Figure 113-1 Most early vehicles used single straight axles.

Figure 113-2 Typical kingpin used with a solid axle.
TECH TIP: Radius Rod Bushing Noise

When the radius rod bushing on a Ford truck or van deteriorates, the most common complaint from the driver is noise. **SEE FIGURE 113–4.** Besides causing tire wear, worn or defective radius rod bushing deterioration can cause the following:

1. A clicking sound when braking (it sounds as if the brake caliper may be loose).
2. A clunking noise when hitting bumps.

When the bushing deteriorates, the axles can move forward and backward with less control. Noise is the first sign that something is wrong. Without proper axle support, handling and cornering can also be affected.

Figure 113–3 Twin I-beam front suspension. Rubber bushings are used to support the I-beams to the frame and help isolate road noise.

Figure 113–4 The rubber radius rod bushing absorbs road shocks and helps isolate road noise.
Figure 113-5  The upper control arm is shorter than the lower control arm on a short/long-arm (SLA) suspension.

Figure 113-6  A typical SLA front suspension using coil springs.

Figure 113-7  An SLA-type suspension with the coil spring placed on top of the upper control arm.
Figure 113-8 A torsion bar SLA suspension can use either the lower or the upper control arm.

Figure 113-9 A typical MacPherson strut showing all of the components of the assembly. A strut includes the shock and the spring in one structural assembly.

Figure 113-10 The modified strut front suspension is similar to a MacPherson strut suspension except that the coil spring is seated on the lower control arm and is not part of the strut assembly.
Figure 113-11 Multilink front suspension design varies depending on the vehicle manufacturer.

Figure 113-12 A leaking strut. Either a cartridge insert or the entire strut will require replacement. If a light film of oil is seen, this is to be considered normal. If oil is dripping, then this
indicates that the metal seal has failed.

TECH TIP

Road Test—Before and After

Every time technicians will start to work on a vehicle, based on the description of the problem by the driver or owner. A typical conversation was overheard where
the vehicle owner complained that the vehicle handled "funny," especially when turning. The owner wanted a wheel alignment, and the technician and shop owner
wanted the business. The vehicle was aligned, but the problem was still present. The real problem was a defective tire. The service technician should have road
tested the vehicle before any service work was done to confirm the problem and try to determine the cause. Every technician should test drive the vehicle after any service
work is performed to confirm that the service work was performed correctly and that the customer complaint has been resolved. This is especially true for any service work
involving the steering, suspension, or braking systems.
Figure 113-13  This front coil spring looks as if it has been heated with a torch in an attempt to lower the ride height of the vehicle. Both front springs will require replacement.

Figure 113-14  It is easy to see that this worn control arm bushing needed to be replaced. The new bushing is shown next to the original.

Figure 113-15  Grease fitting projecting down from the surrounding area of a ball joint. The ball joint should be replaced when the area around the grease fitting is built up or rewelded.
Figure 113-16 Indicator ball joints should be checked with the weight of the vehicle on the ground.

TECH TIP: Think of a Nickel

Most ball joints must be replaced if the joint has more than 0.050 in. axial (up-and-down) movement. To help visualize this distance, consider that the thickness of an American nickel coin is about 0.060 in. It is helpful to know that maximum wear should be less than the thickness of a nickel. A dial indicator (gauge) can be used to measure the exact movement of the ball joint so it can be compared to factory specifications. ◼️ SEE FIGURE 113–17.

Figure 113-17 Typical dial indicator used to measure the suspension component movement. The dial indicator gauge is attached to a stationary part of the vehicle and the flexible coupling allows the dial indicator to be positioned at any angle.
If the spring is attached to the lower control arm as in this SLA suspension, the jack should be placed under the lower control arm as shown. A dial indicator should be used to indicate the amount of freeplay. Be sure that the looseness being measured is not due to normal wheel bearing play.

Figure 113-19  The jack should be placed under the lower control arm of this modified MacPherson-type suspension.

Figure 113-20  A special tool or a block of wood should be inserted between the frame and the upper control arm before the jack is placed on the ground. This will help the tool on the joint against the swivel joint so that a true test can be performed on the condition of the ball joint.
Frequently Asked Question: What Is the Difference Between a Low-Friction Ball Joint and a Steel-on-Steel Ball Joint?

