

# **SERVICE MANUAL**

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## **SERVICE MANUAL SECTION**

### **INTERNATIONAL RIDE OPTIMIZED SUSPENSION (IROS)**

**Truck Model: 4000**

**Truck Model: 4200**

**Truck Model: 4300**

**Truck Model: 4400**

**Truck Model: 7000**

**Truck Model: 8000**

**Truck Model: 9000i**

**Unit Code: 14UNN**

**Unit Code: 14UNM**

**Unit Code: 14UNL**

**Unit Code: 14UNH**

**Unit Code: 14TBJ**

**Unit Code: 14TBG**

**Unit Code: 14TBH**

**Unit Code: 14TBK**

**Unit Code: 14TBL**

**Unit Code: 14TBM**

**Unit Code: 14TBN**

**s03012**

**04/15/2002**

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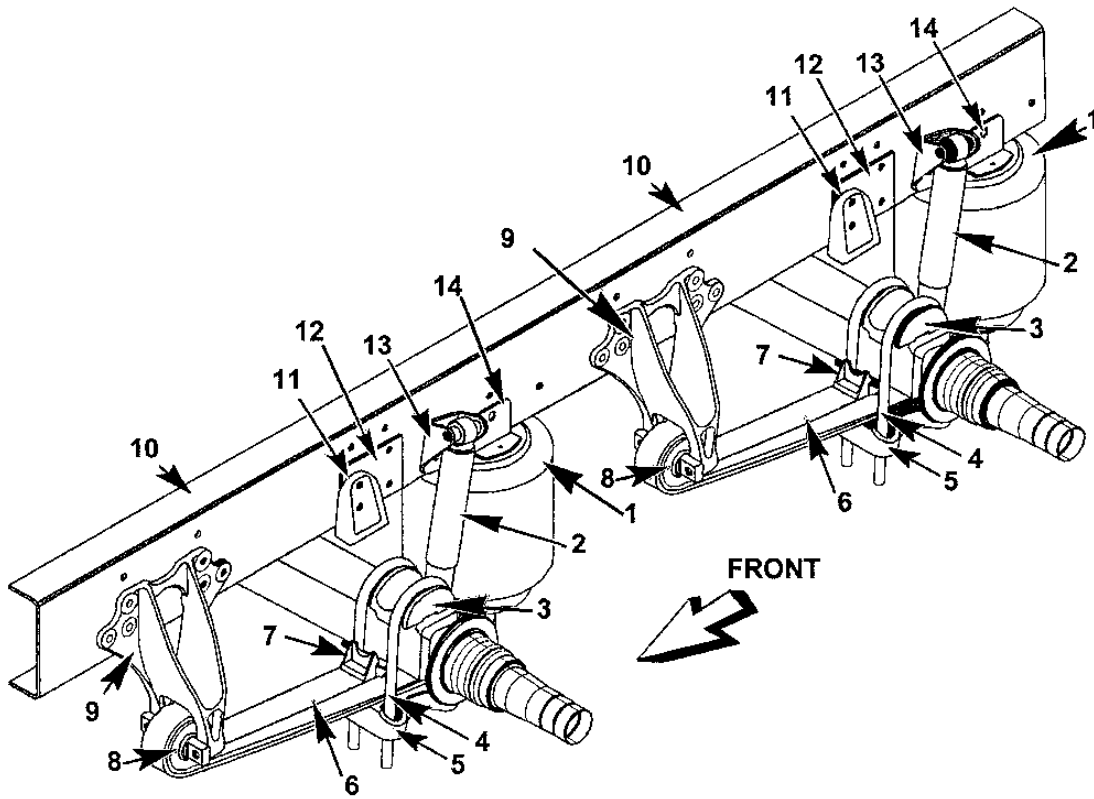


## DESCRIPTION

The air ride suspension is the ultimate in smooth, shock and vibration-free ride with a preset constant frame height.

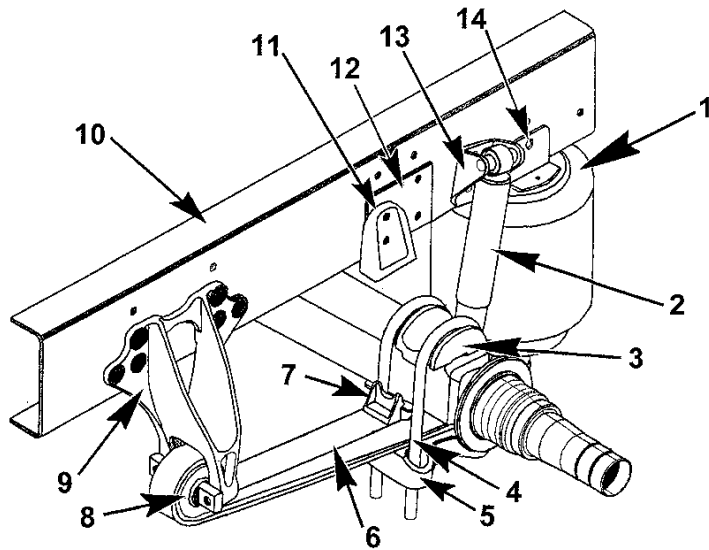
The air springs on the air ride suspension take the place of steel springs, which means there is no inter-leaf friction to overcome. Thereby, minimum road shock is transferred to the frame, cargo and driver (Figure 1 and Figure 2).

The air ride suspension adjusts to load changes automatically, providing a low rate suspension with a light or no load condition, and a higher rate suspension with heavier loads. The major components of the air suspension system, whether used on single or tandem axles are as follows:



**Figure 1 Air Suspension (6X4)**

1. AIR SPRING
2. SHOCK ABSORBER
3. UPPER U-BOLT AXLE SEAT
4. U-BOLTS
5. LOWER U-BOLT PLATE
6. TAPERED LEAF SPRING
7. AXLE SEAT
8. BUSHING
9. SUSPENSION MTG BRACKET
10. FRAME RAILS
11. AXLE STOP
12. REINFORCEMENT PLATE
13. SHOCK ABSORBER FRAME MTG BRACKET
14. AIR SPRING MOUNTING BRACKET



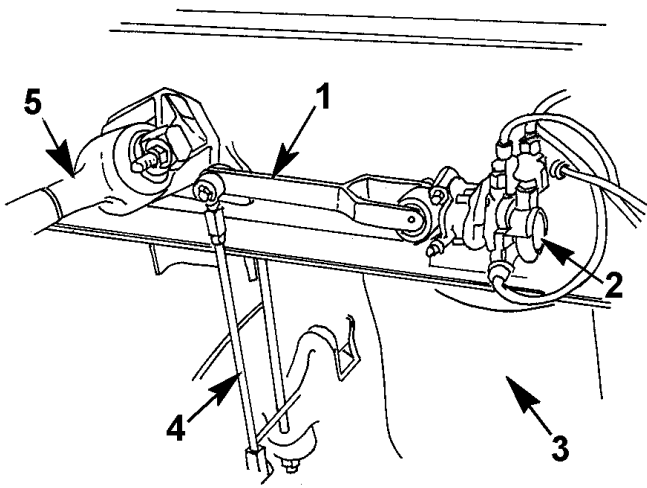
**Figure 2 Air Suspension (4x2)**

1. AIR SPRING
2. SHOCK ABSORBER
3. U-BOLT/ AXLE SEAT
4. U-BOLTS
5. LOWER U-BOLT PLATE
6. TAPERED LEAF SPRING
7. AXLE SEAT
8. BUSHING
9. SUSPENSION MOUNTING BRACKET
10. FRAME RAIL
11. AXLE STOPS
12. REINFORCEMENT PLATE
13. SHOCK ABSORBER UPPER MTG BRACKET
14. AIR SPRING MOUNTING BRACKET

## **1. HEIGHT CONTROL VALVE**

### **1.1. DESCRIPTION**

The height control valve (Figure 3) is the brain of the air suspension and is sensitive to height. When properly adjusted it will provide and maintain ride height.

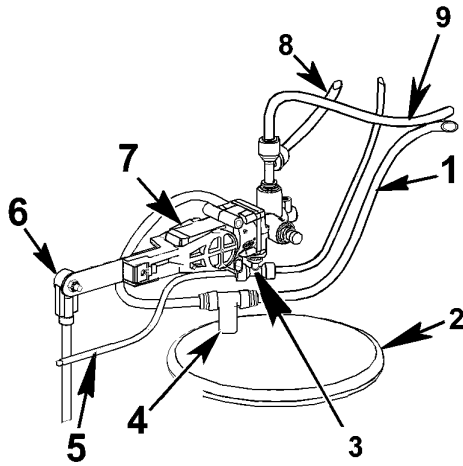


**Figure 3 Height Control Valve System Components**

1. CONTROL VALVE LEVER
2. HEIGHT CONTROL VALVE
3. AIR SPRING
4. HEIGHT CONTROL ADJUSTMENT ROD
5. TORQUE ROD MOUNTING

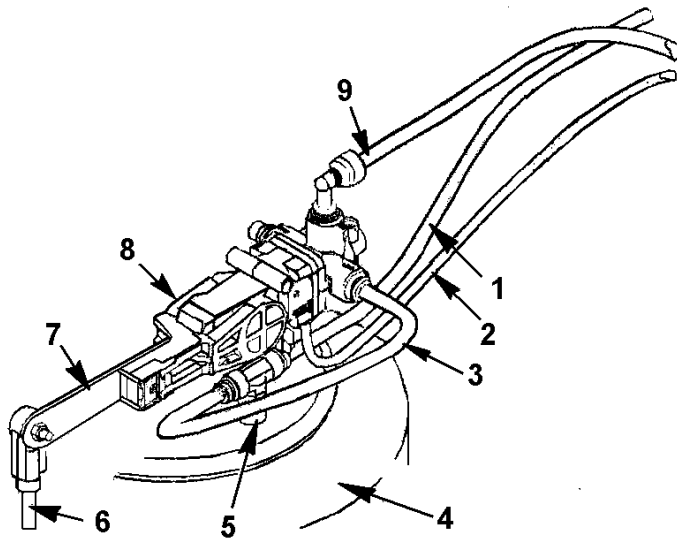
The height control valve (Figure 3) is mounted forward of the front axle on the tandem axle assembly, drivers side frame rail. The valve has a lever arm connected to the forward axle assembly with a vertical linkage rod. This height control valve lever is sensitive to frame height thus providing automatic filling or exhausting of the air springs maintain the vehicle ride height.





