SERVICE MANUAL SECTION

SPRING ASSEMBLIES AND SHOCK ABSORBERS

s03004r, Formerly CTS-5044R

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DESCRIPTION

SPRING ASSEMBLY DESCRIPTION

International uses the following spring assemblies on their vehicles.

CONSTANT RATE SPRINGS

Constant rate springs (Figure 1) are leaf-type springs that have a constant rate of deflection.

NOTE – Example of Constant Rate of Deflection - If 500 pounds will deflect the spring leaves 1 inch (25.4 mm), 1,000 pounds will deflect the same spring leaves 2 inches (50.8 mm). This shows that the rate of deflection is constant.

Constant rate springs mount on the axle with U-bolts, nuts and washers. The front end of the spring mounts to a stationary spring bracket, and the rear end mounts to a spring shackle. This hinged shackle allows for variations in spring length during compression and rebound.

Constant rate springs are used on front and rear axle applications of International vehicles.

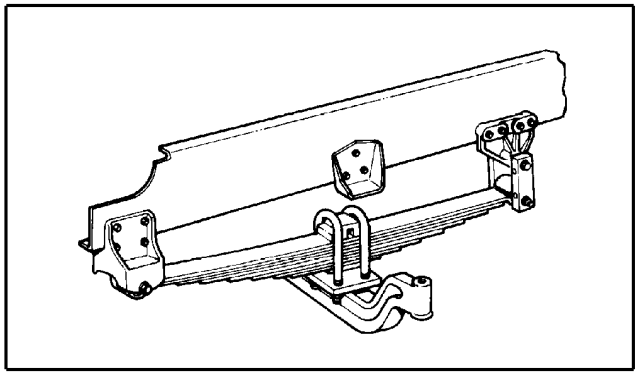

Figure 1 Constant Rate Spring For Front Axle Application

AUXILIARY SPRINGS

Auxiliary springs are leaf-type spring assemblies used on vehicles for heavy loads. They are usually mounted on top of the rear spring assemblies. The auxiliary springs take part of a load by contacting special brackets on the frame rail slides when the load is heavy enough to compress the rear springs to the point of contact.

Figure 2 illustrates an auxiliary spring assembly with a Vari-Rate Spring.

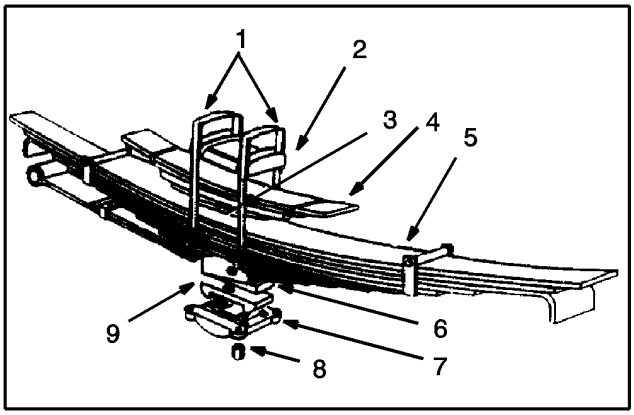

Figure 2 Vari-Rate Spring With Auxiliary Spring Assembly, For Rear Axle Application

1.U-BOLTS
2. U-BOLT SEAT
3. SPACER
4. AUXILIARY SPRING
5. CONSTANT RATE SPRING
6. WEDGE
7. U-BOLT PLATE
8. LOCK NUTS U-BOLTS
9. SEAT

TAPERED LEAF SPRINGS

Tapered leaf springs have leaves which are thicker in the center than on the ends. This design requires fewer leaves, resulting in lighter weight.

Tapered leaf springs mount on the axle with U-bolts, nuts and washers. The front end of the spring mounts to a stationary spring bracket, and the rear end mounts to a spring shackle. This hinged shackle allows for variations in spring length during compression and rebound (Figure 3).

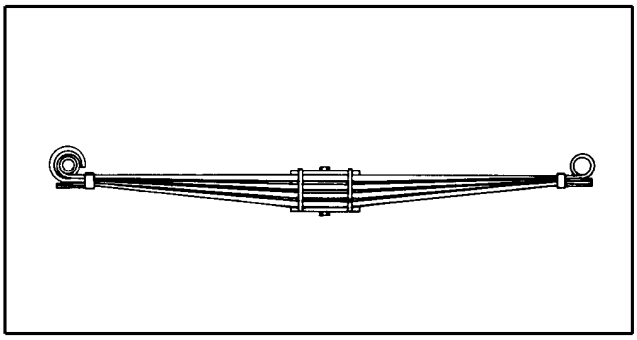

Figure 3 Tapered Leaf Spring Assembly

VARI-RATE SPRINGS

Vari-Rate springs are leaf-type springs that have a variable deflection rate. The variable rate is obtained from the varying effective lengths of the springs, which is accomplished by use of cam-type brackets. As the spring assembly deflects, the points contacted on the brackets are closer to the center of the spring assembly, shortening the effective length (Figure 2 and Figure 4).