Before the late 1980s, most ball joints were constructed with a steel ball that rubbed on a steel socket. This design created friction and provided for a tight high-friction joint until wear caused looseness in the joint.

Newer designs use a polished steel ball that is installed in a hard plastic polymer, resulting in a low-friction joint assembly. Because of the difference in friction characteristics, the vehicle may handle differently than originally designed if incorrect-style ball joints are installed.

Most component manufacturers state that low-friction ball joints in a vehicle originally equipped with steel-on-steel high-friction ball joints are usually acceptable, but high-friction replacement ball joints should be installed on a vehicle originally equipped with low-friction ball joints.

Figure 113-21 The jacking point is under the frame for checking the play of a lower ball joint used with a MacPherson strut.

Figure 113-22 This worn and rusty ball joint was found by moving the wheel and looking for looseness in the joint.
Figure 113-23  A taper breaker tool is being used to separate the upper ball joint from the steering knuckle. This is especially important for vehicles equipped with aluminum alloy control arms.

Figure 113-24  A pinch bolt attaches the steering knuckle to the ball joint. Remove the pinch bolt by turning the nut, not the bolt.

Figure 113-25  If the pinch bolt is overtightened, the steering knuckle can be deformed. A deformed knuckle can cause the pinch bolt to break and the ball joint could become separated from the steering knuckle.
Figure 113-26  By drilling into the rivet, the holding force is released.

Figure 113-27  The head of the rivet can be removed by using a larger-diameter drill bit as shown.

Figure 113-28  Using a punch and a hammer to remove the rivet after drilling down through the center and removing the head of the rivet.
REAL WORLD FIX

The Rattle Story
A customer complained that a rattle was heard every time the vehicle hit a bump. The noise sounded as if it came from the rear. All parts of the exhaust system and suspension system were checked. Everything seemed okay until the vehicle was raised with a frame-type jack instead of a drive-on type. Then, whenever the right rear wheel was lifted, the noise occurred. The problem was a worn (elongated) shock absorber mounting hole. A washer with the proper-size hole was welded over the worn lower frame mount and the shock absorber was bolted back into place.

Figure 113-29 Press-in ball joints are best removed using a large C-clamp press, as shown.

Figure 113-30 Typical kingpin assembly.
TECH TIP: The Shock Stud Trick

Front shock absorbers used on many rear-wheel-drive vehicles equipped with an SLA-type front suspension are often difficult to remove because the attaching nut is rusted to the upper shock stub. A common trick is to use a deep well 9/16-in. socket and long extension and repeatedly bend the shock stud until it breaks off. At first, you would think that this method causes harm, and it does coil the shock absorber—but the shock absorber is not going to be reused and will be discarded anyway.

The usual procedure followed by many technicians is to slightly take a minute or two to break off the upper shock stud, then hoist the vehicle to allow access to the lower front shock bolts, and then the shock can easily be removed. To install the replacement shock absorber, attach the lower bolts, lower the vehicle, and attach the upper rubber bushings and retaining nut.
Figure 113-33 Most shock absorbers used on the front suspension can be removed from underneath the vehicle after removing the attaching bolts or nuts.

Figure 113-34 Removing the upper strut mounting bolts. Some experts recommend leaving one of the lower mount bolts loosely attached to prevent the strut from falling when the lower attaching bolts are removed.

Figure 113-35 A brake hydraulic hose is often attached to the strut housing. Sometimes all that is required to separate the line from the strut is to remove a spring clip.
Figure 113-36  Use a strut spring compressor fixture to compress the spring on a MacPherson strut before removing the strut retaining nut.

Figure 113-37  Removing the strut rod nut. The strut shaft is being helped with one wrench while the nut is being removed with the other wrench. Notice that the spring is compressed before the nut is removed.

Figure 113-38  Typical MacPherson strut showing the various components.
After installing the replacement strut cartridge, reinstall the spring and upper bearing assembly after compressing the spring. Notice that the strut is being held in a strut spring compressor fixture.

Before final assembly, make sure the marks you made are aligned. Some struts are manufactured with marks to ensure proper reassembly.

The strut on a modified MacPherson strut assembly can be replaced by removing the upper mounting nuts.
Figure 113-42 Stabilizer bar links should be replaced as a pair.

