FIGURE 48.1 Most early vehicles used single straight axles.

FIGURE 48.2 Typical kingpin used with a solid axle.
FIGURE 48.3 Twin I-beam front suspension. Rubber bushings are used to support the I-beams to the frame and help isolate road noise.

FIGURE 48.4 The rubber radius rod bushing absorbs road shocks and helps isolate road noise.

FIGURE 48.5 The upper control arm is shorter than the lower control arm on a short/long-arm (SLA) suspension.
FIGURE 48.6 A typical SLA front suspension using coil springs.

FIGURE 48.7 An SLA-type suspension with the coil spring placed on top of the upper control arm.

FIGURE 48.8 A torsion bar SLA suspension can use either the lower or the upper control arm.
FIGURE 48.9 A typical MacPherson strut showing all of the components of the assembly. In strut suspension, the shock and the spring are in one structural assembly.

FIGURE 48.10 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 48.11 Multilink front suspension design varies depending on the vehicle manufacturer.
FIGURE 48.12 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 means that the rod seal has failed.

FIGURE 48.13 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 48.14: It is easy to see that this worn control arm bushing needs to be replaced. The new bushing is shown next to the original.

FIGURE 48.15: 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 flush or recessed.

FIGURE 48.16: Indicator ball joints should be checked with the weight of the vehicle on the ground.
FIGURE 48.17 Typical dial indicator used to measure the suspension component movement. The locking pliers attach the gauge to a stationary part of the vehicle and the flexible coupling allows the dial indicator to be positioned at any angle.

FIGURE 48.18 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 measure the amount of freeplay in the ball joints. Be sure that the looseness being measured is not due to normal wheel bearing endplay.

FIGURE 48.19 The jack should be placed under the lower control arm of this modified MacPherson-type suspension.
FIGURE 48.20 The spring is attached to the upper control arm. The jack should be placed under the frame to check for ball joint wear.

FIGURE 48.21 A special tool or a block of wood should be inserted between the frame and the upper control arm before lifting the vehicle off the ground. This will stop the force of the spring against the upper ball joint so that a true test can be performed on the condition of the ball joint.

FIGURE 48.22 The jacking point is under the frame for checking the play of a lower ball joint used with a MacPherson strut.
FIGURE 48.23 This worn and rusty ball joint was found by moving the wheel and looking for movement in the joint.

FIGURE 48.24 Taper breaker tool 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 48.25 A pinch bolt attaches the steering knuckle to the ball joint. Remove the pinch bolt by turning the nut, not the bolt.
FIGURE 48.26 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 48.27 By drilling into the rivet, the holding force is released.

FIGURE 48.28 The head of the rivet can be removed by using a large-diameter drill as shown.
FIGURE 48.29 A punch and a hammer being used to remove a rivet after the head has been removed.

FIGURE 48.30 Press-in ball joints are best removed using a large C-clamp press, as shown.

FIGURE 48.31 Typical kingpin assembly.
FIGURE 48.32 Driving a kingpin out with a hammer.

FIGURE 48.33 A kingpin being removed showing the worn bushing.

FIGURE 48.34 Most shock absorbers used on the front suspension can be removed from underneath the vehicle after removing the attaching bolts or nuts.
FIGURE 48.35 Removing the upper strut mounting bolts. Some experts recommend leaving one of the upper strut mount nuts loosely attached to prevent the strut from falling when the lower attaching bolts are removed.

FIGURE 48.36 A brake hydraulic hose is often attached to the strut housing. Sometimes all that is required is to unclip the hose from the strut. It is to remove a spring clip.

FIGURE 48.37 Use a strut spring compressor fixture to compress the spring on a MacPherson strut before removing the strut retaining nut.
FIGURE 48.38 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 48.39 Typical MacPherson strut showing the various components.

FIGURE 48.40 After installing the replacement strut cartridge, reinstall the spring and upper bearing retainers, after compressing the spring. Notice the strut in being held in a strut spring compressor fixture.
FIGURE 48.41 Before final assembly, make sure the marks you made are aligned. Some struts are manufactured with marks to ensure proper reassembly.

FIGURE 48.42 The strut on a modified MacPherson strut assembly can be replaced by removing the upper mounting nut.

FIGURE 48.43 Stabilizer bar links should be replaced as a pair.
FIGURE 48.44 A strut rod as viewed from the front of the vehicle.

FIGURE 48.45 Typical strut rod bushing with tabbed on both sides of the frame to help isolate noise, vibration, and harshness from being transferred to the passengers.

FIGURE 48.46 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 48.47 Spring compressing tool in place to hold the spring as the ball joint is separated. Note that the stabilizer bar links have been removed to allow the lower control arm to move downward enough to remove the coil spring.

FIGURE 48.48 The steering knuckle has been disconnected from the lower ball joint. The lower control arm and the coil spring are being held up by a floor jack.

FIGURE 48.49 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 released from the coil spring, it can be removed and the replacement installed.
FIGURE 48.50  Spring insulators are installed between the spring seat and the coil spring to reduce noise.

FIGURE 48.51  The holes in the lower arm are not only used to allow water to drain from the spring seat, but also used as a gauge to show the service technician that the coil spring is correctly seated.

FIGURE 48.52  By rotating the adjusting bolt, the vehicle can be raised or lowered.
FIGURE 48.53 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.

FIGURE 48.1 The tools needed to replace a front strut assembly include several sockets and a ball-peen hammer, plus a strut compressor.

FIGURE 48.2 After safely hoisting the vehicle to elbow height and removing the wheel covers, remove the front tire/wheel assembly.
UNFIGURE 48.3 Remove the two strut retaining nuts.

UNFIGURE 48.4 Before using a hammer to drive the retaining bolts from the steering knuckle, thread the nut into the bolt and back up to prevent causing damage to the threads.

UNFIGURE 48.5 Remove the retaining bolts and separate the strut from the steering knuckle.
UNFIGURE 48.6: Lower the vehicle and remove the upper strut retaining fasteners.

UNFIGURE 48.7: Hold the strut while removing the last upper retaining nut and then remove the strut assembly.

UNFIGURE 48.8: After the strut has been removed from the vehicle, install the assembly into a strut compressor.
UNFIGURE 48.9 Position the jaws of the compression under the bearing assembly as per the vehicle manufacturer's instructions.

UNFIGURE 48.10 Turn the compressor wheel until all tension of the spring has been relieved from the upper bearing assembly.

UNFIGURE 48.11 Remove the strut retaining nut.
UNFIGURE 48.12: Remove the strut assembly.

Before installing the replacement strut, check the upper bearing by exerting a downward force on the bearing after setting and check for roughness. Replace if necessary.

Install the strut from underneath the spring compressor fixture.
UNFIGURE 48.15 Install the strut retaining nut. Most vehicle manufacturers specify that the strut retaining nut be replaced and the old one discarded.

UNFIGURE 48.16 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.

UNFIGURE 48.17 Remove the strut assembly from the compressor and back into the vehicle and install the upper fasteners. Do not torque to specifications until the lower fasteners have been installed.
CHAPTER 48
Front Suspension and Service

UNFIGURE 48.18
Attach the lower strut to the steering knuckle using the original hardened bolts and nuts.

UNFIGURE 48.19
Using a torque wrench, torque all fasteners to factory specifications.

UNFIGURE 48.20
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.