

*General Motors Answers  
Your Questions About*

# **Air Bags and Pretensioners in GM Vehicles**

*in Emergency Rescue  
Situations*



January 2001



# Introduction

Since September 1, 1989, all new cars sold in the United States are required to have an automatic restraint system as standard equipment. By law, all cars starting in model year 1998 and all trucks starting in model year 1999 are required to have air bag systems to provide automatic restraint.

General Motors fields many questions about air bags from emergency rescue professionals-police, fire, and EMS. These professionals ask whether to exercise extra caution when responding to an incident involving a car equipped with frontal and side impact air bags and safety belt pretensioners. The information that follows answers those questions about the GM air bag, which we call the "Supplemental Inflatable Restraint" (S.I.R.) or "Supplemental Restraint System" (S.R.S.). The information in this guide applies specifically to GM's air bag systems. Please contact other automakers for information about their air bag systems.

To help prevent injuries to patients and rescuers in emergency rescue operations, GM recommends several precautions that are explained in this guide.

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# Questions & Answers

**Q** *How does the frontal air bag work?*

Starting with the 2001 model year, certain GM vehicles will have dual-stage frontal air bags. In moderate severity crashes only the first stage may be deployed; severe crashes deploy both stages. The presence of a deployed air bag will no longer assure that the inflator module is inactive. Deployed air bags must be treated as if the second stage is still active.

**A** The air bag is designed to supplement the protection offered by safety belts. Depending on the vehicle in a frontal impact of sufficient severity (comparable to a perpendicular collision of about 9-16 mph or above into a solid wall), sensors in the vehicle detect the sudden deceleration. The controller determines if the crash is severe enough and triggers the inflator module(s), which inflate(s) a cloth bag packed inside the steering wheel and/or instrument panel. As the bag inflates in less than one-twentieth of a second, it splits open its protective cover and inflates (deploys) in front of an occupant.

In a crash, the car begins to stop when the impact occurs, but the occupants continue to move forward until something stops them. Unbelted occupants are stopped by the windshield, the instrument panel, or the steering wheel. Occupants wearing their safety belts are stopped gradually by the belts as the car stops, which distributes the stopping force.

In more severe collisions, however, even belted occupants could contact the steering wheel or instrument panel. The air bag supplements the protection the safety belts provide by distributing the impact load more evenly over the occupant's head and torso. This reduces concentrated loads from the occupant impacting the vehicle interior. As the occupant contacts the bag, gas vents through openings in the bag, which also helps stop the occupant more gradually.

Frontal air bags are designed to deploy in moderate to severe frontal or near frontal crashes, but not in rear impacts, side impacts, or rollovers, although they can in some cases. So it is possible that you will be involved in rescue operations after crashes in which an air bag did not deploy.

**How do I identify whether the car is equipped with an air bag?**

A car in which a frontal air bag has deployed can be identified easily by the cloth bag drooping from the steering wheel hub or instrument panel. A car with an air bag that did not deploy can be identified by several methods. Some GM models with an air bag will have the words “Supplemental Inflatable Restraint” or “S.I.R.,” “Supplemental Restraint System” or “SRS” or “Air Bag” on the steering wheel hub or instrument panel. Otherwise, an air bag can usually be identified by the large size of the steering wheel hub (up to approximately 6” by 9”), which contains the bag, or (on some, but not all, vehicles) by a deployment door on the instrument panel. Figure 1 shows a drawing of a typical GM driver air bag module, as well as a passenger air bag deployment door. Some newer models may open the entire upper instrument panel (I/P) or may have hidden deployment door seams with no obvious markings.

GM cars equipped with an air bag have the number “2,” “3” or “4” in the seventh position of the Vehicle Identification Number, which is visible through the bottom of the windshield on the driver’s side. In 1997 and later passenger cars (not light trucks or minivans), a “4,” “5,” “6,” “7” in this position indicates that the vehicle is also equipped with a side impact air bag. Information on this feature is available later in this guide.