**Figure 4 Height Control Valve (Mounted On Curb Side) For Dual Ride Height Feature**

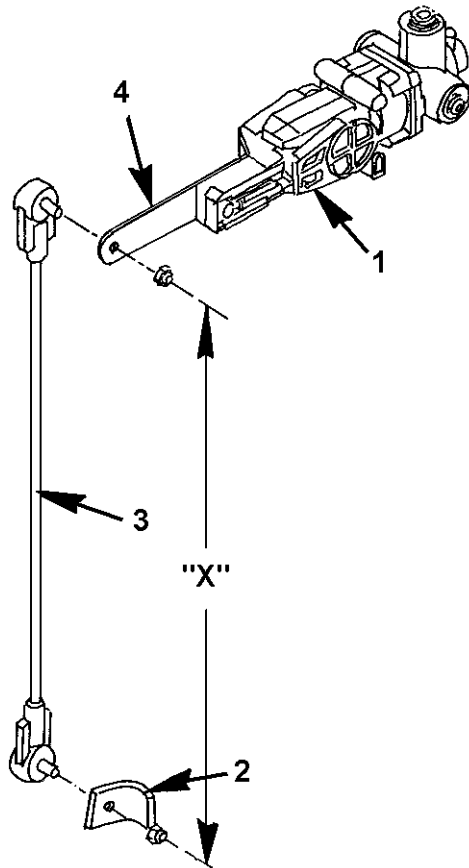
1. AIR LINE
2. AIR SPRING
3. PILOT VALVE TEE
4. SPRING FILL TEE
5. PILOT AIR SUPPLY LINE
6. HEIGHT CONTROL ROD
7. HEIGHT CONTROL VALVE
8. HEIGHT CONTROL VALVE CROSS FEED AIR LINE
9. MAIN FEED AIR LINE SUPPLY



**Figure 5 Height Control Valve (Mounted On Curb Side Rail)**

1. AIR SPRING FILL LINE (REAR) LINE
2. DUMP PILOT LINE
3. AIR SPRING SUPPLY LINE (PRE-FORMED)
4. AIR SPRING
5. TEE
6. HEIGHT CONTROL ROD
7. HEIGHT CONTROL VALVE
8. AIR LINE MAIN FEEDS (VALVE SUPPLY LINE)

Place valve arm in neutral position (on center-indent) (Figure 6) to automatically return the valve to a closed position. The height control valve is closed in the neutral position.



**Figure 6 Height Adjustment Valve And Rod**

1. HEIGHT CONTROL VALVE
2. LOWER ROD MOUNTING BRACKET
3. HEIGHT CONTROL ROD
4. VALVE CONTROL LEVER
- "X". ROD LENGTH (SEE CHART)

## 1.2. OPERATION

Figure 6 illustrates the height control valve in the neutral (closed position). At this point, the lever is parallel to the ground and the air suspension has been properly inflated to level the vehicle. No air can pass through the valve at this time.

When a load is applied, such as coupling a trailer to the tractor, the frame lowers. The lever is moved through an angle above horizontal and the valve opens. As air passes through the valve and the air suspension inflated, the frame resumes its level attitude.

The frame rises when the trailer is uncoupled. The lever moves through an angle below horizontal and once the time delay is surpassed, the valve exhausts air until the frame once again resumes its level attitude.

### 1.3. SERVICE CHECKS (VALVE ON TRUCK)

Often a valve is unnecessarily replaced. There are basic steps to be performed to determine if the valve is defective or if proper adjustment has not been performed. To determine the status of a valve, perform the following service checks:

1. Remove cotter pin and washer from upper link. Loosen the clamp and detach the vertical linkage from the height control lever arm.
2. Assure that brake air reservoir pressure is at governor cutoff pressure or about 100 psi (689.5 kPa).
3. Raise height control valve lever approximately 45 degrees above horizontal. Air pressure at the air springs should begin to increase within 15 seconds which will cause the truck frame to rise. This can easily be detected by feeling the shock absorber extend at the dust tube to shock absorber body joint.
4. Lower height control valve lever approximately 45 degrees below horizontal. Air pressure at the air springs should begin to decrease. Let air escape until air spring height is approximately 10 inches (254 mm).
5. Raise valve lever to 45 degrees above horizontal again, until air spring height is to dimension shown in RIDE HEIGHT DIMENSIONS. Refer to "X" dimension shown in Figure 6. Release the valve lever.
6. Check valve body and all tubing connections and air springs for air leaks with soapy water. Repair as necessary.
7. Recheck air spring height 15 minutes after step 5 above has been completed. If the air spring height has changed, return to step 5 and repeat until the correct height is obtained.
8. If no leaks are found, and the height control valve functions as described above, and air spring height is at the specified dimension after 15 minutes, the valve is functioning properly.
9. Refer to RIDE HEIGHT ADJUSTMENT and perform the adjustment.

### 1.4. RIDE HEIGHT ADJUSTMENT

1. If the air spring height **exceeds** specifications, loosen the bolt that holds the lever arm to the height control valve. Pivot the loosened lever arm down and exhaust air from the suspension, lowering the chassis to some point below the correct air spring height. Final air spring height must be achieved by adding air to the suspension, not exhausting. Add air until the air spring reaches the proper length according to the chart specifications. When the correct air spring length has been achieved, retighten the lever arm bolt.
2. If the air spring height **is less** than specifications, loosen the lever arm to the height control valve. Push the lever up and add air to the suspension, raising the chassis, until the air spring reaches proper length according to the chart specifications. When the correct air spring length has been achieved, retighten the lever arm bolt.

**IMPORTANT – Air spring height and chassis ride height are not the same thing.** Specifications for air spring height (length) have been calculated to result in the correct chassis ride height. When you have adjusted the air spring height to chart specifications, the chassis ride height is also correct.

## 1.5. ROD CUTTING INSTRUCTIONS

Before any measurements are taken for determining the correct control rod length, check for proper vehicle ride height according to procedures explained in your Original Equipment Manufacturers (OEM) service manual. If the chassis height is not correct, make adjustments necessary to bring it into compliance with the manufacturers specifications.

After the correct chassis ride height specification has been confirmed or adjusted, use a tape measure or steel rule and measure the center-to-center distance (X) (Figure 6, Item "X" ) between the attachment hole in the ride height control valve actuating lever and the attachment hole in the lower linkage mounting bracket (Figure 6). This center-to center dimension will be your "X" dimension.

### To calculate the proper final cut length of the new control rod:

Subtract 1–5/8 (1.625) inches from the "X" dimension (  $X - 1.625$  )

### Example:

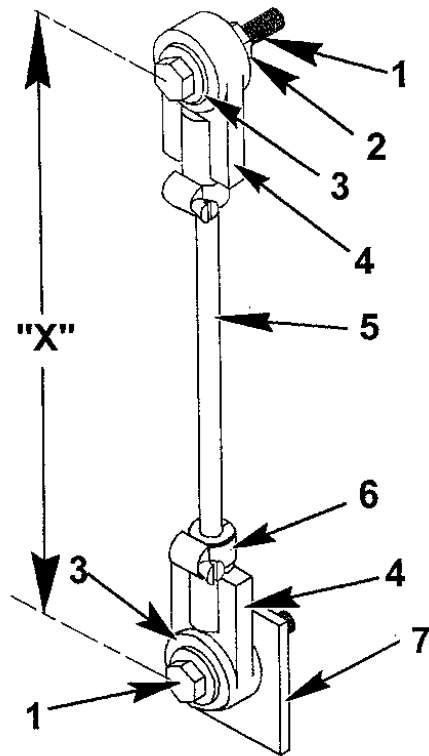
If the center-to-center measurement is 16– 1/2 inches (  $X = 16.5$  ).

16–1/2 inches minus 1– 5/8 inches = 14– 7/8 inches.

The length of the rod after cutting should be 14– 7/8 inches long.