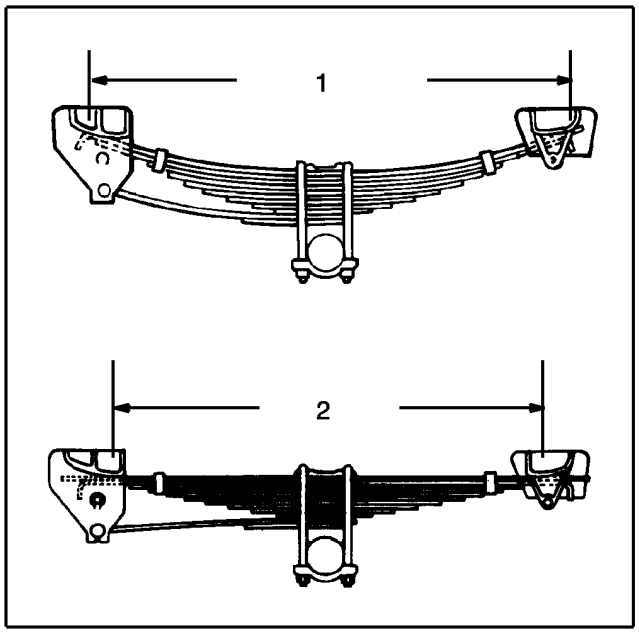

Figure 4 Progressive (Vari-Rate) Spring Assembly

1. UNLOADED EFFECTIVE LENGTH
2. LOADED EFFECTIVE LENGTH

1. MAINTENANCE

1.1. LUBRICATION

Refer to the GROUP 10 - LUBRICATION in the CTS-5000 Master Service Manual for recommended types of lubricants, and the recommended intervals.

1.2. RETIGHTENING U-BOLT NUTS

For both new vehicles and for those having spring service, retighten the U-bolt nuts at the intervals listed below to the values found in the TORQUE CHART.

- Tighten the U-bolt nuts after the vehicle has operated under load for 1,000 miles (1,600 kilometers) or 6 months, whichever occurs first.
- Thereafter, tighten the spring U-bolt nuts every 50,000 miles (80,000 km).

CAUTION – Joint integrity is ensured for U-bolts and nuts in like-new condition if they are tightened at 40% of specifications. When checking the integrity of U-bolts and nuts however, always tighten them to values specified in the TORQUE CHART.

NOTE – Disassemble, clean and lubricate rusty joints to ensure like-new condition.

1.3. WEAR LIMITS FOR REAR SUSPENSION TORQUE LEAF BUSHINGS

The following procedures may be used to determine when Vari-Rate rear suspension torque leaf bushing service is required.

NOTE – The following bushing wear check should be made PRIOR to lubrication.

1. Insert a 12” to 16” (305 to 406 mm) bar between the spring bracket rebound pin and the torque leaf spring eye. Observe movement of the torque leaf spring eye while pushing up and down on the outer end of the bar. If movement of the torque leaf spring eye at the frame mount bracket appears to be more than 1/8 inch (3.2 mm), go to step 2.

   It should be noted that a bar of greater length than 16” (406 mm) could possibly exert undue force causing the spring to be deformed.

2. The only accurate measurement of bushing wear requires removing the spring eye pin, measuring the outside diameter of the pin and the inside diameter of the spring eye bushing (Figure 5). The difference between the two measurements is the amount of clearance between the spring eye bushing and the spring eye pin. If a measurement of .007 to .012 inch (.1778 to .3048 mm) is noted, the bushing is new. A measurement of .080 to .090 inch (2.032 to 2.286 mm) indicates that the bushing should be replaced during the next vehicle service interval; if the measurement is .120 inch (3.048 mm) or more, the bushing should be replaced immediately.