If you cannot determine whether the car is equipped with an air bag, take the same precautions as if it were equipped with an undeployed air bag. Always assume that any late-model vehicle is equipped with a frontal air bag. There is no specific marking to indicate dual-stage.

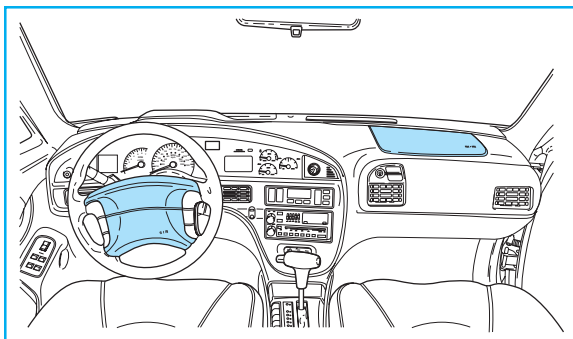


Figure 1

***Q I've heard that a deployed air bag produces what appears to be smoke. Is the air bag hot?***

**A** After the air bag has deployed in a crash, the air bag itself is not hot to the touch. Some components within the air bag module will be hot for a short time. A small amount of smoke coming from a deployed air bag module is normal and should not be a cause for concern.

When the gas is vented out of the air bag, small particles from inside the bag are also vented into the passenger compartment. These airborne particles look like smoke, and some of the particles are deposited as residue on and around the air bag.

***Q What about the residue on and around the air bag?***

**A** The residue vented from air bags using sodium azide as a propellant during deployment consists primarily of cornstarch, which is used to lubricate the bag as it deploys, and of by-products from the chemical reaction. A small amount of sodium hydroxide dust, a potential irritant, is produced as a by-product of the reaction. The sodium hydroxide interacts with the moisture in the air and quickly converts to sodium carbonate and sodium bicarbonate (baking soda). Thus, it is unlikely that significant amounts of sodium hydroxide will be present after the crash.

As in all other rescue procedures, wear protective gloves and safety glasses. If gloves are not worn, wash your hands with mild soap and water after handling the deployed air bag. Also, avoid rubbing your eyes after handling the bag until you have removed the gloves and/or washed your hands. Take care to avoid introducing the residue into the eyes or any wounds of the patient. These precautions will help prevent eye or skin irritation in the unlikely event that you do contact any sodium hydroxide. Frontal and side impact air bags in newer models may not have sodium azide in the propellant.

**Q** *Is there any sodium azide in the residue? I've heard it's harmful.*

**A** There is no detectable amount of sodium azide present in the passenger compartment of the vehicle after the air bag deploys. For many inflators sodium azide is a component of the propellant that produces the nitrogen gas and is toxic if ingested. The sodium azide is sealed in a metal canister until it converts to nitrogen gas to deploy the bag.

**Q** *If the air bag did not deploy in the crash, how can I prevent it from deploying in the rescue operation?*

**Q** *I've heard that the air bag has an energy reserve that will allow the bag to deploy even if the battery is disconnected. How can I prevent the energy reserve from firing the bag?*

**A** In the event of an emergency rescue of someone inside a vehicle with an undeployed air bag, we recommend that you disconnect the negative battery cable. If you are not sure which battery cable is negative, disconnect both battery cables to ensure that battery power is disconnected.

*Note: Not all vehicles have the battery in the engine compartment. The following cars have the battery under the rear seat:*

*Starting 1995 - Aurora, Riviera, and Seville*

*Starting 2000 - DeVille, Bonneville, and LeSabre*

*Regardless of the battery location, it is best to disconnect vehicle power at the battery.*

If you cannot disconnect the battery power, do not place your body or any objects on or very close to the front of the air bag module. You could be injured if the air bag deploys while your body is against or very close to the front of the steering wheel or instrument panel.

Newer models may have dual-stage frontal air bags. The air bag(s) may have an active second stage even if the first stage has already deployed.

**A** The GM air bag system is equipped with an energy reserve feature that enables the air bag(s) to deploy even if the battery has been destroyed early in a severe frontal crash. Though unlikely, it is possible that the energy reserve in some air bag systems has power to deploy the bag(s) for up to 10 minutes after the battery is disconnected or the ignition is turned off.

