

CHAPTER

11

Steering and Suspension

Instructor Name: (Your Name)

Objectives

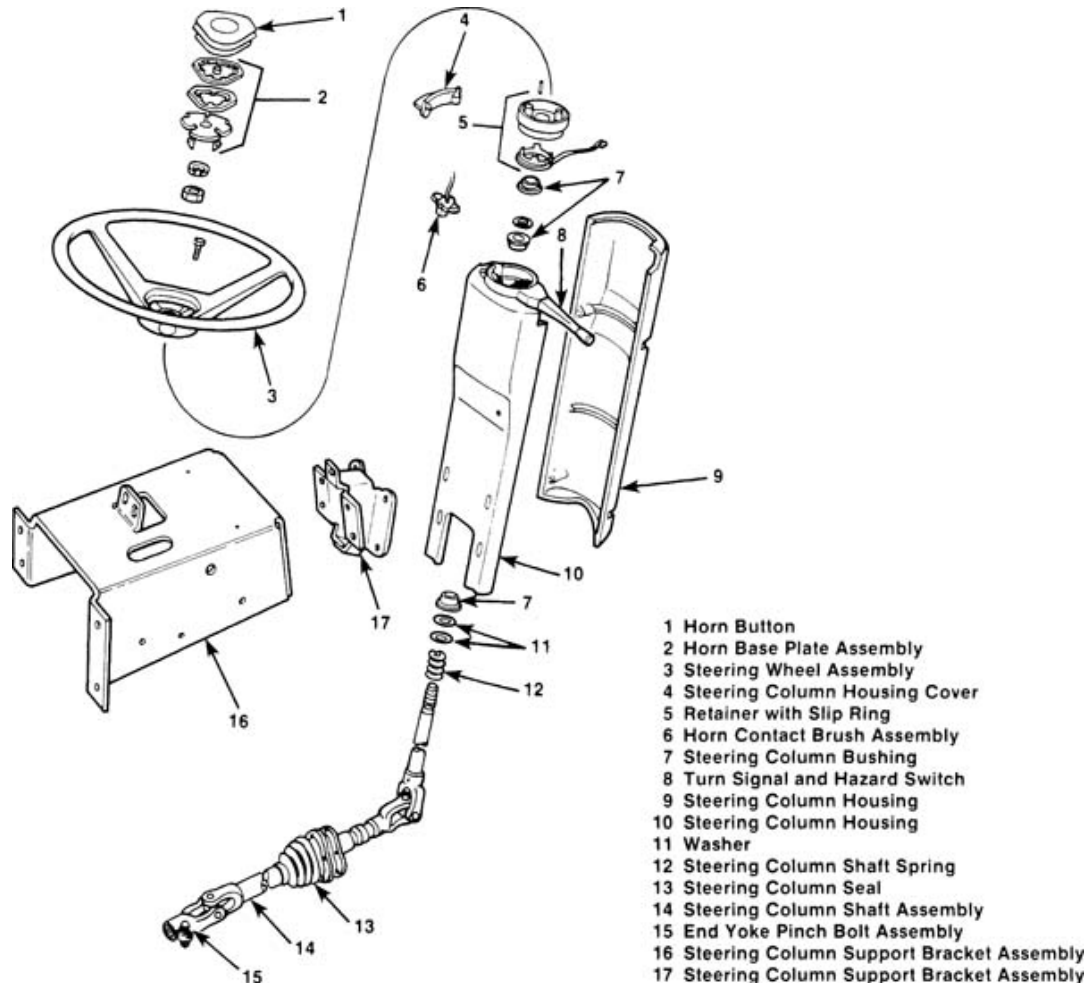
Upon completion and review of this chapter, the student should be able to:

- List the components of the steering system and explain their function.
- Perform a steering axle inspection.
- Verify a steering complaint.
- Perform a complete steering knuckle inspection.
- Explain how to perform a tie-rod inspection.
- Perform a wheel bearing inspection.
- Explain some of the basic steering geometry.

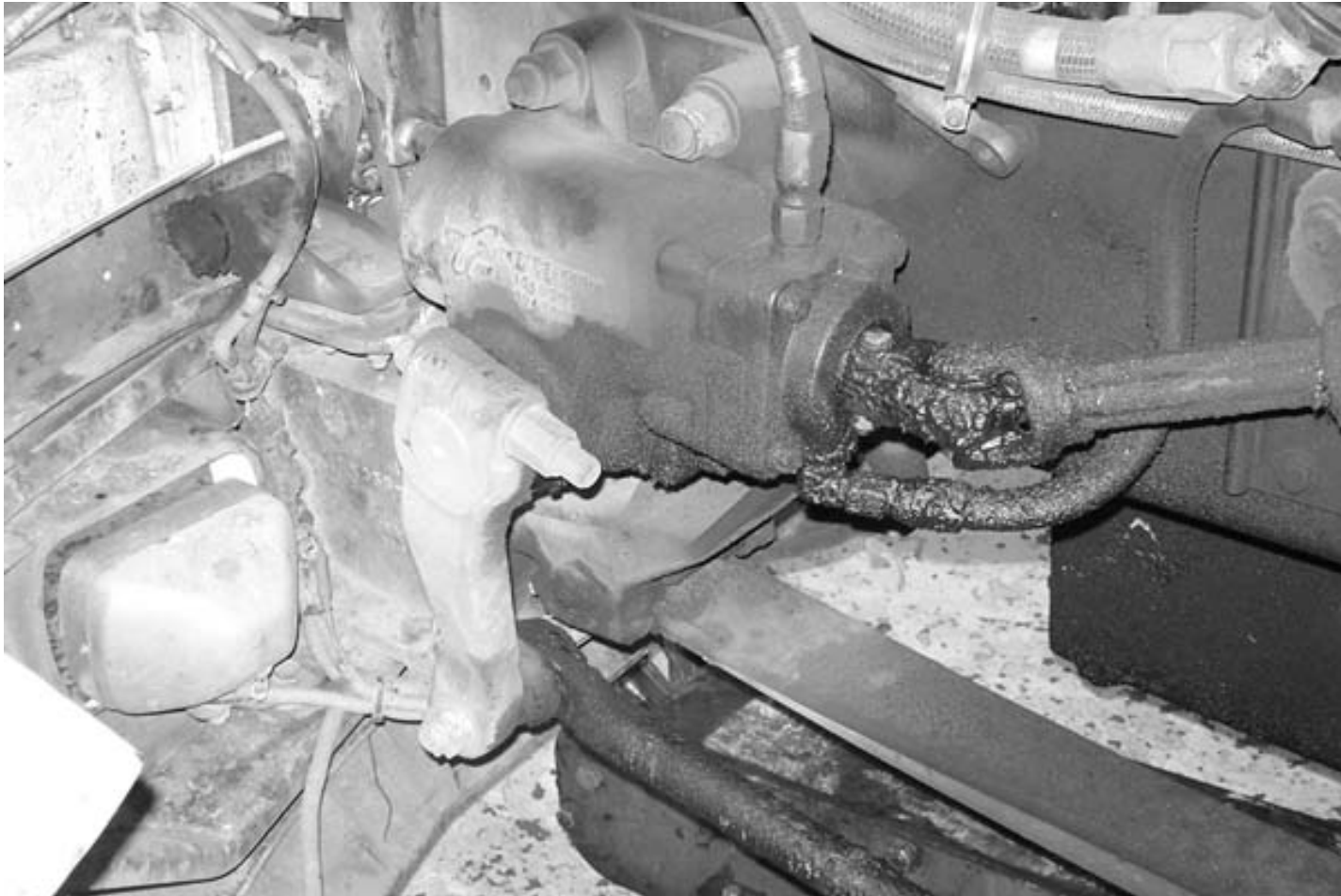
Objectives Continued

- List the importance of a suspension system.
- Explain some of the basic terminology used when discussing suspensions.
- Explain the different types of suspension systems used in the heavy-duty truck industry.
- Perform service inspections on the various types of suspensions.
- Explain how to identify and maintain U-bolts.
- Perform inspection procedures for air spring suspensions.
- Explain and perform servicing procedures for height control valves.