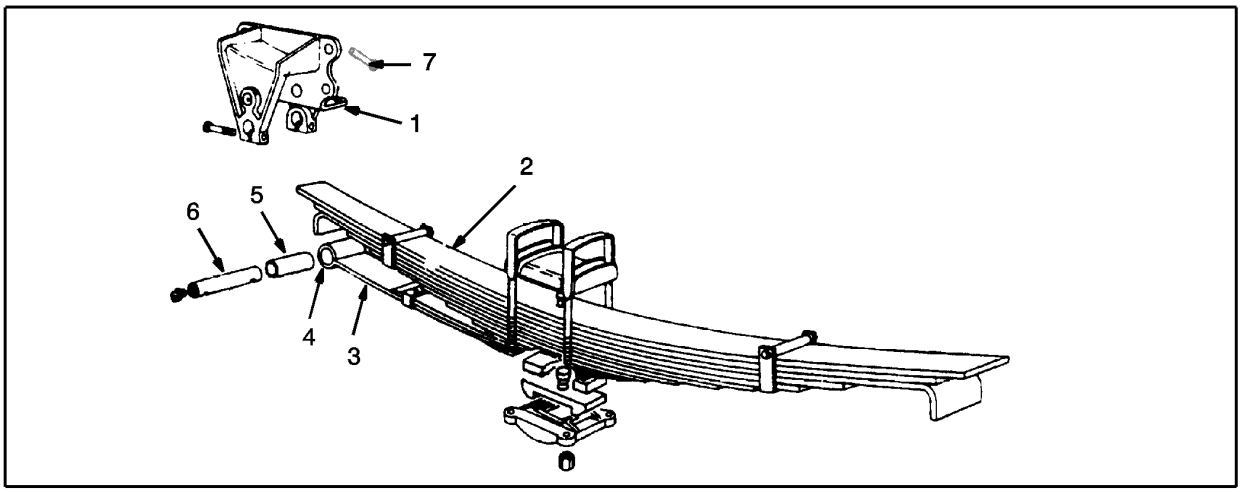

Figure 5 Vari-Rate Spring Suspension

1. SPRING BRACKET
2. SPRING
3. TORQUE LEAF
4. SPRING EYE
5. SPRING EYE BUSHING
6. SPRING EYE PIN
7. REBOUND PIN

2. REMOVE

The exact service procedures will vary for each type of spring. A general guideline follows:

1. Place a floor jack under the vehicle frame, and raise the vehicle enough to relieve all the weight from the spring to be removed.

2. When removing the rear spring to have better access to spring, remove rear wheels from the axle side being serviced. Refer to GROUP 17 - WHEELS, RIMS AND TIRES in the CTS-5000 Master Service Manual.

3. Remove shock absorbers (where used).

4. Remove the U-bolts and retaining nuts, the spring bumper and retainer and the spring bottom plate.

5. Remove the lubricators (not on springs having rubber bushings).

6. Remove nuts from the spring shackle pins and the bracket pins.

7. Slide the spring off the bracket pin and shackle pin.

3. DISASSEMBLE

NOTE – If only the spring eye bushing is to be replaced, position spring in shop press to remove bushing. If a press is not available, follow step 1 below. If the complete spring assembly is going to be disassembled, remove bushing. After spring has been disassembled, it is easier to handle the spring leaf.

1. Clamp the spring end in a vise and remove the old bushing from the spring eye to disassemble spring.

2. Reposition the spring assembly in a vise so that it is clamped near its center.

3. If bolted-type rebound clips are used, remove the nuts, bolts and spacers.

4. If clinch-type rebound clips are used, bend the clip tabs up, being careful not to break them.

   NOTE – Heat clinch-type rebound clips with a torch to help avoid breaking them.

5. Remove the retaining nut from the spring center bolt.

6. Release the vise, letting the spring leaves separate. Remove the spring assembly from the vise, and remove the center bolt from the leaves.

4. CLEAN AND INSPECT

1. Wash all the spring parts, except rubber spring bushings, in cleaning solvent, or use steam cleaning equipment to remove grease and scale.

   NOTE – Use a wire brush to easily remove dirt.

> **CAUTION – Do not immerse rubber spring bushings in cleaning solvent unless you plan to replace them. Use a non-petroleum base rubber lubricant on a clean cloth to wipe rubber parts clean.**

2. Inspect all spring leaves for breakage and cracks. Compare the arch of leaves with new leaves. Replace any leaves that are broken, cracked or flattened out.

3. Replace spring pins that are worn, corroded or cracked.

4. Replace spring eye bushing and spring shackle bushing if they are defective.

5. Check spring frame brackets for cracks, and for wear around mounting bolt or rivet holes. Replace brackets that are damaged.

6. Replace the spring center bolt with every overhaul.

5. ASSEMBLE

NOTE – If spring bushing is to be replaced, use press to install new bushing in main leaf before assembling spring.

1. Lightly lubricate the spring leaves with a thin coat of graphite grease. Place the leaves in the proper order and align center bolt hole with a long drift.

2. Compress the spring leaves enough to install the center bolt and nut.

3. Place the spring assembly in the vise and fully compress the leaves. Tighten center bolt nut to 40 ft-lbs. (54 N•m). Cut off excess bolt leaving about 1/4 inch (6.35 mm) from center bolt nut.