***Q Does this mean that I cannot carry out patient care and rescue during the ten minutes if I cannot disconnect the air bag connector?***

***Q I've heard sodium azide is reactive with water. If there is a fire in a car equipped with an air bag, can water be used to extinguish it?***

***A*** Although it is possible for an undeployed air bag to inflate during rescue operations, it is unlikely to occur. Carry out your normal patient care and rescue operations, but do not place your body or objects against or very close to the air bag module except for essential maneuvers.

***A*** Use any effective fire-fighting medium, including water, to extinguish a fire in a car equipped with an air bag. The sodium azide is sealed within a metal canister and is unlikely to come into contact with water used in fire-fighting efforts.

***Q*** If the air bag module is somehow ruptured, what precautions should I take?

***A*** In the highly unlikely event that the disk-shaped driver inflator canister (see Figure 2), tube-shaped passenger inflator (see Figure 3) or linear inflator (not shown here) is ruptured in a crash or in rescue operations, do not touch or ingest any exposed chemicals.

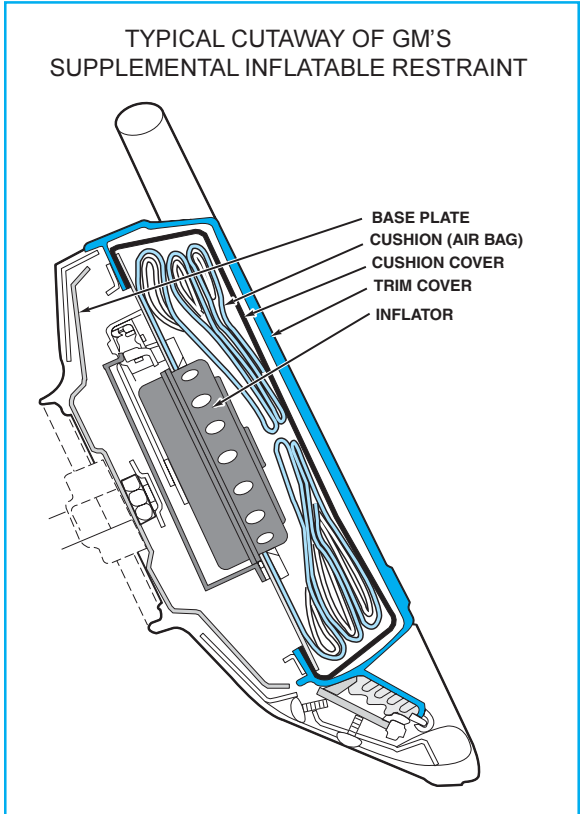


Figure 2

**O**ccasionally we use damaged cars for rescue training purposes. The cars are scrapped after we finish the training. Should we take any precautions to prevent an unwanted deployment during training?

**A** Before using a car with an air bag for rescue training purposes, manually deploy the air bag in the car. Refer to the manual deployment procedure described in the service manual for the specific car being used. Contact a GM dealer or zone office for assistance.