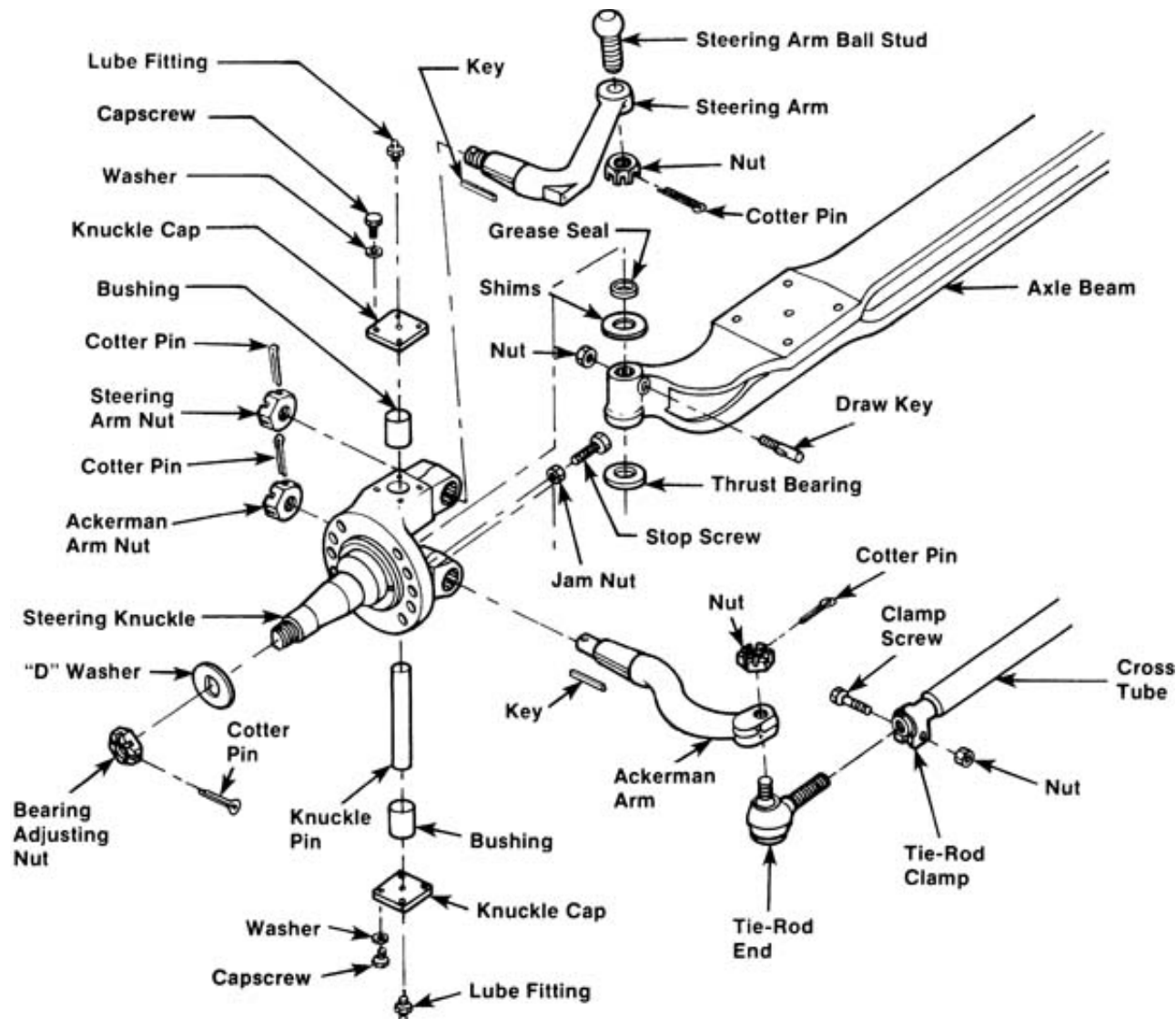
Steering Column



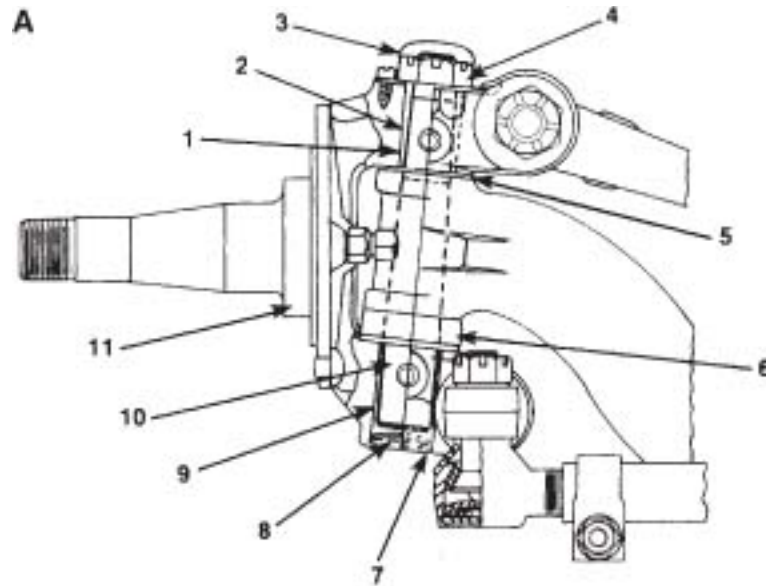
Steering Gear



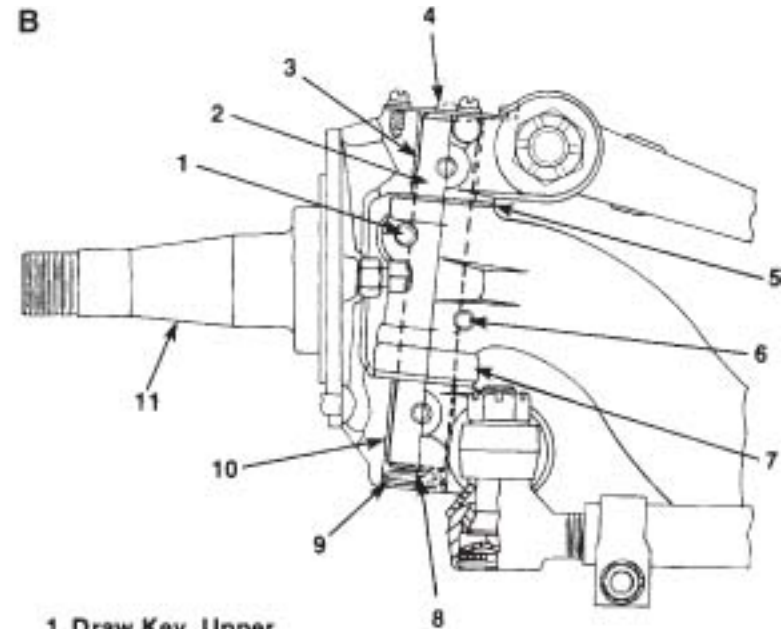
Steering Axle Components



Straight and Tapered Knuckle pin



- 1 Knuckle Upper Bushing
- 2 Knuckle Pin Sleeve
- 3 Upper Dust Cap
- 4 Knuckle Pin Nut
- 5 Shims
- 6 Thrust Bearing
- 7 Expansion Plug Lock Ring
- 8 Expansion Plug
- 9 Knuckle Lower Bushing
- 10 Tapered Knuckle Pin
- 11 Knuckle/Spindle