### Final Assembly Instructions

1. The new linkage must be assembled using only those parts supplied with this kit. Substituting any other parts will void the manufacturers warranty.
2. Remove all burrs and sharp edges from both ends of the rod.
3. Install a rubber rod end onto one end of the rod. Make sure it is pushed on until it bottoms out on the rod.
4. Slide two loose hose clamps onto the opposite end of the rod.
5. Install the remaining rubber rod end according to step 3.
6. Rotate the rubber rod ends to align the mounting bolt holes so they are aligned identically with one another.
7. Place one hose clamp on each rubber end as shown in Figure 7, and torque the clamps to 15 lbf-in.
8. Measure the center-to center distance to insure that it is equal to the "X" dimension.
9. Attach one end of the completed rod assembly to the ride height control valve arm and the opposite end to the lower mounting bracket. Tighten both nuts to 60–80 lbf-in.
10. Examine the linkage for any valve lever interference through the entire range of suspension travel.

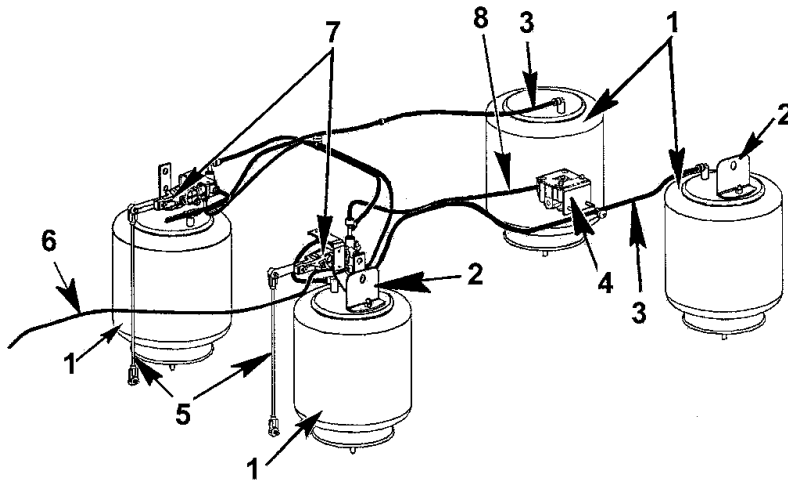


**Figure 7 Height Control Rod**

1. SHOULDER BOLT 0.34 X 2- 5/32 LONG
2. PREVAILING TORQUE LOCK NUTS
3. FLAT WASHER
4. RUBBER ROD ENDS
5. STEEL ROD .25" DIA.
6. HOSE CLAMPS
7. AXLE BRACKET

## 2. AIR LINES

Air is supplied to the height control valve (Figure 6) from the air solenoid valve. There are two delivery ports in the height control valve supplying air to the right and left air springs.



**Figure 8 Air Spring Hosing And Valves**

1. AIR SPRINGS
2. AIR SPRING CHASSIS MOUNTING BRACKET
3. AIR SUPPLY TO REAR AIR SPRINGS
4. SOLENOID PACK / RELAY VALVE
5. HEIGHT CONTROL RODS
6. PILOT SUPPLY LINE
7. HADLEY HEIGHT CONTROL VALVE
8. CROSS FEED LINE
9. PILOT CROSS FEED LINE
10. MAIN AIR SUPPLY

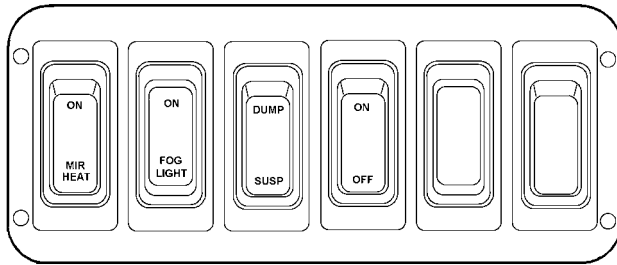
Air lines between the front and rear axle air springs provide air flow transfer between axles to maintain constant frame rail height and equal load distribution between the axles (Figure 6).

### 3. SUSPENSION DUMP FEATURE

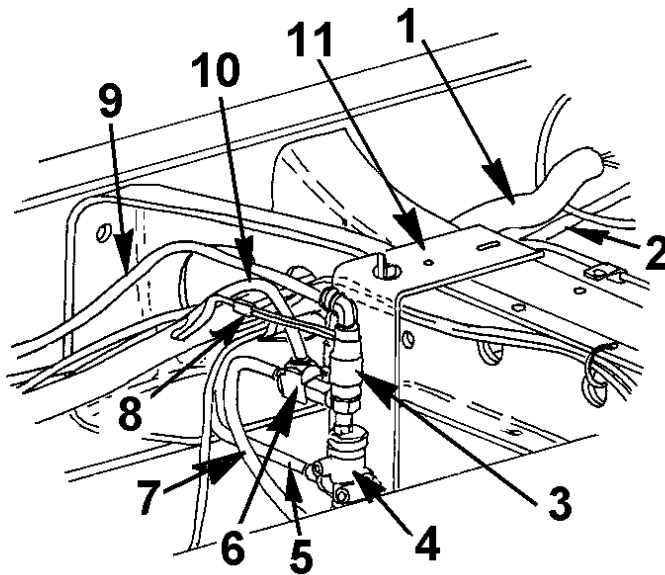
#### 3.1. DESCRIPTION

The Suspension Dump Feature controls permit the driver to deflate the air springs from the cab when hooking up to a trailer. This operation is done by a solenoid (Figure 8) switch in the 4200, 4300 and 4400 series vehicles located in the center dash panel.

In the 9000 series vehicle cab operations an "air suspension cab control valve". This control valve will be located on the lower dash panel. This control will be in the RUN position. To dump the air from the springs, place the valve in the DUMP position. The switch has a guard to prevent an unintentional air dump. **Do not remove the guard.** Refer to Figure 12, Item 3.



**Figure 9 System Dump Feature Controls, 4200, 4300 And 4400 Series Typical**



**Figure 10 Air Suspension Solenoid Switch (Single / Dual Split)**

1. REAR CHASSIS HARNESS
2. AIR SUPPLY TO TANK SOLENOID
3. AIR SOLENOID VALVE
4. SV1 SWITCH
5. PILOT VALVE TO HEIGHT CONTROL VALVE
6. TEE
7. PILOT AIR SUPPLY TO VALVE / RELAY VALVE
8. SOLENOID HARNESS CONNECTION
9. LEFT SUSPENSION AIR BAG TO AIR SOLENOID SUPPLY
10. AIR SUPPLY LINE FROM TANK TO SOLENOID
11. SOLENOID MOUNTING BRACKET ON CHASSIS CROSSMEMBER

**NOTE – Location of switches as shown in Figure 10 may vary with truck options.**



### 3.2. OPERATION

With the "Suspension Dump Feature" the air piping for the system includes an air switch (Figure 10 and Figure 11).

1. The control valve in the instrument panel has two positions. In the RUN position, the valve is closed. Placing the valve in the DUMP position opens the valve and sends air pressure to the leveling valve.
2. The air supply to the height control valve, air comes from the pressure protection valve (9000 series). Air is delivered from the height control valve which distributes air to the right and left air spring.
  - a. Placing the "Suspension Dump Feature" in the DUMP position directs air to the valve causing it to stop the air supply to the air springs and dump the air from the air springs.
  - b. Placing the "Suspension Dump Feature" back into the RUN position returns air spring control to the height control valve and the air springs will inflate until the vehicle is at ride height.
  - c. The air suspension dump valve must always be in the RUN position when operating with a trailer or in a bobtail (tractor only) mode.

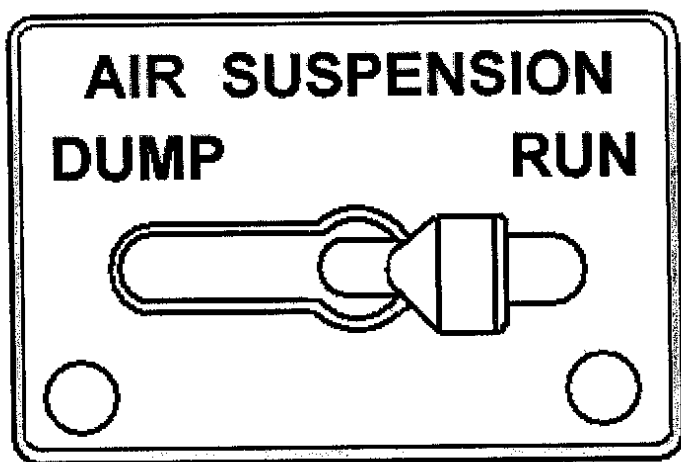
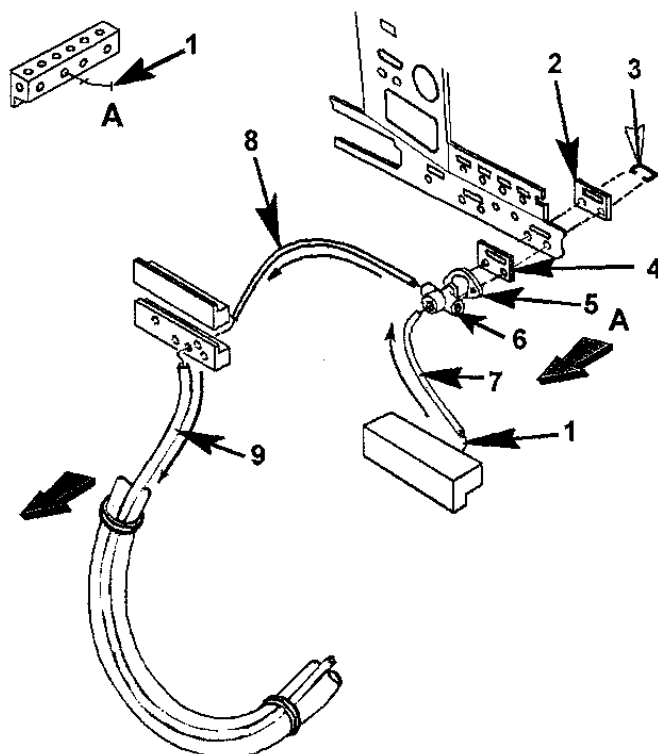