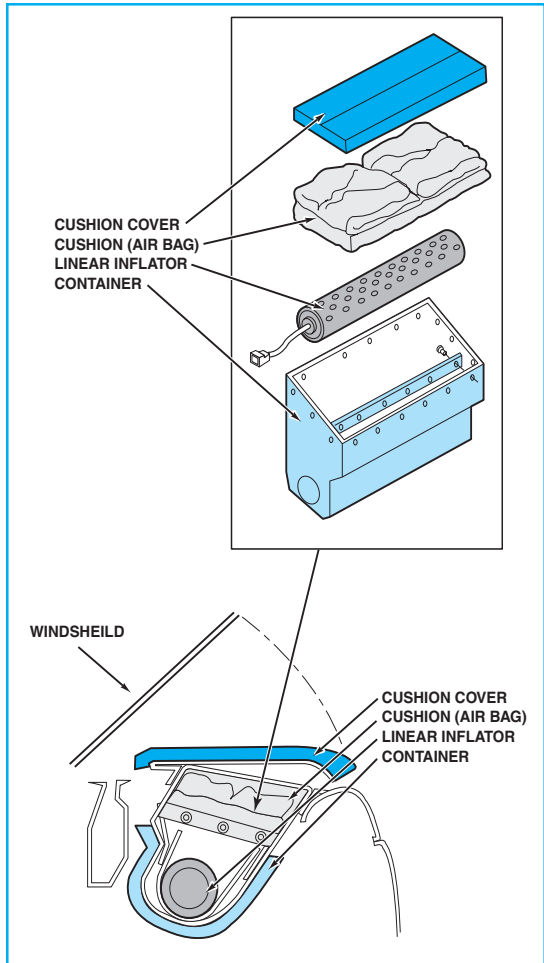


Figure 3

**Q** *Where are the air bag sensors? Should I avoid disturbing them in rescue operations?*

**A** Each GM model equipped with air bags has unique sensor locations. The sensors are designed to resist false triggering when the car is jarred. However, after a more severe crash, the air bag electrical system might be damaged, making the air bag more susceptible to unwanted deployment.

Disconnecting the negative battery cable is the best way to reduce the likelihood of unwanted air bag deployment in rescue operations.

**Q** *Are any precautions required to avoid an unwanted deployment while securing an unstable car?*

**A** It is unlikely that securing the car will cause the bag to deploy. If the car must be secured to prevent dangerous motion during the rescue, first secure the car, then follow the other precautions described in this guide.

**Q** *Can we use rescue tools to cut the steering wheel or to sever the steering column?*

**A** You may use hydraulic shears or other tools to separate the steering wheel rim from the steering wheel. Do **not** cut or drill in the area of the steering wheel hub that contains the air bag module. Some newer models may have dual-stage frontal air bags. Even if the air bag has deployed; it may have an active second stage.

If it is necessary to cut through the steering column, first disconnect battery power as described previously.

Do not apply heat (above 300°F) in the area of the inflator module. The air bag module is designed to self-deploy in the event of a fire, and applying heat could cause the self-deploy feature to activate. These precautions will help prevent an unwanted air bag deployment.

**Q** *How does the side impact air bag work?*

**A** Like the frontal air bag, the side impact air bag is designed to work with the safety belts to provide protection in a moderate to severe side impact. In a side impact of sufficient severity, a sensor in the door or B-pillar detects the sudden lateral acceleration of that structure (see Figure 4). That sensor triggers its respective inflator module, causing the propellant sealed inside to inflate a cloth bag packed behind the door trim or in the seat cushion. As the bag inflates in less than 1/40 of a second, it splits open its cover and inflates beside the occupant. Some newer models may have front and rear seat side impact air bags.

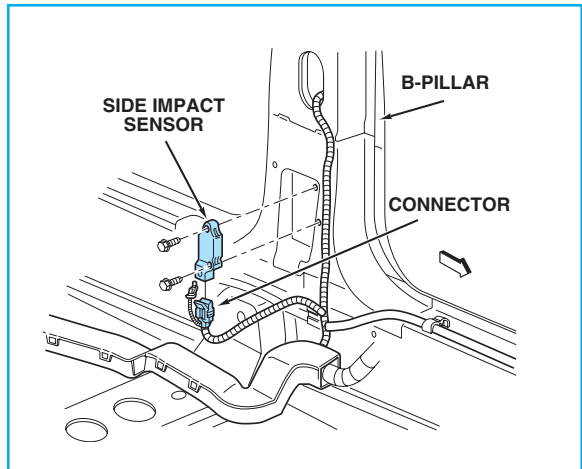


Figure 4

**Q** *How similar are the side impact air bag modules to the frontal air bag modules?*

**A** Early side impact air bag modules were door mounted and used the same technologies as the driver frontal module (see Figure 5).

All information pertaining to the safe handling of deployed modules and precautions for sodium azide apply to the side impact air bag modules also. More recent models use seat mounted (see figure 4) side impact air bags and may not use sodium azide as a propellant.