- 1 Draw Key, Upper
- 2 Knuckle Pin
- 3 Knuckle Bushing, Upper
- 4 Kingpin Cap
- 5 Shims
- 6 Draw Key, Lower
- 7 Thrust Bearing
- 8 Expansion Plug
- 9 Expansion Plug Lock Ring
- 10 Knuckle Bushing Lower
- 11 Knuckle/Spindle

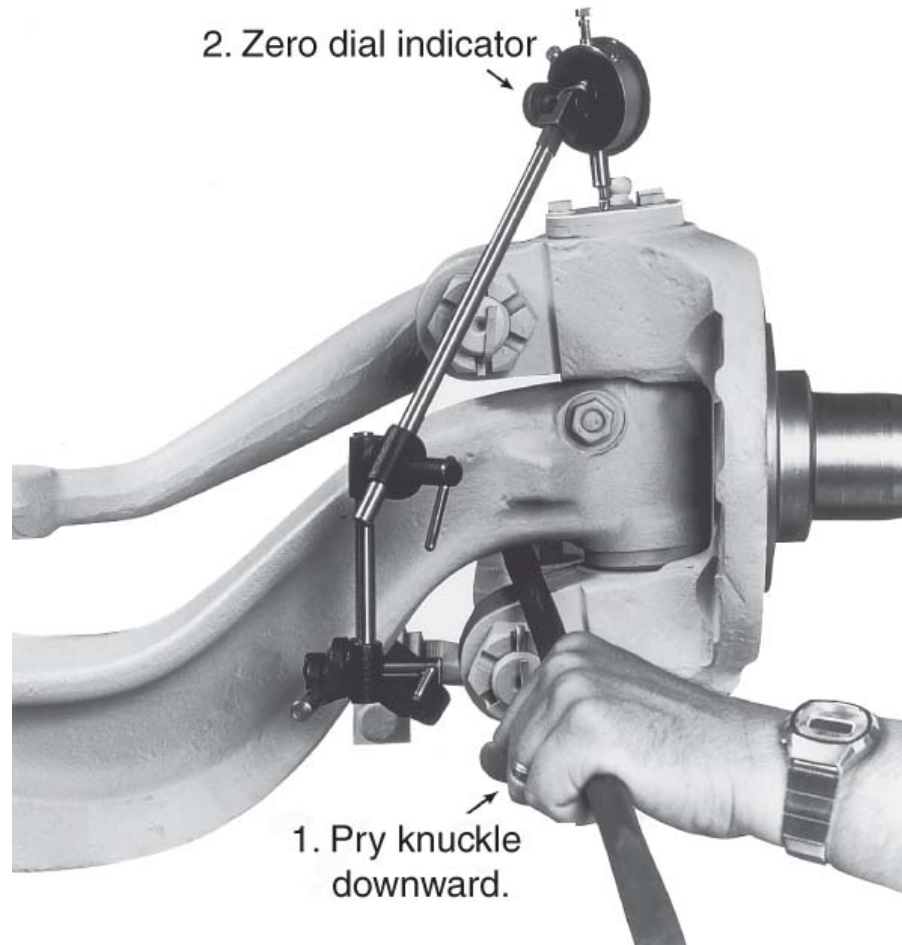
Tie Rod Ends



CAUTION

All steering mechanisms are critical safety items. A vehicle should be deadlined (OOS report) when a defect is reported. It is essential that instructions in the service literature be adhered to. Failure to observe these procedures may result in loss of steering with life threatening results.

Knuckle Vertical Play



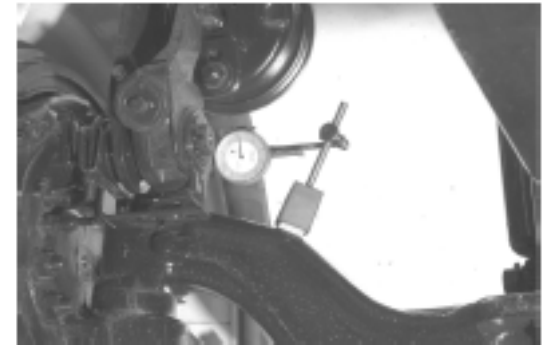
Measuring Steering Kingpin Wear and Vertical End Play



P9-1 Apply the parking brakes, block the rear wheels, and use a floor jack to raise the front axle until the tires are off the shop floor.



P9-2 Lower the vehicle so that it is supported securely on safety stands with the front tires still off the shop floor.



P9-3 Mount a dial indicator on the front axle I-beam and position the dial indicator plunger on the inner side of the upper end of the steering knuckle. Zero the dial indicator.

Measuring Steering Kingpin Wear and Vertical End Play



P9-4 While a helper moves the top of the wheel and tire inward and outward, observe the dial indicator reading. If the total movement on the dial indicator exceeds the specified kingpin bushing movement, the kingpin bushing must be replaced.



P9-5 Mount the dial indicator on the front axle I-beam with the dial indicator plunger touching the inner side of the lower end of the knuckle. Zero the dial indicator. While a helper moves the bottom of the tire inward and outward, observe the dial indicator reading. If the dial indicator reading exceeds the specified kingpin bushing movement, replace the lower kingpin bushing.



P9-6 Mount the dial indicator on the axle I-beam and position the dial indicator plunger on top of the upper knuckle joint cap.

Measuring Steering Kingpin Wear and Vertical End Play



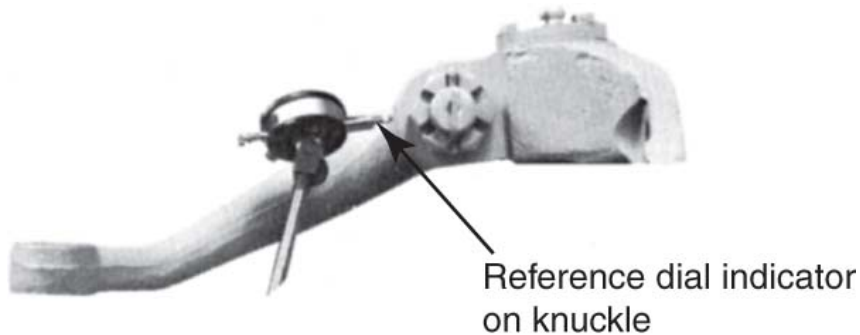
P9-7 Use a pry bar to force the steering knuckle downward. Check the reading on the dial indicator.