Figure 11 System Dump Feature (9000 Series)



**Figure 12 Air Spring Piping With System Dump Feature**

- A. VIEW IN DIRECTION OF ARROW "A"
- 1. AIR SUPPLY PORT
- 2. PRODUCT GRAPHIC
- 3. CONTROL VALVE GUARD
- 4. SWITCH GROUNDING
- 5. AIR SUPPLY VALVE
- 6. PLUG
- 7. 3/8 INCH BLACK TUBE (SUPPLY)
- 8. 3/8 INCH BLACK TUBE (DELIVERY)
- 9. 3/8 INCH BLUE TUBE

## 4. MAIN SUPPORT MEMBER

The main support member acts as a lightweight one-piece beam to transfer the load directly to the axle and also absorb road shock, starting and braking loads.

### 4.1. MAIN SUPPORT MEMBER REMOVAL



**WARNING – A jack must never be used alone to support vehicle while under chassis service is being performed. The jack may lower and serious personal injury could result. Always support vehicle with floor stands.**

1. When replacing the MAIN SUPPORT MEMBER, use only approved International parts.
2. Unload vehicle and block wheels to prevent vehicle from rolling. Support vehicle with floor stands.
3. Exhaust air from vehicle and suspension system.
  - a. Automatic control-height control valve- disconnect link at lower connection, then rotate arm to exhaust (approximately 45 degrees down) position.
  - b. Disconnect air supply line from air spring.
  - c. Exhaust air from reservoir.
4. Remove air spring assembly.
5. Support the rear axle assembly before proceeding to remove shock absorber.
6. Loosen and remove u-bolt nuts (Figure 18) from axle brackets and taper leaf spring lower u-bolt plate.
7. Remove u-bolts (Figure 19).
8. Remove the upper shock absorber mounting bolt from upper shock mounting bracket (Figure 20).
9. Remove lower shock absorber mounting bolt, and remove shock absorber (Figure 21).
10. With rear portion of tapered leaf spring supported, loosen forward tapered leaf spring bolts from chassis mounting bracket, at front bushing.
11. Inspect all parts for wear or damage and replace all hardware if any contamination may exist.

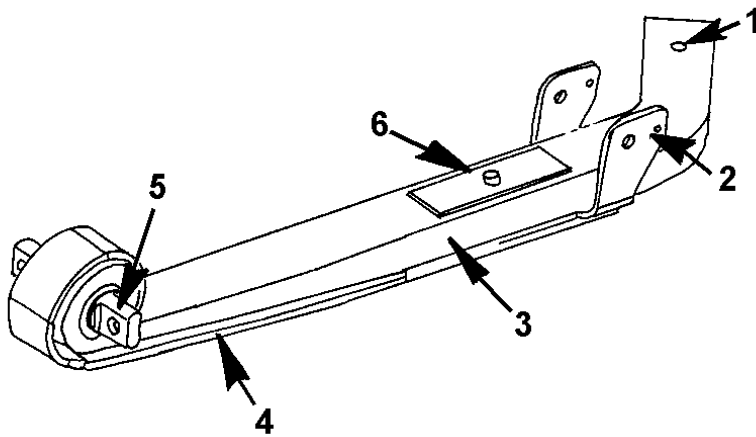
## 4.2. MAIN SUPPORT MEMBER INSTALL

Prior to installing the MAIN SUPPORT MEMBER assembly, a careful inspection of component parts including tapered leaf spring mounting bushing should be undertaken. Only authorized International parts should be used in the installation procedure.

### Main Support Member Installation

1. Locate main support member end with (Figure 13, Item 5) bushing assembly, at the forward suspension mounting bracket (Figure 22, Item 1).
2. Insert bolt and hand tighten.
3. Place axle seat bracket on main support member with alignment pin, axle seat bracket forward mark indicator should be facing in forward direction.
4. Place u-bolts and u-bolt axle top mounting bracket on axle assembly.
5. Install air spring assembly to top bracket mounted on chassis frame (Figure 16, Item 4).
6. Align and install lower u-bolt mounting plate, install u-bolt nuts and hand tighten (Figure 18, Items 2 and 3).
7. Insert mounting nut on air spring threaded stud, hand tighten.

8. Locate and install shock absorber to upper shock absorber mounting bracket, install bolts and hand tighten (Figure 20, Items 1, 2 and 3).
9. Locate and install shock absorber lower bolts at bracket mounted on tapered leaf spring assembly, and hand tighten (Figure 21).
10. Place lower air spring mounting stud in applicable mounting hole in rear of tapered leaf spring (Figure 13, Item 1).
11. Tighten all mounting hardware to appropriate values as indicated on the torque chart.
12. When all torque requirements are met and installations complete, follow procedures for re-inflating suspension to proper ride height. See the first section and appropriate subsection for correct ride height procedures.



**Figure 13 Main Support Member**

1. AIR SPRING LOWER MOUNTING LOCATION
2. LOWER SHOCK ABSORBER MOUNTING BRACKET
3. MAIN SUPPORT MEMBER
4. AUXILIARY LEAF
5. BUSHING
6. AXLE SEAT LOCATOR

## 5. SHOCK ABSORBERS

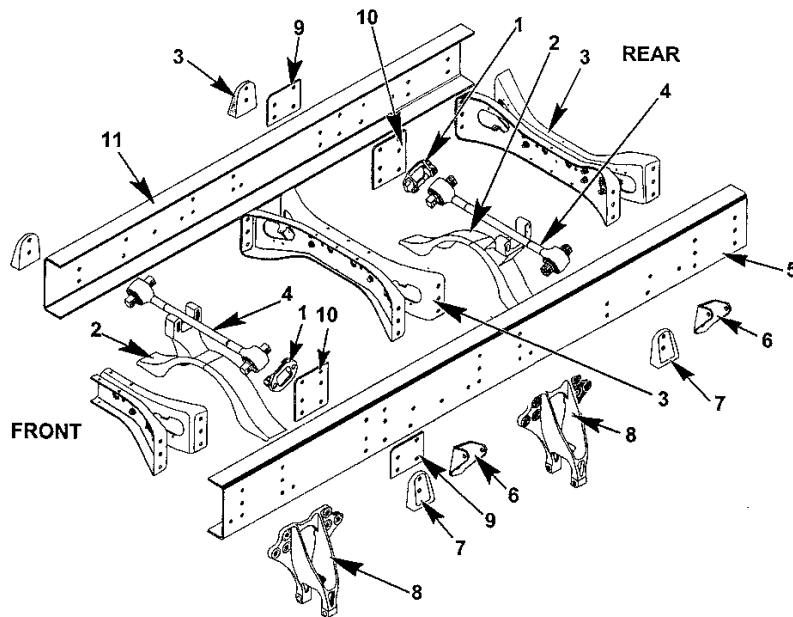
Each axle is controlled by hydraulic shock absorbers (Figure 1, Item 2) which are mounted where shock travel is greatest to provide maximum control.

Remove and install procedures — follow procedures outlined above under MAIN SUPPORT MEMBER REMOVAL and MAIN SUPPORT MEMBER INSTALL.

## 6. TORQUE RODS

Lateral torque rods (Figure 14, Item 4) provide stiffness during cornering of the vehicle.

## 7. REMOVE AND INSTALL



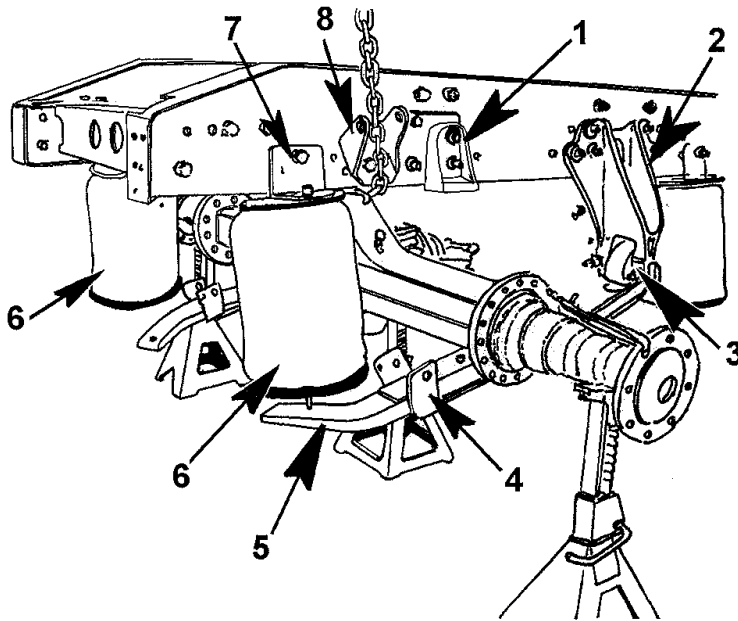
**Figure 14 Forward Rear Springs, Torque Rod, Crossmembers And Mounting — 6x4**

1. TRANSVERSE TORQUE ROD END MOUNTING BRACKET
2. TORQUE ROD MOUNTING BRACKET
3. TRANSVERSE CROSSMEMBER
4. TORQUE ROD ASSEMBLY
5. STREET SIDE FRAME RAIL
6. SHOCK ABSORBER MTG BRACKET (UPPER)
7. AXLE STOP
8. SPRING BRACKET
9. REINFORCEMENT PLATE (ON 55" AND 60" AXLE SPREADS)
10. TORQUE ROD REINFORCEMENT PLATE
11. CURBSIDE FRAME RAIL

Refer to Figure 17 and Figure 18 for assembly detail of 6x4 rear shock absorber removal and installation.