Figure 113-43 A strut rod as viewed from the front of the vehicle.

Figure 113-44 Typical strut rod bushing with rubber on both sides of the frame to help isolate noise, vibration, and harshness from being transferred to the passengers.
Notice that if the front coil springs are sagging, the resulting angle of the lower control arm causes the wheels to move from side to side as the suspension moves up and down. Note the difference between the distance at A with good springs and the distance at B with sagging springs.

Figure 113-46  Spring compressing tool in place to hold the spring as the ball joint is separated. Note that the shock absorber has been removed to allow the lower control arm to move downward enough to remove the coil spring.

Figure 113-47  The steering knuckle has been disconnected from the lower ball joint. The lower control arm and coil spring are being held up by a floor jack.
Figure 113-48  A rubber mallet is being used to support the upper control arm as the lower control is being lowered using a floor jack. After all of the tension has been removed from the coil spring, it can be removed and the replacement installed.

Figure 113-49  Spring insulators install between the spring seat and the coil spring to reduce noise.

Figure 113-50  The holes in the lower arm are not only used to allow water to drain from the spring seat, but are used as a gauge to allow the service technician to see if the coil spring is centered properly.
REAL WORLD FIX: The Rock-Hard Problem

The owner of a six-month-old full-size pickup truck complained that occasionally when the truck was driven up to a driveway, a loud grinding sound was heard. Several service technicians worked on the truck, trying to find the cause for the noise. After the left front shock absorber was replaced, the noise did not occur for two weeks, and then started again. Finally, the service manager told the technician to replace everything in the front suspension in an effort to solve the customer’s intermittent problem. Five minutes later, a technician handed the service manager a small, deformed rock. This technician had taken a few minutes to carefully inspect the entire front suspension. Around the bottom coil spring seat, the technician found the rock. Apparently, when the truck made a turn over a bump, the rock was forced between the coils of the coil spring, making a very loud grinding noise. But the rock did not always get between the coils. Therefore, the problem occurred only once in a while. The technician handed the rock to the very happy customer.

Figure 113-51  By rotating the adjusting bolt, the vehicle can be raised or lowered.

Figure 113-52  An adapter and a press or large clamp are used to remove the old bushing from the control arm and to install a new bushing.
The tools needed to replace a front strut assembly include several sockets and a ball-peen hammer, plus a strut compressor.

After safely hoisting the vehicle to elbow height and removing the wheel covers, mark and remove the front tire/wheel assembly.

Remove the two strut retaining nuts.
Before using a hammer to drive the retaining bolts from the steering knuckle, thread the nut backwards to prevent causing damage to the threads.

Remove the retaining bolts and separate the strut from the steering knuckle.

Lower the vehicle and remove the upper strut retaining fasteners.
STRUT REPLACEMENT 7 Hold the strut while removing the last upper retaining nut and then remove the strut assembly.

STRUT REPLACEMENT 8 After the strut has been removed from the vehicle, install the assembly into a strut compressor. Position the jaws of the compressor under the bearing assembly as per the vehicle manufacturer’s instructions. Mark the relationship of spring to strut before disassembly.
STRUT REPLACEMENT 10  Turn the compressor wheel until all tension of the spring has been relieved from the upper bearing assembly.

STRUT REPLACEMENT 11  Remove the strut retaining nut.

STRUT REPLACEMENT 12  Remove the strut assembly.
Before installing the replacement strut, check the upper bearing by exerting a downward force on the bearing while rotating and check for roughness. Replace if necessary.

Install the strut from underneath the spring compressor fixture.

Most vehicle manufacturers specify that the strut retaining nut be replaced and the old one discarded.
Before loosening the tension, check that the coil spring is correctly located at both the top and the bottom, then release the tension on the spring.

Remove the strut assembly from the compressor and place back into the vehicle and install the upper fasteners. Do not torque to specifications until the lower fasteners have been installed.

Attach the lower strut to the steering knuckle using the original hardened bolts and nuts.
19. Using a torque wrench, torque all fasteners to factory specifications.

20. Install the tire/wheel assembly, lower the vehicle, and torque the lug nuts to factory specifications. Align the vehicle before returning it to the customer.