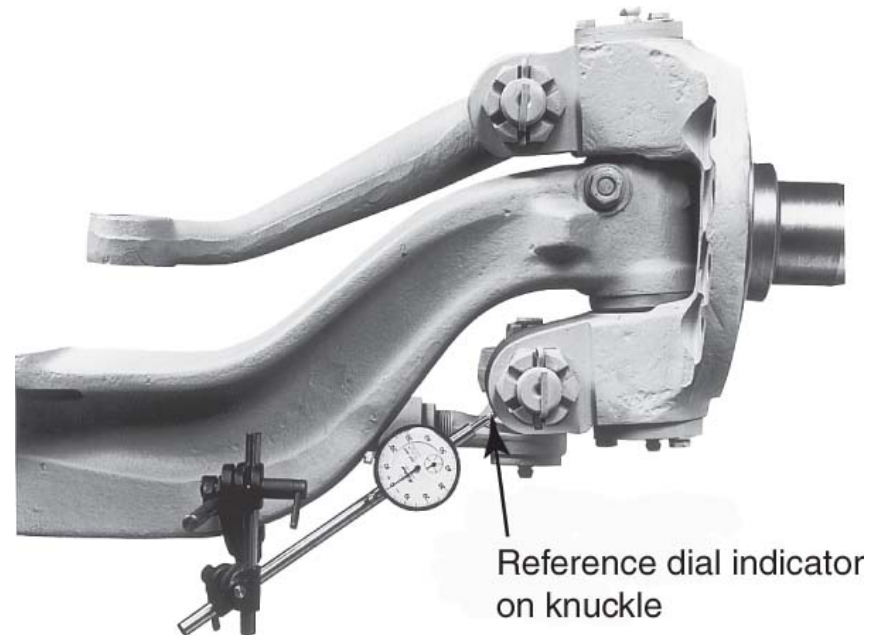
P9-8 Next, observe the dial indicator reading while a helper uses a large pry bar to lift upward on the tire and wheel. If the dial indicator reading exceeds the truck manufacturer's specifications, remove the steering knuckle and inspect the thrust bearing. Replace this bearing if necessary and install the required shim thickness.

Upper and Lower Bushing Freeplay

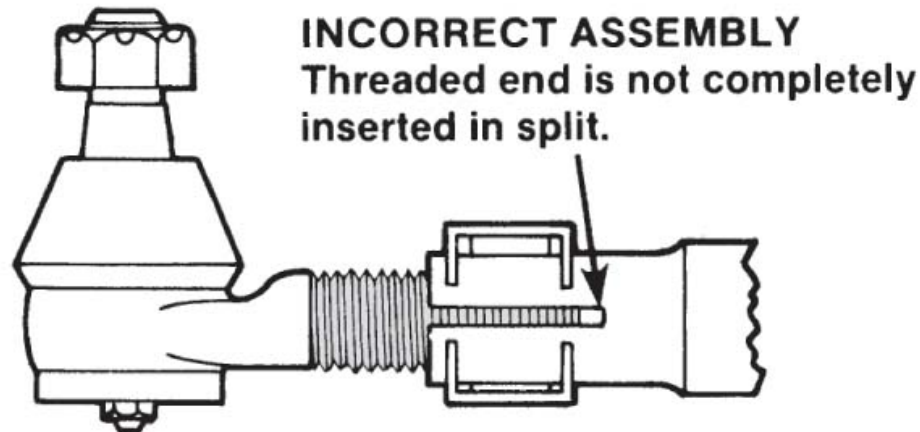
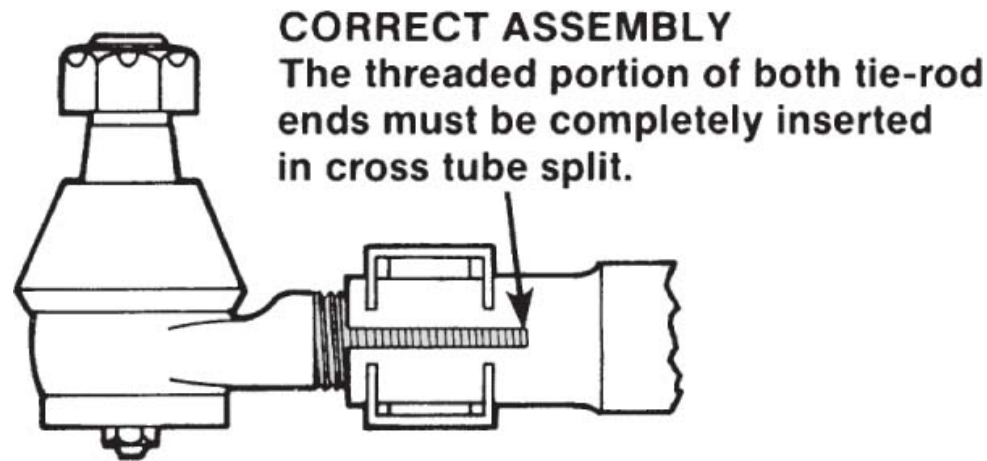
Upper