## 7.1. SUSPENSION AIR SPRINGS

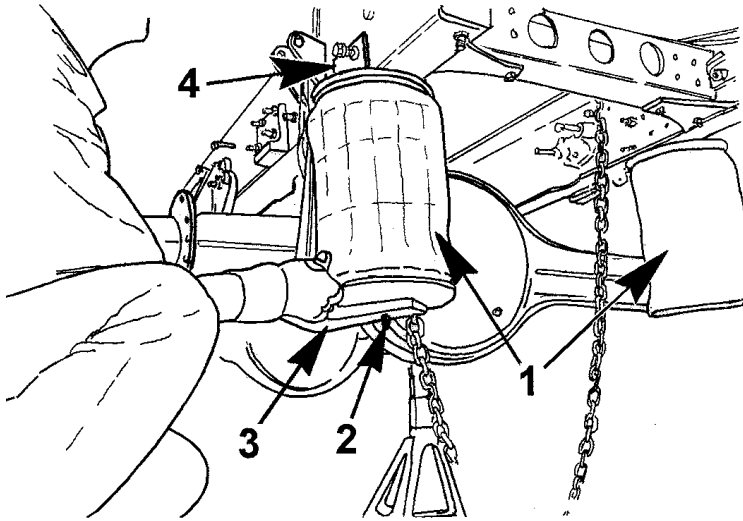
### Removal of Suspension Air Springs



**Figure 15 Air Spring Location And Removal**

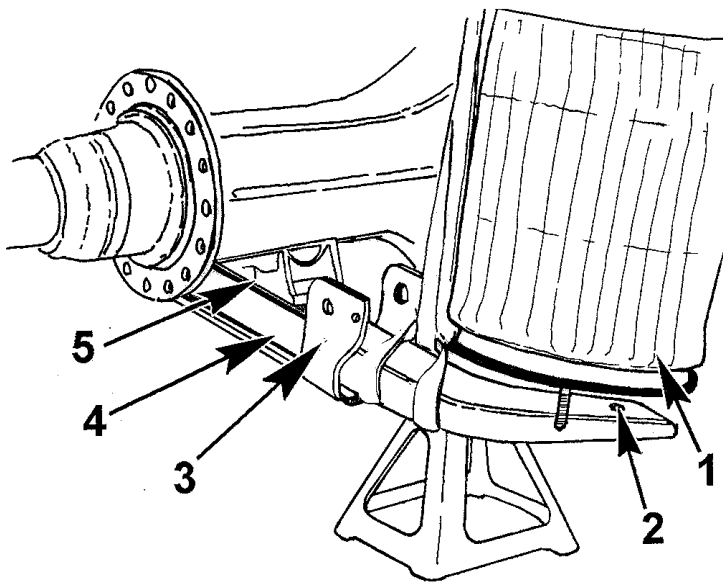
1. AXLE STOP
2. SPRING HANGER CASTING
3. BUSHING
4. LOWER SHOCK ABSORBER MTG BRACKET
5. MAIN SUPPORT MEMBER
6. AIR SPRING
7. AIR SPRING MTG BRACKET
8. UPPER SHOCK ABSORBER MTG BRACKET

1. When replacing air springs, use only approved International parts for vehicle.
2. Unload vehicle and block wheels to prevent vehicle from rolling. Support vehicle with floor stands.



**Figure 16 Air Spring Mounting Points**

1. AIR SPRING
2. LOWER AIR SPRING MOUNTING BOLT
3. TAPERED LEAF SPRING
4. AIR SPRING UPPER MOUNTING BRACKET



**Figure 17 Air Spring Removal**

1. AIR SPRING
2. AIR SPRING MOUNTING HOLE
3. LOWER SHOCK ABSORBER MOUNTING BRACKET
4. TAPERED LEAF SPRING
5. AXLE SEAT



**WARNING – A jack must never be used alone to support vehicle while under-chassis service is being performed. The jack may lower and serious personal injury could result. Always support vehicle with floor stands.**

3. Exhaust air from vehicle and suspension system. Exhaust air by:

**NOTE – Even if air spring has a leak and is deflated, the air must still be exhausted from system.**

- a. Automatic control — height control valve - disconnect link at lower connection, then rotate control arm to exhaust (approximately 45 degrees down) position.
  - b. Disconnect air supply line from air spring.
  - c. Exhaust air from reservoir.
4. Remove air spring assembly.

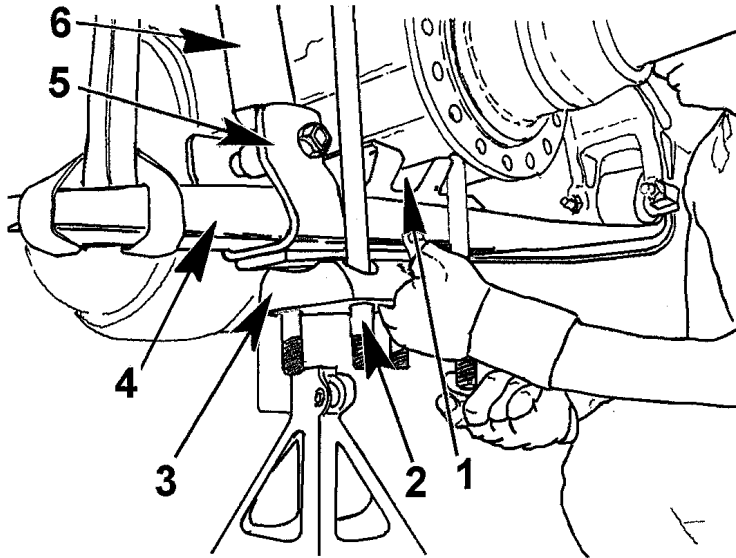
#### **Install**

1. Install replacement air spring assembly and tighten fasteners to specified torque values. Refer to the TORQUE CHART.
2. Connect air line to air spring and install height control valve linkage at lower end.
3. Build vehicle system air pressure to governor cutout pressure and use soap solution to check for leaks.
4. Check for proper ride height adjustment. Refer to RIDE HEIGHT ADJUSTMENT.



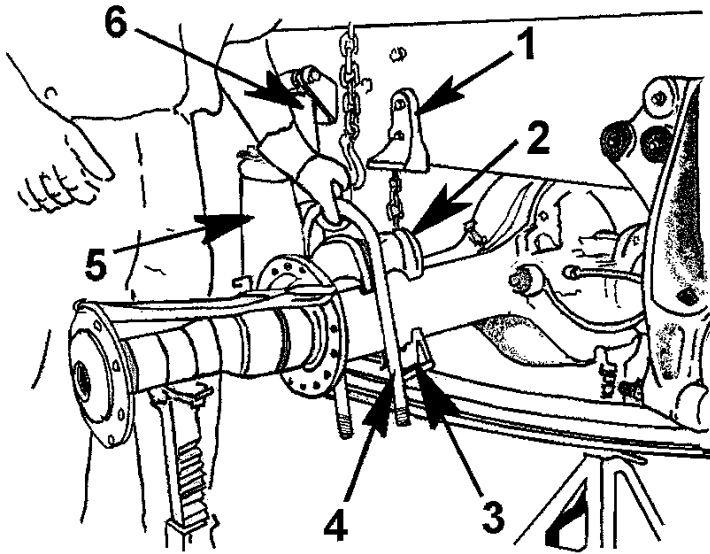
## 7.2. SHOCK ABSORBERS

### Removal Suspension System Shock Absorbers



**Figure 18 U-bolt Removal**

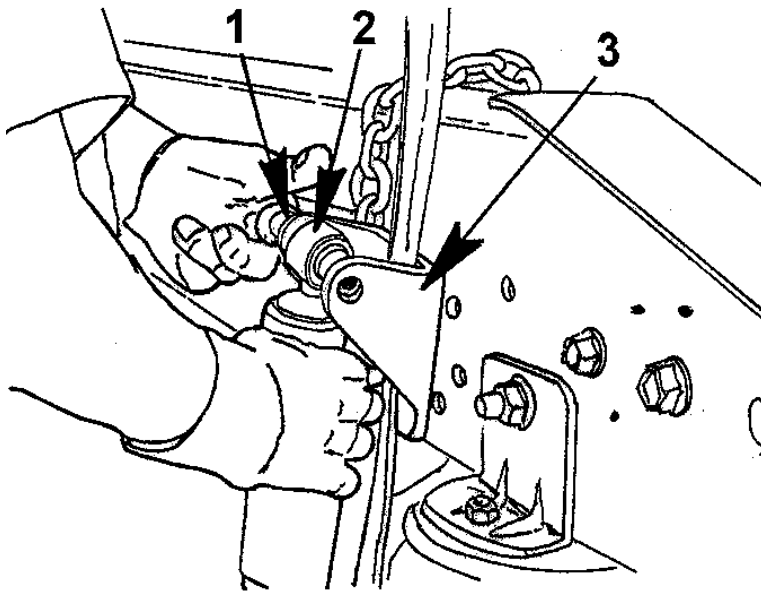
1. AXLE SEAT
2. U-BOLTS
3. U-BOLT LOWER PLATE
4. TAPERED LEAF SPRING
5. LOWER SHOCK MOUNTING BRACKET
6. SHOCK ABSORBER ( PASSENGER SIDE SHOWN)