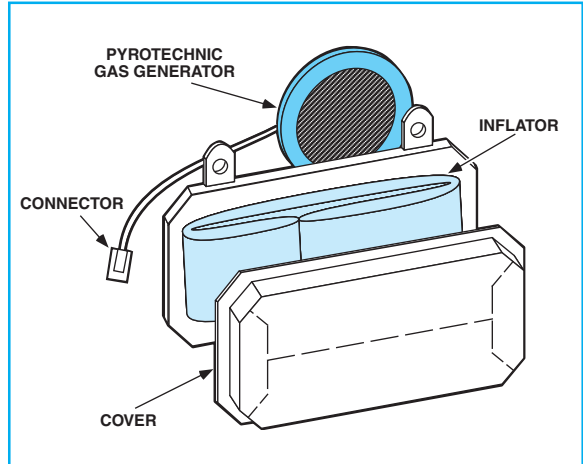


Figure 5

**How do I identify whether the car is equipped with a side impact air bag?**

A car in which a side impact air bag has deployed can be identified by the cloth bag drooping from the rear upper corner of the front door trim or from the outboard side of the seat on the struck side of the car. Due to the relatively small size of the bag, it may be obscured by the occupant of the seat.

A car with a side impact air bag that did not deploy can be identified using several methods. Starting in 1997, all Cadillac DeVille, Concours and D'Elegance models have door-mounted side impact air bags. These vehicles have the words "AIR BAG" embossed on the lower rear applique of the front door trim or on the seat trim. On passenger cars only (not light trucks or vans), the presence of a side impact air bag can be determined by looking at the VIN. There is a "4" in the seventh position of the VIN for passenger vehicles manufactured in model year 1997 through 1999. For model year 2000, front seat side impact air bags are also indicated by a "5" or "6" in the seventh position of the VIN; front and rear seat side impact air bags are indicated by a "7". Truck and van VINs do not have restraint codes, but a deployment door is visible on the outboard side of the front seatback as on passenger cars (see Figure 6).

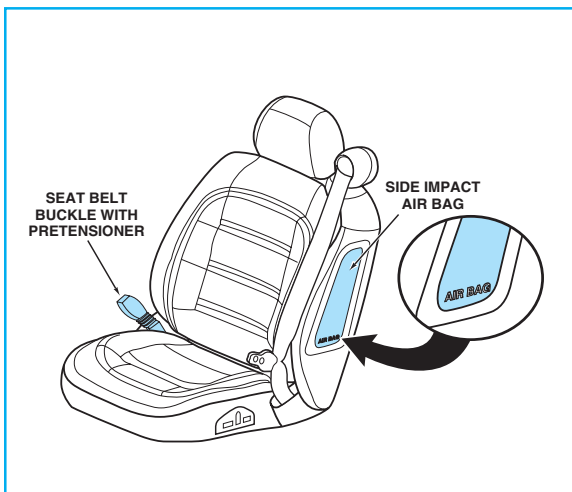


Figure 6

***Q*** ***If the side impact air bag did not deploy in the crash, how can I prevent it from deploying in the rescue operation?***

***Q*** ***Does the side impact air bag have an energy reserve?***

***Q*** ***Where are the side impact air bag sensors? Should I avoid disturbing them in rescue operations?***

***A*** In the event of the rescue of someone inside a car with an undeployed air bag, we recommend that you disconnect the negative battery cable. If you are not sure which cable is negative, disconnect both cables to ensure that the power is disconnected. In most crash situations, a vehicle with side impact air bags will have at least one air bag undeployed since those air bags are designed to inflate only on the struck side of the vehicle.

If you cannot disconnect the battery power, do not place your body or any objects close to the air bag module. You could be injured if the air bag deploys while your body is against or very close to the door or seat trim insert area. Remember to also take precautions to stay clear of undeployed frontal air bag modules.