Lower

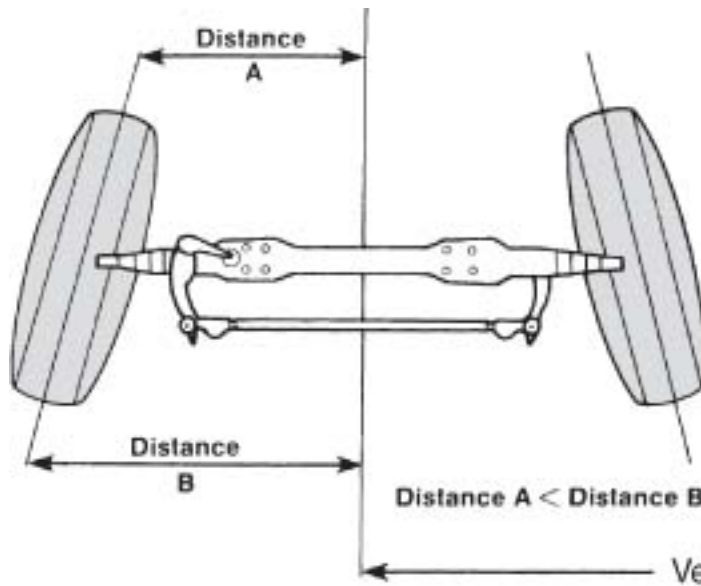


Tie Rod Installation

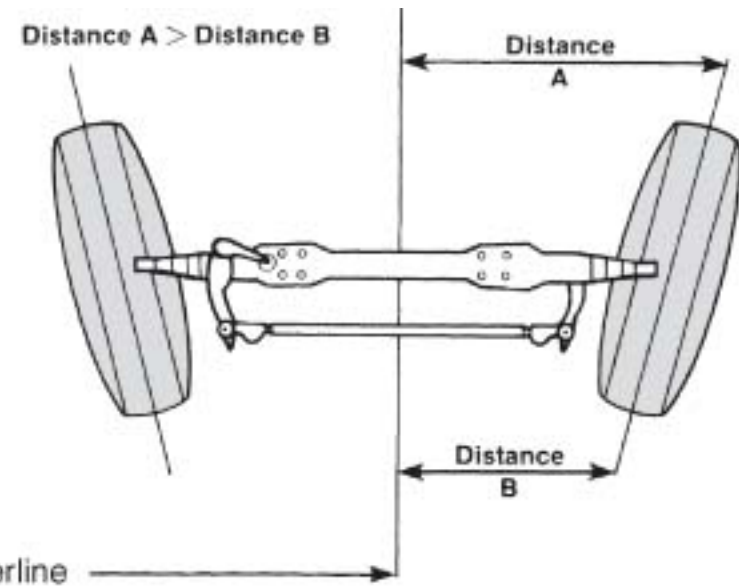


Toe Settings

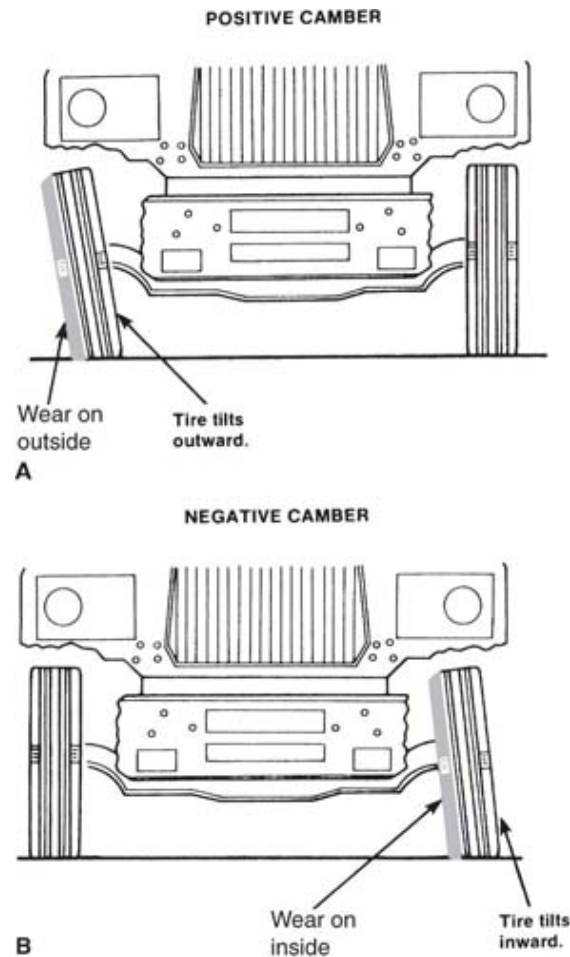
Toe in



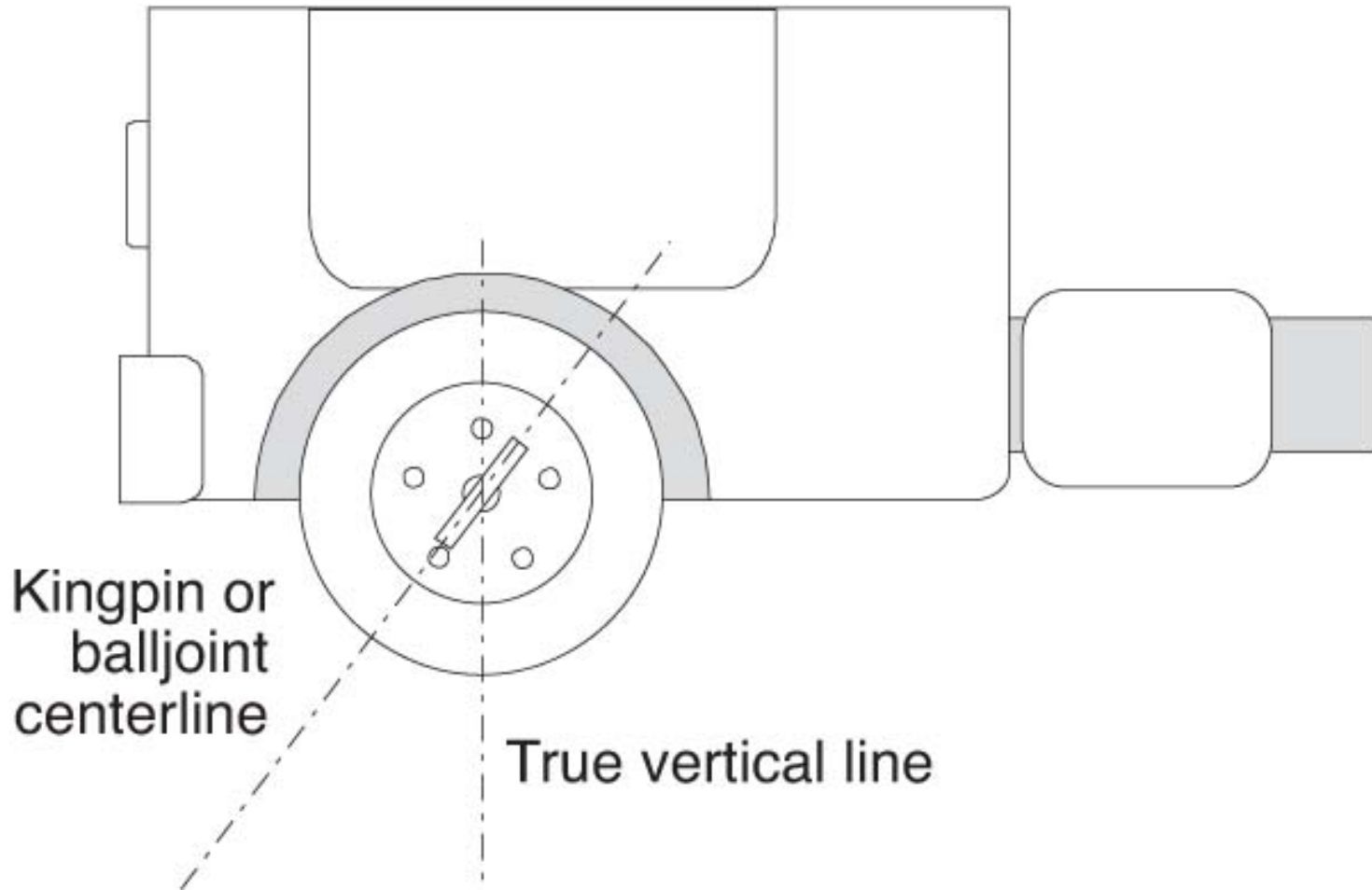
Toe Out



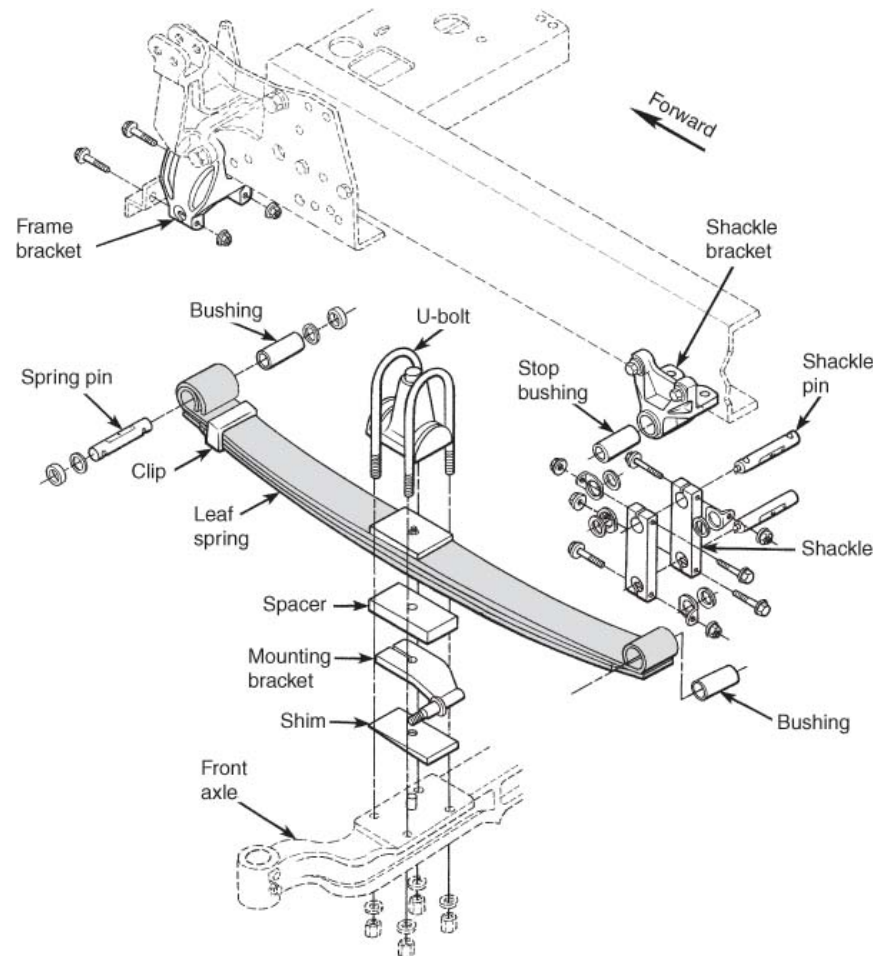
Camber



