All Operations		
206459	Plate	End Bushing Installation		
302018	Spacer (3 qty.)	Center and End Bushing Removal and Installation		
302019	Receiving Adapter	End Bushing Removal and Installation		
302023	Pulling Screw	All Operations		
302024	Removing and Installing Adapter	Bronze Center Bushing Removal and Installation		
302026	Installing Adapter	Rubber Center Bushing Removal and Installation		
302027	Removing Adapter	Rubber Center Bushing Removal and Installation		
302028	Hexnut	All Operations		
302029	Speed Nut	All Operations		
302030	Removing Adapter	End Bushing Removal and Installation		

Table 1, Special Tools (Owatonna Tool Company)

Shop-Made Adapters				
Tool Number	Dimensions	Usage		
1	4-1/4 inch o.d. by 4 inch	Beam End Bushing Removal		
2	4-1/2 inch i.d. by 4 inch	Beam End Bushing Installation		
3	4-5/8 inch o.d. by 7 inch	Beam Center Bushing Removal and Installation		

Table 2, Shop-Made Adapters

Torque Values				
Description	Size	Torque: Ibf·ft (N·m)		
Top Pad to Spring Aligning Setscrew	_	100–150 (135–200)		
Top Pad Nut	_	275–400 (375–542)		
Spring Pin Locknut	1/2–13	45–63 (61–85)		
Torque Rod Straddle Mount Nut	5/8-11	190 (260)		
Torque Rod Stud Locknut	1-1/4-12	175–225 (235–305)		
Saddle Cap Stud	7/8–14	55–65 (75–90)		
Saddle Cap Locknut	7/8–14	225–275 (305–373)		

## **Specifications**

Torque Values				
Description	Size	Torque: lbf·ft (N·m)		
Adapter-Type Beam End Locknut	3/4–16	210–240 (285–325)		
Tube-Type Beam End Nut	2-1/2-12	375–425 (508–576)		
Chrina Contar Balt	7/16–20	50-60 (70-80)		
Spring Center Bolt	1/2–20	65–75 (90–100)		
Rebound Spacer Locknut	1/2–13	38–45 (51–61)		
Spring Alignment Clip	_	15 (20)		
Fore and Aft Torque Rod Mount Nut	_	95 (130)		

**Table 3, Torque Values**