***A*** The side impact air bag system is equipped with an energy feature that enables the air bag to deploy even if the power is lost early in a severe side crash. There is power to deploy the side impact air bags for approximately 10 seconds after the battery is disconnected or the ignition is turned off. Patient care and rescue operations should begin immediately. As with frontal air bags, take caution initially not to place your body or objects against or close to any of the undeployed air bag modules except for essential maneuvers.

***A*** Side impact sensors are located in the lower center portion of the door or in the lower portion of the B-pillar. The sensors are designed to be resistant to false triggering from jarring the car. However, after a more severe crash, the air bag electrical system might be damaged and more susceptible to an unwanted air bag deployment. Disconnecting the negative battery cable is the best way to reduce the likelihood of an unwanted deployment in rescue operations.

**Q** Can we use rescue tools to pry or cut the front doors off?

**A** After the air bag has been deployed, you may use any rescue procedure to cut the front door or seat. If the bag did not deploy, you may pry or cut in the forward half of the front door if the side impact bag system is mounted in the door. If the system is not a door-mounted system, any part of the door may be cut. On vehicles equipped with door-mounted side impact bags, there are no issues with cutting the door wires where they enter the door at the hinge, because the firing loop for the side impact air bag is contained in the rear of the door between the side impact sensing module and the air bag module. Figure 7 shows the air bag module location and the routing of the firing loop wiring. Do not cut or drill in the upper rearward quadrant of the front door where the side impact air bag module is packaged. When possible, disconnect the battery as described previously before cutting in the rear half of the door.

If the side impact air bag did not deploy, do not apply heat above 300°F (such as from an acetylene torch) in the area of the inflator module. The air bag module is designed to self-deploy in the event of a fire, and applying heat could cause the self-deploy feature to activate. These precautions will help prevent an unwanted air bag deployment.

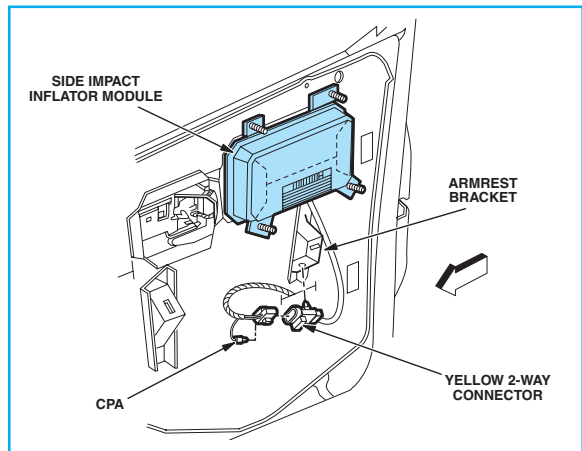


Figure 7

**Q** Can we use rescue tools to pry or cut out the roof?

**A** As of this book's production, only two models use optional roof-mounted curtain air bags instead of the previously-described side impact air bags mounted in the doors or seats — 2000-2001 Saturn L- and S-Series (see Figures 8 and 9). This technology may be used on other models in the future.

If the curtain air bags have deployed, you may use any rescue procedure to cut the roof. If the curtain air bags have not deployed, avoid cutting or prying anywhere along the perimeter of the roof structure. The module wiring comes up the A-pillars, outboard of the windshield. The modules are positioned in the roof, just inboard of the door jambs. The sensors for these curtain air bags are found in the door or B-pillar (depending on model) as you would find on a side impact air bag-equipped vehicle.