> ⚠ **WARNING – To prevent personal injury when assembling the spring leaves, use "C" clamps or a special fixture to hold the leaves in place.**

4. Align the leaves by tapping the edges with a hammer, then position the rebound clips on the assembled spring leaves.

5. If bolted-type clips are used, install the spacers, bolts and nuts. Tighten the nuts enough to hold the leaves in alignment, but not enough to restrict free movement of the leaves.

6. If clinch-type clips are used, bend ends of the clips down on the top leaf. Do not restrict free movement of the leaves.

6. INSTALL

The exact installation procedures will vary for each type of spring. A general guideline follows:

1. Before assembling the spring, clean and lubricate all the hardware. Most often the pivoting end of the spring should be fastened to the bracket first. Then align the shackle end to the other spring bracket.

2. Using floor jack, raise axle assembly enough to align center bolt head into axle housing spring pad guide hole.

3. When installing the U-bolts to the axles, do not final-tighten the retaining nuts to values specified in the TORQUE CHART until you have put the springs under normal load.

4. Spring failures may occur at the center bolt if the U-bolt nuts are loose. Retighten these bolts at the intervals specified under MAINTENANCE .

7. SHOCK ABSORBERS

7.1. DESCRIPTION

Shock absorbers control vehicle body sway, and also eliminate excessive tire wear, front wheel shimmy and spring breakage. They improve the ride qualities, and are especially effective when the vehicle is empty or only partly loaded.

The direct-acting type shock absorber has sealed construction and requires no periodic maintenance (Figure 6).

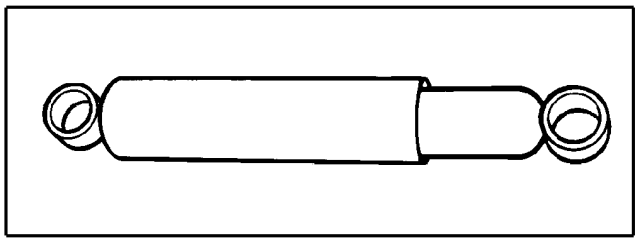

Figure 6 Direct-Acting Shock Absorber

7.2. INSPECT

Inspect direct-acting shock absorbers every 50,000 miles (80,000 km) to be sure they are functioning satisfactorily, that the bushings are not worn, and that the outer jacket is not damaged by flying stones or debris from the road.

NOTE – If a shock absorber is leaking, fails to operate, or is noisy, replace the complete unit. Direct-acting shock absorbers are not refillable; the only service is replacement.

7.3. MOUNTING AND LINKAGE

1. Check for and correct loose, bent or broken shock absorber mountings and linkage when servicing the suspension system.

2. Inspect all rubber bushings and grommets to see that they prevent metal-to-metal contact.

8. TROUBLESHOOTING

The following list includes the most frequent causes of trouble in suspension systems.

Several of these complaints are also commonly found in axle and wheel alignment troubleshooting.

Table 1 Troubleshooting

Condition	Possible Cause
Vehicle wanders.	a. Front axle shifted on springs. b. Broken spring. c. Out of alignment.
Vehicle bottoms.	a. Overloading. b. Broken spring leaves.
Vehicle lopsided.	a. Broken spring leaves. b. Wrong spring installed. c. Weak spring.
Frequent spring breakage.	a. Overloading or severe operation. b. Loose U-bolts. c. Defective shock absorbers. d. Rusted spring pins.
Noisy springs.	a. Loose U-bolts. b. Loose rebound clips. c. Loose shackles. d. Worn shackle bushings. e. Loose, bent or broken spring brackets. f. Worn spring pins.
Erratic steering when braking.	Loose U-bolts.

9. TORQUE CHART FOR ASSEMBLY OF SUSPENSION U-BOLTS

Table 2 Recommended Wrench Torque

U-Bolt Diameter (In.) and Thread	Rolled Thread U-bolts					
	All Steel Locknut **All Steel Locknut** 		All Steel Flange Nut **All Steel Flange Nut** 		Nylon Insert Nut **Nylon Insert Nut** 	
	Ft-Lbs.	N•m	Ft-Lbs.	N•m	Ft-Lbs.	N•m
1/2-20	50 - 60	68 - 81	65 - 80	88 - 109	—	—
5/8-18	105 - 125	142 - 170	130 - 160	176 - 217	—	—
3/4-16	237 - 292	321 - 396	260 - 300	353 - 407	—	—
7/8-14	—	—	—	—	260 - 300	353 - 407
1-14	—	—	—	—	325 - 400	441 - 543