

Automotive Technology 6th Edition

Chapter 60 Air Bags

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Technology 6th text provides complete coverage of automotive components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and ASEEducation (NATEF) and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Case Studies, Videos, Animations, and ASEEducation (NATEF) Task Sheets.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	Explain learning objectives to students as listed below: <ol style="list-style-type: none"> 1. Explain how safety belts and retractors function. 2. Explain the operation of front airbags. 3. Describe the procedures to diagnose and repair common faults in airbag systems. 4. Explain how the passenger presence system works. 5. Describe how seat and side curtain airbags function. 6. Describe the data recorded by an event data recorder when an airbag is deployed. 7. This chapter will help prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "H" (Accessories Diagnosis and Repair).
Establish the Mood or Climate	Provide a WELCOME , Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

NOTE: Lesson plan is based on 6th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

DOWNLOAD Chapter 60 Chapter Images: From http://www.jameshalderman.com/automotive_principles.html

NOTE: You can use Chapter Images or possibly Power Point files:

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1. SLIDE 1 Ch60 AIRBAG AND PRETENSIONER CIRCUITS

Check for **ADDITIONAL VIDEOS & ANIMATIONS**
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Videos

[Airbag, Supplemental Restraint System \(View\)](#)
[\(Download\)](#)
[Safety Belt Forces \(View\) \(Download\)](#)

DEMONSTRATION: Show students different types of seat belt locking mechanisms & and how they work.

2. **SLIDE 2 EXPLAIN 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 bodily injury.

http://www.jameshalderman.com/automotive_principles.html
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Crossword Puzzle (Microsoft Word) (PDF)
Word Search Puzzle (Microsoft Word) (PDF)

DISCUSSION: Discuss different types of retractors used in automobiles. What types of retractors are used for safety belts?

3. **SLIDE 3 EXPLAIN Figure 60-2** Most safety belts have an inertia-type mechanism that locks the belt in the event of rapid movement.

4. **SLIDE 4 EXPLAIN Figure 60-3** A typical safety belt warning light

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5. **SLIDE 5 EXPLAIN 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

DISCUSSION: Discuss advantages & disadvantages of car with pretensioners. What safety concerns are associated with pretensioners? Discuss the dangers associated with working around seat belt pretensioners.

6. **SLIDE 6 EXPLAIN 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 keep checking the circuits for continuity and the capacitors that are discharged to deploy the air bags.
7. **SLIDE 7 EXPLAIN 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.

DISCUSSION: Discuss why airbags are considered supplemental. What safety feature do they supplement?

DEMONSTRATION: Show students different types of airbag inflation systems. Demonstrate & explain how to differentiate between systems

8. **SLIDE 8 EXPLAIN Figure 60-7** The inflator module is being removed from the airbag housing. The squib, inside the inflator module, is the heating element that ignites the pyrotechnic gas generator that rapidly produces nitrogen gas to fill the airbag.
9. **SLIDE 9 EXPLAIN Figure 60-8** This shows a deployed side curtain airbag on a training vehicle.
10. **SLIDE 10 EXPLAIN Figure 60-9** airbag magnetic sensor.
11. **SLIDE 11 EXPLAIN Figure 60-10** Some vehicles use a ribbon-type crash sensor

DISCUSSION: discuss how airbags affect driving habits. For example, how do airbags change hand position on steering wheel?

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DISCUSSION: talk about using more than one impact sensor in airbag circuits. What is the squib?

12. SLIDE 12 **EXPLAIN** Figure 60-11 A sensing and diagnostic module that includes an accelerometer.
13. SLIDE 13 **EXPLAIN** 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.

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.

14. SLIDE 14 **EXPLAIN** 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.

DEMONSTRATION: Show students different types of sensors & explain their operation

HANDS-ON TASK: On a Lab Vehicle, have the students locate air bag sensors and label them with masking tape

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15. SLIDE 15 **EXPLAIN** Figure 60-14 An airbag diagnostic tester. Included in the plastic box are electrical connectors and a load tool that substitutes for the inflator module during troubleshooting.

EXPLAIN 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 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.

DISCUSS FREQUENTLY ASKED QUESTION:
What Are Smart Airbags? Smart airbags use information from sensors to determine 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 is 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 deploys accordingly. If the driver or passenger is not wearing a seat belt, the airbag system deploys with greater force compared to when the seat belt is being worn.
- **Passenger seat sensor.** The sensor in the seat on passenger's side determines the force of deployment. If there is not a passenger detected, the passenger side airbag does not deploy on the vehicle

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equipped with a passenger seat sensor system.