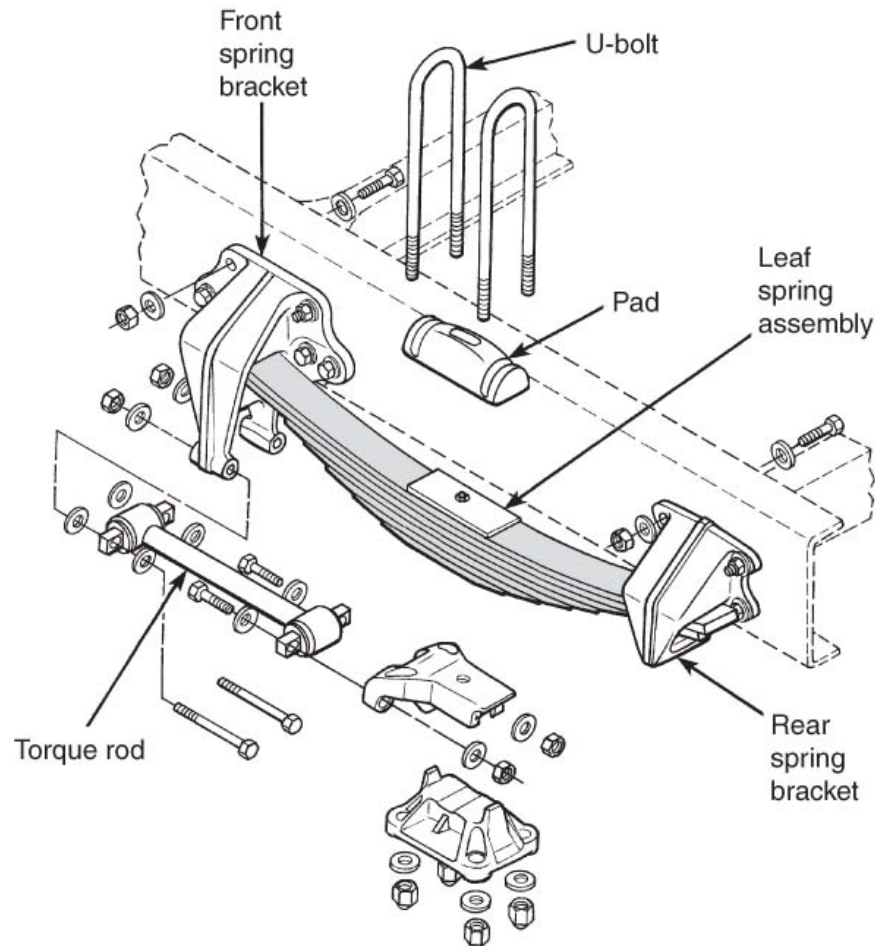
Caster



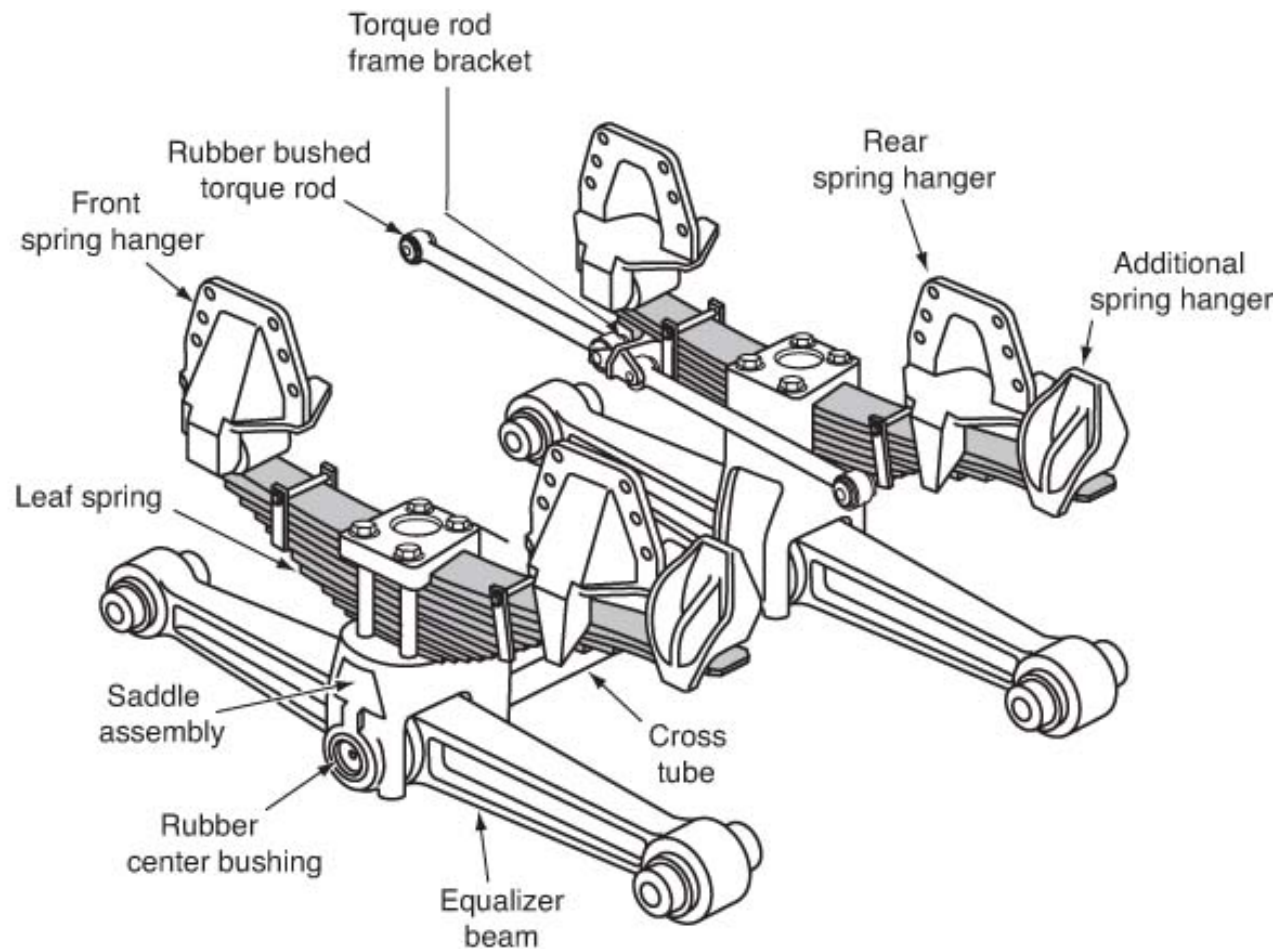
Front Leaf Spring Suspension



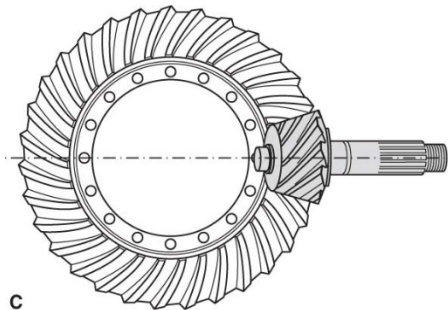
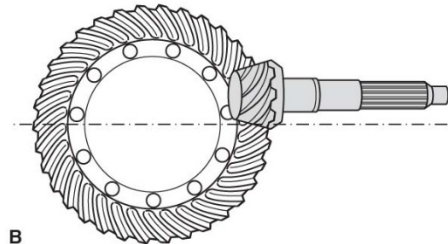
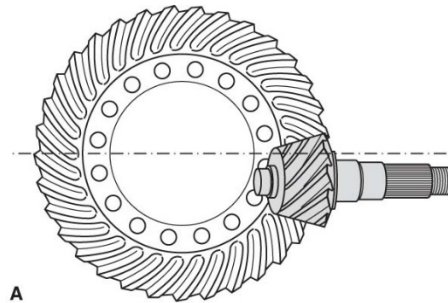
Single Drive Rear Leaf Spring Suspension