**Figure 19 Removing U-Bolt**

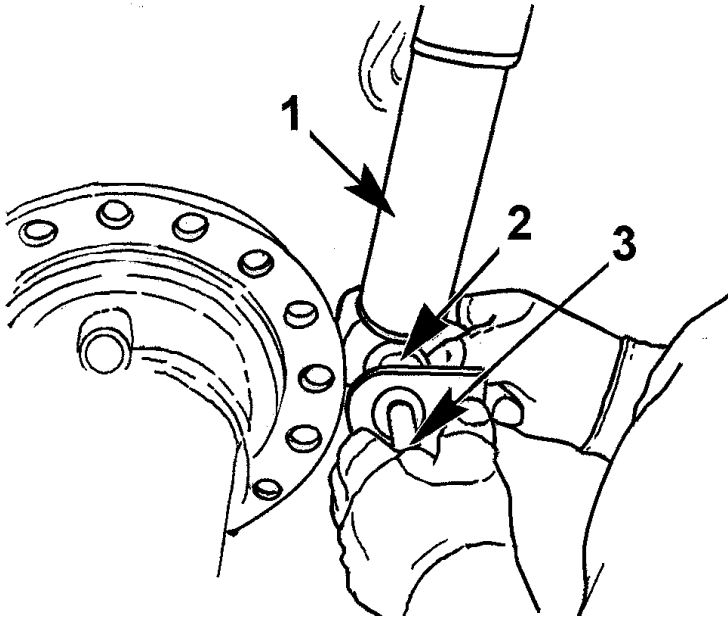
1. AXLE STOP
2. U-BOLT SADDLE SEAT
3. AXLE SEAT
4. U- BOLT
5. AIR SPRING
6. SHOCK ABSORBER

1. Unload vehicle and assure that frame is at approximate ride height so that tension is relieved on shocks.
2. Remove upper and lower shock mounting fasteners and remove shock absorber.

**Install Shock Absorber****Figure 20 Upper Shock Mounting Bolt Removal/ Install**

1. SHOCK ABSORBER MOUNTING BOLT
2. SHOCK ABSORBER
3. UPPER SHOCK MOUNTING BRACKET

1. Position shock absorber and install mounting bolts.



**Figure 21 Lower Shock Removal/ Install**

1. SHOCK ABSORBER
2. LOWER MOUNTING BRACKET
3. MOUNTING BOLT

2. Tighten shock mounting fasteners to specified torque values. Refer to the TORQUE CHART.

### 7.3. MAIN SUPPORT MEMBERS

Refer to Figure 13.

#### Remove

**NOTE – When replacing main support members, it is recommended that you replace all hardware items also.**

1. Unload vehicle and block wheels to prevent vehicle from rolling. Raise vehicle frame 2 inches and support with floor stands. Place floor stand in position to support transverse crossmember in present position (to maintain position when spring U-bolts are removed).



**WARNING – A jack must never be used alone to support vehicle while under-chassis service is being performed. The jack may lower and serious personal injury could result. Always support vehicle with floor stands.**

2. Remove wheel assembly from axle side being serviced. Refer to GROUP 17 - WHEELS in the Master Service Manual.
3. Exhaust air from vehicle and suspension system. Exhaust air by:

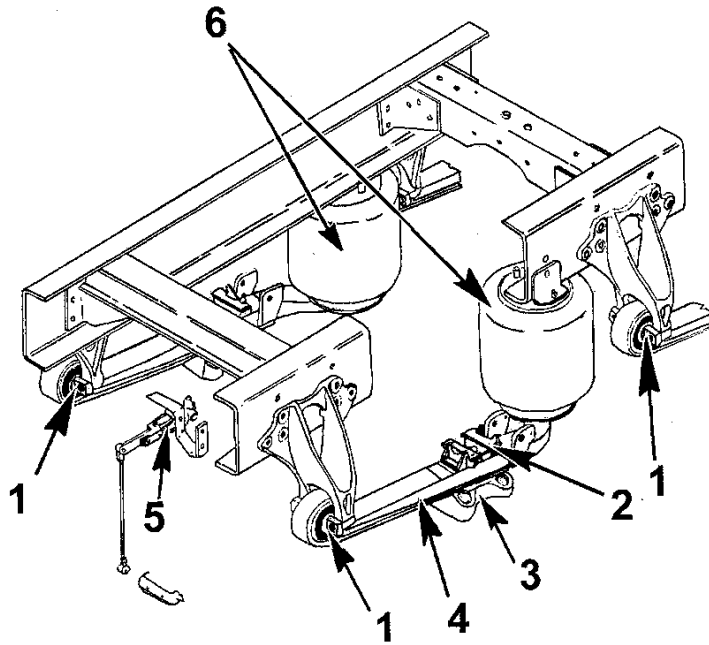
**NOTE – Even if air spring has a leak and is deflated, the air must still be exhausted from system.**

- a. Automatic control — height control valve - disconnect link at lower connection, then rotate control arm to exhaust (approximately 45 degrees down) position.
  - b. Disconnect air supply line from air spring.
  - c. Exhaust air from reservoir.
4. Disconnect shock absorbers and air springs at lower end.
  5. Disconnect torque rod at spring hangar end and remove spring pin from spring hangar. Also loosen rear torque rod mounting nuts (Do not normally need to be removed).
  6. Remove lower shock absorber plate from transverse beam.
  7. Remove spring U-bolts while supporting lower U-bolt plate and related parts. Remove and discard spring liner.
  8. Inspect all parts for wear, cracks or failed welds. Repair or replace.

**CAUTION – Do not repair a cracked spring, U-bolt or spacer plates. The listed parts must be replaced if cracks are present**

### **Install**

**NOTE – When tightening spring U-bolts, torque rod fasteners and other related mounting fasteners to specifications, the vehicle must be at proper ride height to avoid introducing unnecessary stress on the bushings. Refer to the TORQUE CHART for specified torque values.**



**Figure 22 Suspension Components**

- 1. TAPERED LEAF BUSHING MOUNT
- 2. U-BOLT SADDLE SEAT
- 3. LOWER U-BOLT MOUNTING PLATE
- 4. TAPERED LEAF SPRING
- 5. HEIGHT CONTROL VALVE
- 6. AIR SPRING

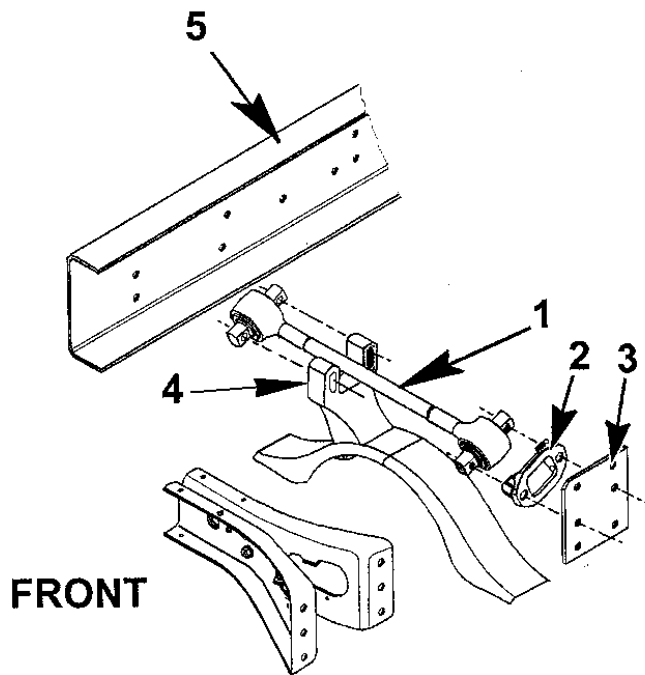
1. Position spring to approximate installed position (Figure 15, Items 2 and 3) and install the bar pin in hanger **on the forward side of the spring hanger**. Also install lower shock bracket end and **do not** tighten fasteners.
2. Place U-bolt seat on top of spring (Figure 19, Item 2) with tab towards vehicle frame then install U-bolt assembly to spring and axle. **Do not** tighten fasteners to specified values at this time.
3. At this point assemble the spring clamp group and main support member to the axle, align the suspension and tighten assembly. Tighten to specifications in the following sequence: U-bolts (tighten diagonally),(Figure 26) front torque rod nuts, rear torque rod nuts, and the lower shock absorber mounting plate on the transverse beam. Refer to the TORQUE CHART.
4. Connect lower air spring, shock absorbers and height control valve linkage and any air lines that were removed. Tighten all fasteners to values specified. Refer to the TORQUE CHART.
5. Install tires/wheels. Refer to GROUP 17 - WHEELS in the Master Service Manual.
6. Lower vehicle. Remove all stands.
7. Build vehicle air pressure to governor cutout pressure and use soap and water solution to check for leaks.