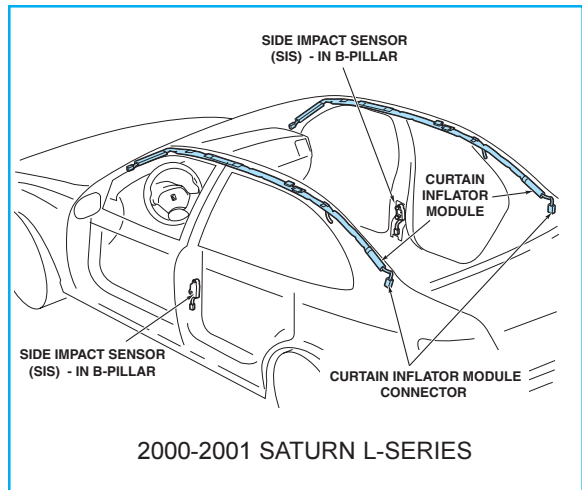


Figure 8

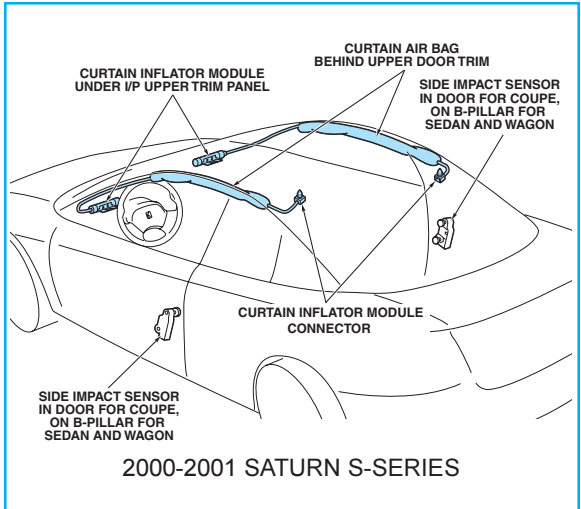


Figure 9

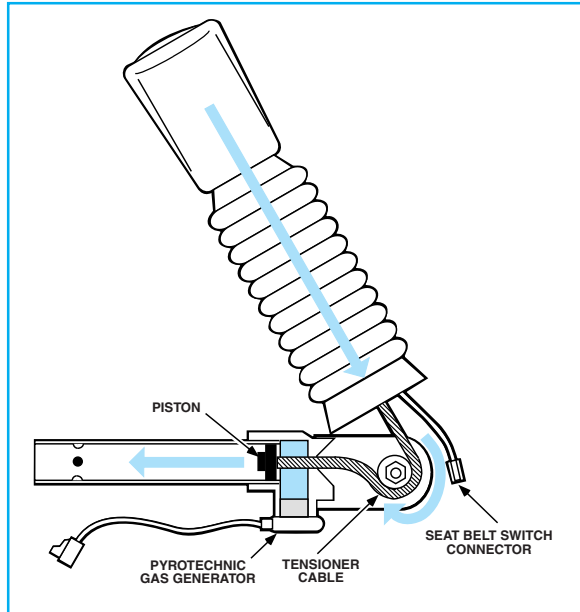
**Q** *What does a pretensioner do?*

**Q** *How does the pretensioner tighten the safety belt?*

**A** A pretensioner is a device that is connected to the safety belt buckle or is attached to the safety belt retractor. The pretensioner will tighten the belt during crashes that involve frontal air bag deployment.

**A** The buckle pretensioner uses a pyrotechnic gas generator to propel a piston that is attached to the safety belt buckle with a cable (Figure 10). The cable pulls the buckle down toward the seat adjusting rail.

The retractor pretensioner uses a pyrotechnic gas generator that propels a piston, which is attached to the retractor spool with a cable. The cable “backwinds” the retractor spool.



*Figure 10*

**Q** *How will I know if the buckle pretensioner has deployed?*

**A** The top of the safety belt buckle will be at or below the top of the seat cushion. Also, the “accordion” sleeve below the buckle will be compressed.

**Q** *How will I know if the retractor pretensioner has deployed?*

**A** There may be some tension in the belt system.

**Q** *How should I handle the pretensioner in a non-deployment situation?*

**A** Use the same precautions you would for the other inflatable restraint components. Disconnecting the battery allows the capacitor to discharge and disable the system. There is little risk of injury from deployment, especially if the belt is unbuckled or cut.

**Q** *Does the pretensioner device have an energy reserve?*

**A** There is power to activate a pretensioner for approximately 10 seconds after the battery is disconnected or the ignition is turned off.

# Conclusion

GM has taken great care in designing the Supplemental Inflatable Restraint. By taking the simple precautions described, you can help reduce the risk of injuries in emergency rescue operations involving GM vehicles equipped with supplemental restraint systems.