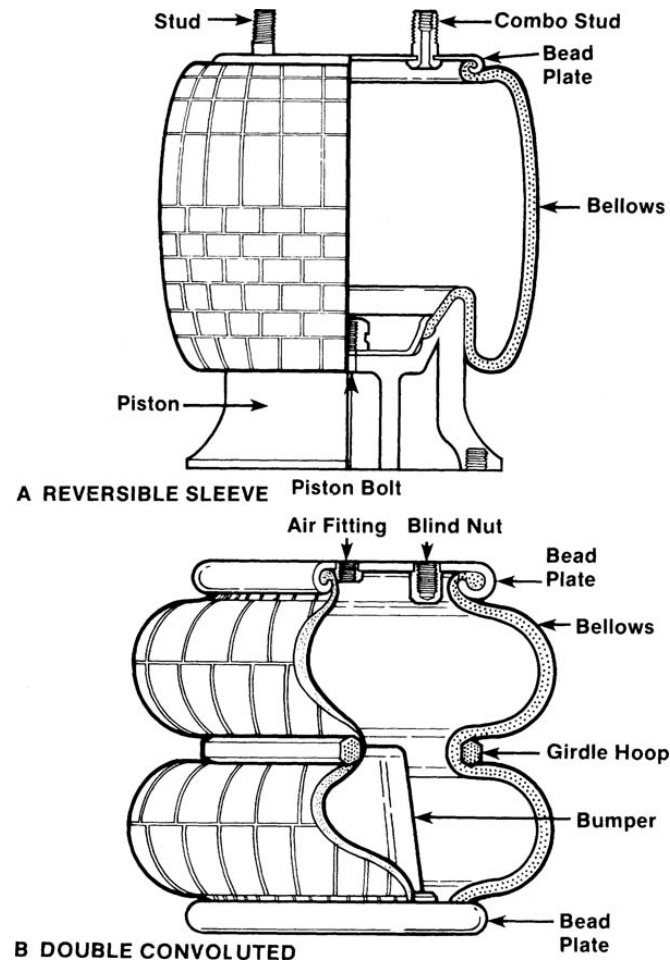
Equalizing Beam Suspension



(A) Hypoid (B) Amboid and (C) Spiral Gear Arrangements



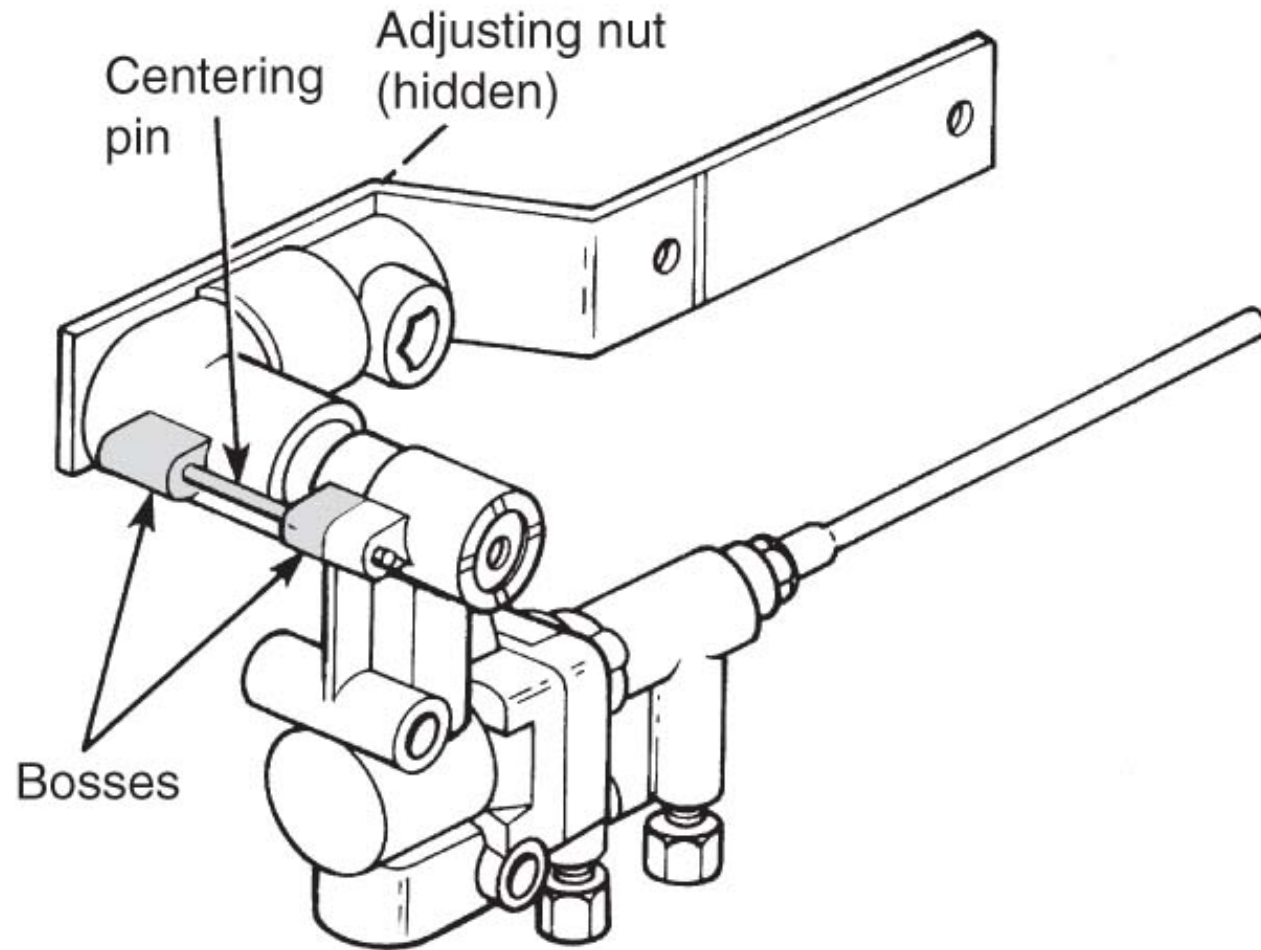
Air Springs



CAUTION

Exercise extreme caution around air springs. The forces that these springs contain when pressurized can cause serious bodily injury or death if they explode. Never use an air spring as a jack. Avoid using torches or sharp objects around loaded air springs. If service work must be performed around the air springs, remove the air from the suspension before proceeding.

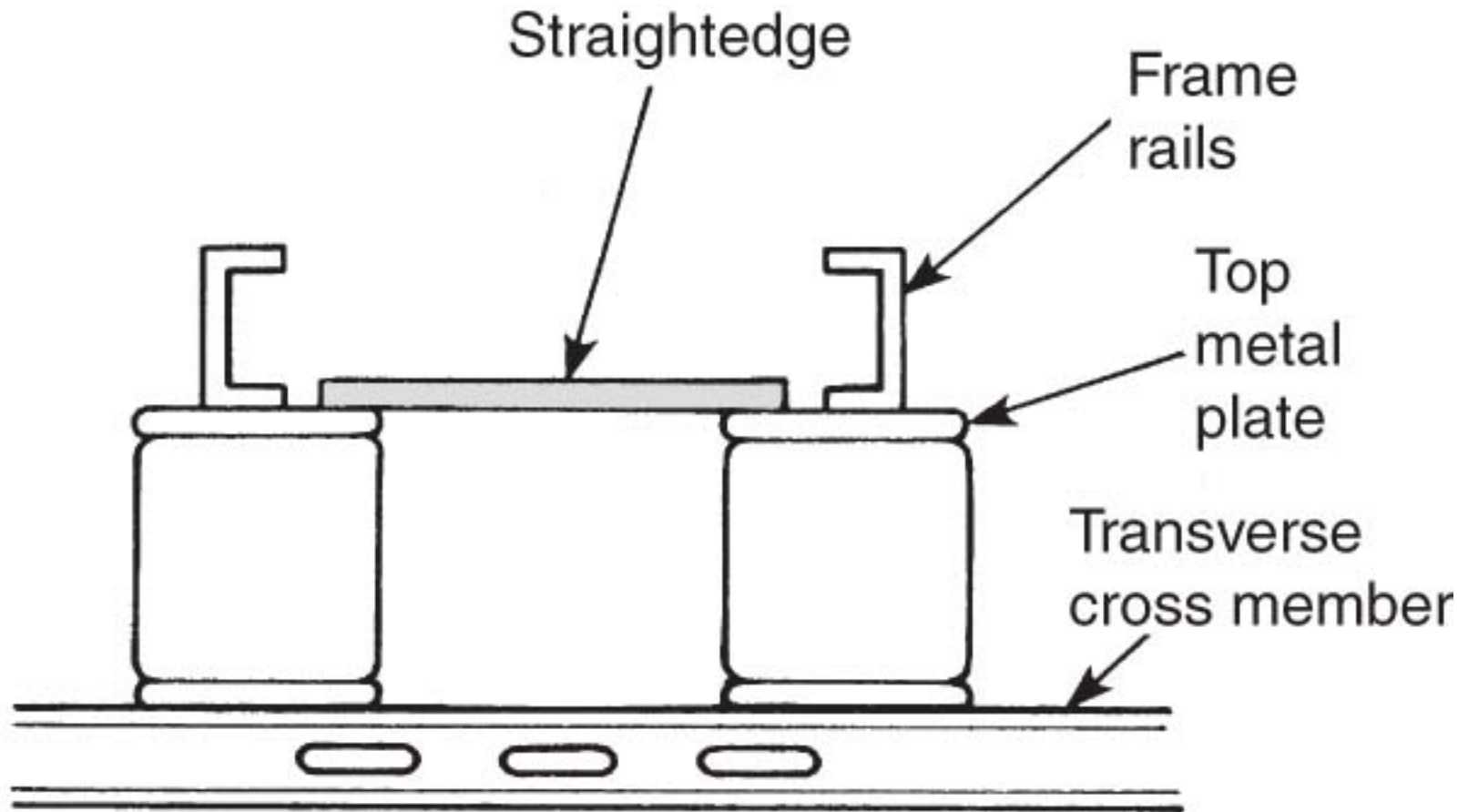
Height Control Valve Centering Pin



CAUTION

Most height control valves have a delayed reaction time that can be as long as 15 seconds. This is used to prevent continuous correction cycling; remember this when diagnosing height control valve problems. Also, before condemning a valve that does not allow the springs to inflate, make sure the height control valve is receiving air pressure from the reservoir. Often, a pressure protection valve can be the culprit.

Ride Height Adjustment



Summary

- The steering wheel is the driver's means to control the direction that the vehicle travels.
- The larger the steering wheel diameter, the more torque is generated from the same amount of driver effort.
- The steering column connects the steering wheel to the steering gear.
- The steering gear, sometimes referred to as the steering box, is used to multiply the driver's efforts at the steering wheel.
- The steering knuckles should be greased by raising the steering axle off the ground.

Summary Continued

- Ball joints are necessary to compensate for movement between the steering linkage and the frame of the vehicle.