## 7.4. TORQUE RODS

Refer to Figure 23.

### Remove

1. Disconnect and remove torque rods.



**Figure 23 Torque Rod Assembly**

1. TORQUE ROD
2. TORQUE ROD FRAME MOUNTING BRACKET
3. REINFORCEMENT PLATE
4. AXLE BRACKET BOSS TORQUE ROD MOUNTING

**NOTE – Note the position and quantity of alignment spacers for reassembly.**

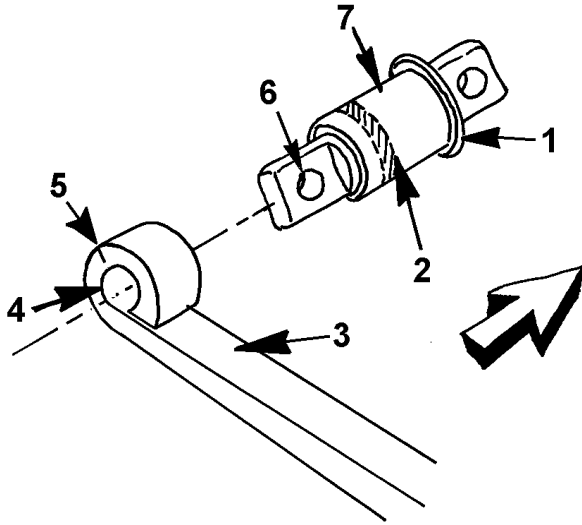
2. Inspect axle bracket boss for excessive wear. Replace if needed. Inspect all parts for wear, cracks or failed welds. Repair or replace.

### Install

1. Install replacement torque rods (be sure to use correct length torque rods for vehicle), connecting the end to the frame side rail first and end to axles second (for transverse rods).
2. Tighten fasteners to specified torque values. Refer to the TORQUE CHART.
3. Recheck axle alignment. Adjust if necessary.

## 7.5. MAIN SUPPORT MEMBER BUSHINGS

The bushing assembly is mounted in each main support member assembly. This assembly is pressed into the main support member assembly **flange must be on the in-board side**. The main support member assembly with bushing is placed into the chassis forward spring suspension mounting bracket and is bolted in place. **The bushing pin angle must be relative to the main support member. Mark the orientation of bushing on main support member. When replacing new bushing check alignment with mark on main support member** (Figure 1 and Figure 2, Item 8). The bolts are tightened to the correct torque value as specified in the TORQUE CHART.



**Figure 24 Main Support Member And Bushing Assembly**

1. BUSHING FLANGE (MUST BE INBOARD)
2. RUBBER BUSHING
3. TAPERED LEAF SPRING
4. TAPERED LEAF SPRING BUSHING WRAP
5. BUSHING BOLT MOUNTING HOLES

**For all bushing types:**

TO INSURE PROPER MOUNTING OF NEW BUSHING, CLEAN MAIN SUPPORT MEMBER WHERE BUSHING IS TO BE PRESS FITTED WITH DEGREASING FLUID AND WIRE BRUSH. USE DRILL MOUNTED WIRE BRUSH ONLY.

Apply 1/4– 1/2" wide ring of bonding agent to lower quarter of bushing as shown (Figure 25, Item 1), before pressing into spring eye.

**NOTE – APPROVED COMPOUNDS ARE:**

1. PERMABOUND HM160
2. LOCTITE RC/680

**LOCTITE RC/680 IS PREFERRED**



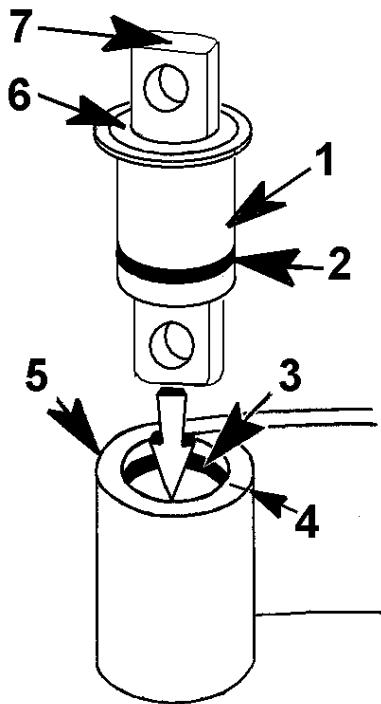
Apply 1/4– 1/2" ring of bonding agent to top edge of eye I.D. (Figure 25, Items 3 and 4), as shown, before installing bushing.

**NOTE:**

Unless otherwise specified, minimum push out force after 24 hours cure is 6750 lbs. for threaded bushings and 4000 lbs. for all other bushings.

Bushing must be clean and free of oil and grease prior to installation.

After bushing installation, residual bonding agent must be removed.



**Figure 25 Bonded Bushings**

1. PRESSED BUSHING
2. BONDING AGENT
3. THREADED BUSHINGS
4. BONDING AGENT

## 7.6. U-BOLTS AND U-BOLT NUTS INSTALLATION

Installing 'U' — Bolts and 'U' Bolt Nuts

1. Inspect the 'U'-bolt threads , and 'U'- bolt nuts for rust and debris and clean the threads if contaminated.
2. Install the 'U'-bolts and nuts and torque the nuts to 15 lbf-ft, using a diagonal pattern.
3. Re-torque the nuts to 100 lbf-ft, using a diagonal pattern.

4. Re-torque the nuts to 200 lbf-ft, using a diagonal pattern.
5. Re-torque the nuts to 300 lbf-ft, using a diagonal pattern.
6. Re-torque the nuts to 425 lbf-ft, using a diagonal pattern.
7. Use the same diagonal pattern with each 'u' bolt nut re-torque.

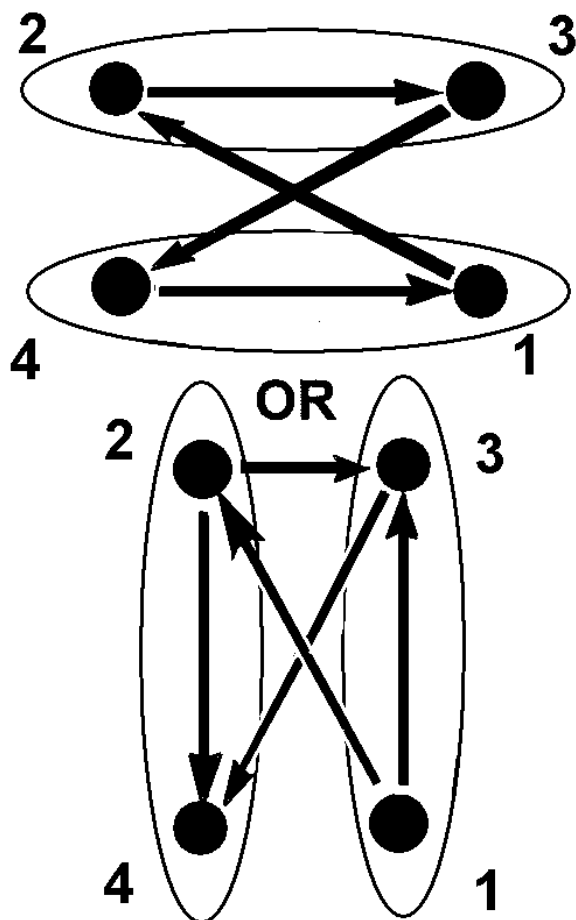


Figure 26 'U'-Bolt Torque Patterns

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## 7.7. CHECKING 'U'- BOLT NUT TORQUE AND 'U'-BOLT NUT TIGHTENING PROCEDURE

1. Inspect the 'U'-bolt threads and 'U'-bolt nuts for rust and debris and clean threads if contaminated.
2. Using a torque wrench determine the torque required to turn the 'U'-bolt nuts while tightening (clockwise rotation)
3. Using the lowest nut torque discovered as the reference starting point re-tighten the nuts using the sequence noted in : Installing 'U'- Bolts and 'U'- Bolt Nuts.

## 8. RIDE HEIGHT DIMENSIONS

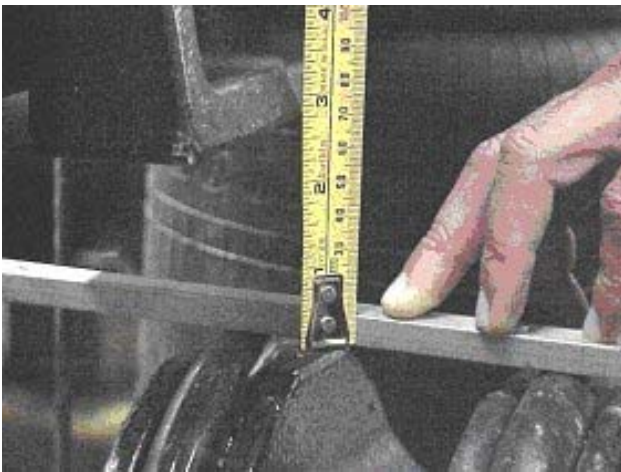
### 8.1. PROCEDURE FOR CHECKING/SETTING RIDE HEIGHT ON THE INTERNATIONAL RIDE OPTIMIZED SUSPENSION (IROS)

**Note:** Chassis ride height is not measured directly. Instead, axle travel measurements will be taken. Specifications for axle travel have been calculated to result in the correct chassis ride height.