DISCUSSION: Discuss why gold is used in connectors found in airbag circuits. Why is it important for airbag connectors to resist corrosion? Have students explain why airbag circuits must not be serviced until a set period of time after disconnecting the battery.

DEMONSTRATION: Show students proper procedures to safely disarm airbags

DISCUSS FREQUENTLY ASKED QUESTION:
Why Change Knee Bolsters If Switching to Larger Wheels? Larger wheels and tires can be installed on vehicles, but PCM needs to be reprogrammed so speedometer and other systems that are affected by a change in wheel/tire size can work effectively. When 20-inch wheels are installed on GM Trucks or sport utility vehicles (SUVs), GM specifies that replacement knee bolsters be installed. ***Knee bolsters*** are the padded area located on the lower part of dash where a driver or passenger's knees would hit in event of a front collision. The reason for the need to replace the knee bolsters is to maintain the crash testing results. The larger 20-inch wheels tend to be forced further into the passenger compartment in the event of a front-end collision. Therefore, to maintain the frontal crash rating standard, the 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 occupant protection as designed by the crash

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DEMO



QUESTION



QUESTION



DEMO



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test star rating that the vehicle originally achieved.

DEMONSTRATION: Show students how to properly handle & store non-deployed airbags.

Many airbag connectors have redundant locking mechanisms. Make sure to disable both locks before attempting to separate connector.

16. SLIDE 16 **EXPLAIN** Figure 60-15 After disconnecting battery and yellow connector at 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

DISCUSSION: discuss how airbag control module performs self-test on its circuitry. What is purpose of this self-test?

- 17.SLIDE 17 **EXPLAIN** 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

DISCUSSION: discuss purpose of shorting bars. How do these devices help prevent accidental deployment of airbags?

18. SLIDE 18 **EXPLAIN** Figure 60-17 An airbag clockspring showing the flat conductor wire. It must be properly positioned to ensure proper operation.

DEMONSTRATION: Demonstrate how to access steering column components to remove air bag

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QUESTION



QUESTION



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HANDS-ON TASK: Have students remove an airbag to gain access to steering column components and switches

ON-VEHICLE NATEF TASK Diagnose supplemental restraint systems; determine necessary action

DEMONSTRATION: Demonstrate & Explain all safety precautions & procedures to **SAFELY DEPLOY** an Air Bag

19. **SLIDE 19 EXPLAIN** Figure 60-18 An airbag being deployed as part of a demonstration in an automotive laboratory.

Airbag inflator modules can easily exceed 400°F when deployed. Let them cool before handling

DISCUSSION: Discuss why airbags must be deployed before disposal. In addition to endangering people, what other problems could be caused by disposing of airbags that have not been deployed?

DISCUSSION: discuss importance of installing the airbag sensor with the arrow pointing in correct direction. What does this directional mounting ensure? Talk about common locations where impact sensors are mounted on a lab vehicle. Why are sensors mounted in these locations?

121. **SLIDE 121 EXPLAIN** 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.
124. **SLIDE 124 EXPLAIN** Figure 60-20 passenger side airbag “on” lamp will light if a passenger is detected on the passenger seat.
24. **SLIDE 24 EXPLAIN** Figure 60-21 gel-filled (bladder-type) occupant detection sensor showing the pressure sensor and wiring.

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QUESTION



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23. SLIDE 23 **EXPLAIN** 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 module weight of occupant.
24. SLIDE 24 **EXPLAIN** Figure 60-23 test weight is used to calibrate occupant detection system on Chrysler.

DISCUSSION: Discuss different types of seat sensors and how they work. Why is there a need to determine passenger presence?

DEMONSTRATION: Demonstrate how to use a scan tool to check seat sensor calibration.

25. SLIDE 25 **EXPLAIN** Figure 60-24 A typical seat (side) airbag that deploys from the side of the seat.

DEMONSTRATION: Show students how to decipher a blinking airbag warning light to retrieve trouble codes

EXPLAIN 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 is usually determined if the accelerometer registers slightly over 1 g-force, which could be achieved while driving on a race track.

ON-VEHICLE NATEF TASK G4 Diagnose operation of safety systems and related circuits (such as: horn, airbags, seat belt pretensioners, occupancy classification, wipers, washers, speed control/collision avoidance, heads-up display, park assist, and back-up camera); determine needed repairs.