- Ackerman arms or tie-rod arms are used to transfer and synchronize steering action on both steer wheels on a steering axle.
- The tie-rod ends are ball joints that connect to the Ackerman arms on each steering knuckle.
- When a steering problem is reported, systematically inspect the vehicle steering system, front and rear suspensions, and trailer suspensions.

Summary Continued

- All steering mechanisms are critical safety items. A vehicle should be deadlined (OOS report) when a defect is reported.
- Do not drive a vehicle with too much lash in the steering gear.
- Steering knuckles can be the source of a number of steering-related problems, and many of these originate from lack of lubrication.
- The major front end alignment settings are toe, camber, and caster.
- The purpose of the suspension system is to support the vehicle and its intended load.

Summary Continued

- A leaf spring is a steel plate or stack of clamped steel plates.
- Equalizing beam suspension uses a lever principle to divide the load equally between two axles as well as reduce the effect of road irregularities.
- Solid rubber suspensions use hard rubber cushions to absorb the shock instead of steel leaves or air.
- Maintaining proper torque is the key to preventing U-bolt and suspension problems.
- Air ride suspensions do a better job of isolating the vehicle from shock than do leaf springs or solid rubber suspensions.

Summary Continued

- The height control valve's function is to maintain the chassis ride height.
- Two types of air spring may be used in an air suspension system: the reversible sleeve type and the convoluted type.
- Air lines connect all of the components of the system together.
- Shock absorbers reduce potentially damaging shock and vibration.