Figure 60-1. (a) Safety belts are the primary restraint system. (b) During a collision, the stretching of the safety belt slows the impact to help reduce injury.

Figure 60-2. Most safety belts have an inertia-type mechanism that locks the belt in the event of rapid deceleration.
Figure 60-3 A typical safety belt warning light

Figure 60-4 A small explosive charge in the pretensioner forces the end of the seat belt down the tube, which removes any slack in the seat belt.

Figure 60-5 A typical airbag system showing many of the components. The SDM is the sensing and diagnostic module and includes the arming sensor as well as the electronics that help checking the circuits for continuity and the capacitors that are discharged to deploy the airbag.
Figure 60-6 A simplified airbag deployment circuit. Note that both the arming sensor and at least one of the discriminating sensors must be activated at the same time. The arming sensor provides the power, and either one of the discriminating sensors can provide the ground for the circuit.

Figure 60-7 The inflator module is being removed from the airbag housing. The squib, inside the inflator module, is the heating device that ignites the pyrotechnic gas generator that rapidly produces nitrogen gas to fill the airbag.

Figure 60-8 This shows a deployed side curtain airbag on a training vehicle.
Figure 60-9 An airbag magnetic sensor.

Figure 60-10 Some vehicles use a ribbon-type crash sensor.

Figure 60-11 A sensing and diagnostic module that includes an accelerometer.
Figure 60-12  A driver’s side airbag showing two inflator connectors. One is for the lower force inflator and the other is for the higher force inflator. Either can be ignited or both at the same time if the deceleration sensor detects a severe impact.

SAFETY TIP: Dual-Stage Airbag Caution
Many vehicles are equipped with dual-stage airbags (two-stage airbags) that actually contain two separate inflators, one for less severe crashes and one for higher speed collisions. These systems are sometimes called smart airbag systems because the accelerometer-type sensor used can detect how severe the impact is and deploy one or both stages. If one stage is deployed, the other stage is still active and could be accidentally deployed. A service technician cannot tell by looking at the airbag whether both stages have deployed. Always handle a deployed airbag as if it has not been deployed and take all precautions necessary to keep any voltage source from getting close to the inflator module terminals.

TECH TIP: Pocket the Ignition Key to Be Safe
When replacing any steering gear such as a rack-and-pinion steering unit, be sure that no one accidentally turns the steering wheel. If the steering wheel is turned without being connected to the steering gear, the airbag wire coil (clockspring) can become off center. This can cause the wiring to break when the steering wheel is rotated after the steering gear has been replaced. To help prevent this from occurring, simply remove the ignition key from the ignition and keep it in your pocket while servicing the steering gear.
Figure 60-13  The airbag control module is linked to the powertrain control module (PCM) and the body control module (BCM) on this Chrysler system. Notice the airbag wire connecting the module to the airbag through the clockspring. Both power, labeled “driver airbag high,” and ground, labeled “driver airbag low,” are conducted through the clockspring.

Figure 60-14  An airbag diagnostic tester. Included in the plastic box are electrical connections and a load tool that simulates the inflator module during troubleshooting.

FREQUENTLY ASKED QUESTION: What Are Smart Airbags? Smart airbags use the information from sensors to determine the level of deployment. Sensors used include:

- Vehicle speed (VS) sensors. This type of sensor has a major effect on the intensity of a collision. The higher the speed is, the greater the amount of impact force.
- Seat belt fastened switch. If the seat belt is fastened, as determined by the seat belt buckle switch, the airbag system will deploy accordingly. If the driver or passenger is not wearing a seatbelt, the airbag system will deploy with greater force compared to when the seat belt is being worn.
- Passenger seat sensor. The sensor in the seat on the passenger side determines the force of deployment. If there is not a passenger detected, the passenger side airbag will not deploy on the vehicle equipped with a passenger seat sensor system.
FREQUENTLY ASKED QUESTION: Why Change Knee Bolsters If Switching to Larger Wheels?

Larger wheels and tires can be installed on vehicles, but the powertrain control module (PCM) needs to be reprogrammed so the speedometer and other systems that are affected by a change in wheel/tire size can work effectively. When 20 in. wheels are installed on General Motors trucks or sport utility vehicles (SUVs), GM specifies that replacement knee bolsters be installed. These knee bolsters are mounted into the lower part of the dash. They are designed to absorb impact energy in the event of a front collision. The knee bolsters are required to maintain the crash testing results. The larger 20 in. wheels would tend to be forced further into the passenger compartment in the event of a front-end collision. Therefore, for the vehicle to maintain its crash testing rating, larger knee bolsters are required.

WARNING: Failure to perform the specified changes when changing wheels and tires could result in the vehicle not being able to provide the occupant protection as designed by the crash test rating that the vehicle originally achieved.

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Figure 60-15 After disconnecting the battery and the yellow connector at the base of the steering column, the airbag inflator module can be removed from the steering wheel and the yellow airbag electrical connector at the inflator module disconnected.

Figure 60-16 Shorting bars are used in most airbag connectors. These spring-loaded clips short across both terminals of an airbag connector when it is disconnected to help prevent accidental deployment of the airbag. If electrical power was applied to the terminals, the shorting bars would simply provide a low-resistance path to the other terminal and not allow current to flow past the connector. The mating part of the connector has a tapered piece that spreads apart the shorting bars when the connector is reconnected.
Figure 60-17  An airbag clockspring showing the flat conductor wire. It must be properly positioned to ensure proper deployment.

Figure 60-18  An airbag being deployed as part of a demonstration in an automotive laboratory.

Figure 60-19  A dash warning lamp will light if the passenger side airbag is off because no passenger was detected by the seat sensor.
Figure 60-20  The passenger side airbag "on" lamp will light if a passenger is detected on the passenger side.

Figure 60-21  A gel-filled (bladder-type) occupant detection sensor showing the pressure sensor and wiring.

Figure 60-22  A resistor-type occupant detection sensor. The weight of the passenger strains these resistors, which are attached to the seat, thereby signaling to the module the weight of the occupant.
Figure 60-23 A test weight is used to calibrate the occupant detection system on a Chrysler vehicle.

Figure 60-24 A typical seat (side) airbag that deploys from the side of the seat.

TECH TIP: Aggressive Driving and OnStar

If a vehicle equipped with the OnStar system is being driven aggressively and the electronic stability control system has to intercede to keep the vehicle under control, OnStar may call the vehicle to see if there has been an accident. The need for a call from OnStar usually will be determined if the accelerometer registers slightly over 1 g-force, which could be achieved while driving on a race track.