1. Park the vehicle unloaded on a level surface with a light application of the brakes.
2. Do not apply the parking brake. Chock axles to prevent vehicle movement.
3. Make sure there is at least 100psi in the vehicle's air system, and then shut the engine off.
4. Dump air from the rear suspension, then re-pressurize and allow it to return to ride height.
5. To measure the axle travel you will need a tape measure that will remain rigid when extended to 6 inches and one (1) 6 inch straight edge such as a piece of 3/8" by 3/8" square bar stock.
6. Measurements are to be taken at the air spring located closest to the height control valve (usually forward left). Place the straight edge across the topmost portion of the u-bolts.
7. Measure the vertical distance from the bottom of the straight edge that is resting against the u-bolts to the bottommost portion of the axle stop (Figure 27 and Figure 28). There should be no angle created between the two measurement points. The measurement you obtain should fall within the values listed in the table below. If not, the height control valve will need to be adjusted as per the instructions below.



**Figure 27 Axle Travel Measurement**



**Figure 28 Forward Left Wheel End**

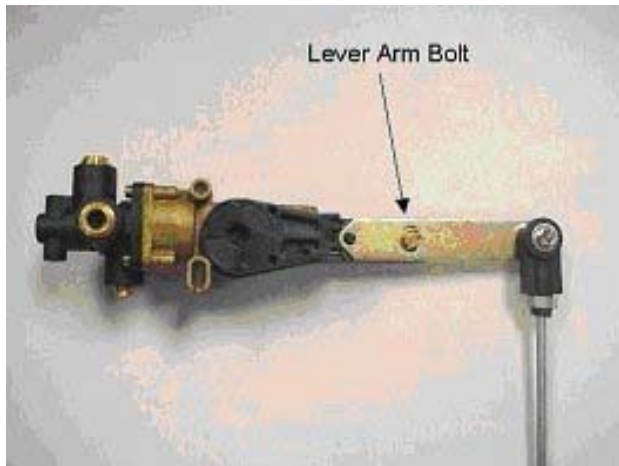
**1. If the axle travel exceeds specifications,**

Loosen the lever arm bolt that holds the arm to the height control valve. Pivot the loosened lever arm up and exhaust air from the suspension, lowering the chassis to some point below the correct air spring height. Final air spring height must be achieved by adding air to the suspension, not exhausting. Add air until the axle travel reaches the proper value according to the chart specifications. When the correct axle travel value has been achieved, retighten the lever arm bolt.

**2. If the axle travel is less than specifications,**

Loosen the lever arm bolt (Figure 29 and Figure 30) that holds the arm to the height control valve. Push the lever down and add air to the suspension, raising the chassis, until the axle travel reaches the proper value according to the chart specifications. When the correct axle travel value has been achieved, retighten the lever arm bolt.

**Note:** Air spring height, axle travel, and chassis ride height are not the same thing. Specifications for axle travel have been calculated to result in the correct chassis ride height. When you have adjusted the axle travel to chart specifications, the chassis ride height is also correct.



**Figure 29** Adjustment - Height Control Valve



**Figure 30** Lever Arm Bolt – Detail

**NOTE –** Do not bend the height control system brackets or rods to adjust suspension height. The lower bracket (Figure 31 and Figure 32) by design, is specially contoured or shaped to facilitate shock absorber servicing. Do not confuse its complex shape with damage.



**Figure 31 4000/3200 Lower Bracket**

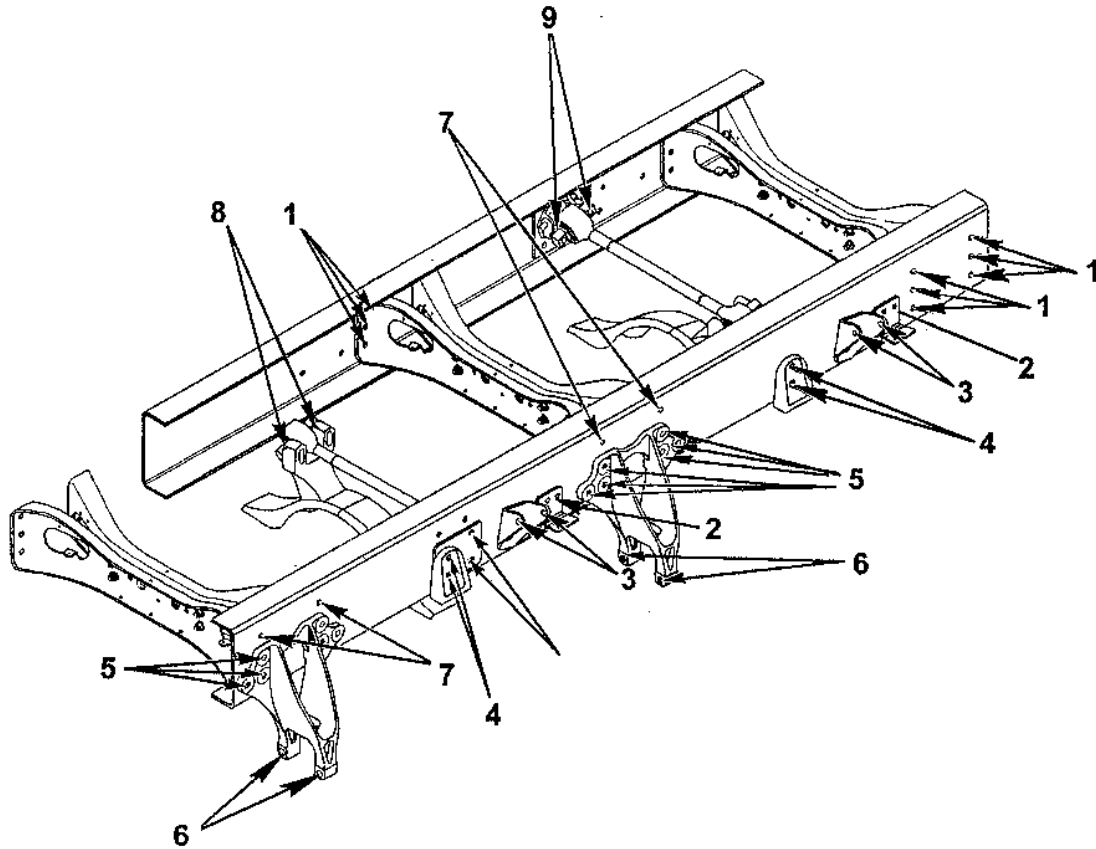


**Figure 32 4000/3200 Bracket Detail**

**Table 1**

Suspension feature code	Configuration	Ride Height	Model	Minimum Axle Travel Inches (")	Target Axle Travel Inches (")	Maximum air Axle Travel Inches (")
14UNN 14UNM 14UNL	6x4	9.25	ALL	2.6	2.75	2.9
14TBJ 14TBK	4x2	9.25	9000 8000 7000	2.6	2.75	3.0
14TBJ 14TBG 14TBH 14TBK	4X2	9.25	4000 3200	2.875	3.0	3.125
14TBL 14TBM 14TBN	4X2	5.3	4000	4.45	4.6	4.75
14UNH	6X4	5.3	9000	1.4	1.55	1.7
FLAT FLOOR	4X2	11.3	3200	2.55	2.7	2.85

## TORQUE



**Figure 33 Torque Locations**

1. CROSS MEMBERS
2. AIR SPRING MOUNTING BRACKET
3. SHOCK MOUNTING BRACKET
4. AXLE STOP
5. AIR SPRING MOUNTING BRACKET
6. MAIN SUPPORT MEMBER MOUNTING BRACKET
7. UPPER CROSS-MEMBER MOUNTING
8. TRANSVERSE TORQUE ROD AXLE MOUNTING
9. TRANSVERSE TORQUE ROD FRAME MOUNTING

**Table 2 Torque Chart**

Description	Lbf-ft	N•m
Shock Absorber Nuts (Figure 21 and 22)	100–130	135–176
U-Bolt Lock Nuts (Figure 27)	400–450	542–610
Air Spring Mounting Stud Nuts — M12 STUD (Figure 17)	40–60	54–81



**Table 2 Torque Chart (cont.)**

Description	Lbf-ft	N•m
3/4" Stud On Air Spring (Figure 28)	45–50	61–68
3/4 Inch Nut (grade 8/ grade 10.9)	300–370	407–501
M20 Flange Bolt Stud Nut (grade 8/grade10.9)	369–461	500–625
Torque Rod Nuts For 9.25 Ride Ht. (Figure 28)	200–240	271–325
5/8" or M16 Flange Bolt (grade 8/ grade 10.9)	200–240	271–325
Nut Transverse Torque Rod at Axle End of Taper Pin Torque Rod 5.3" Ride Ht. (Figure 28)	225–275	305–373