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FALL NEWSLETTER

AIR BAGS: CONSTRUCTION, FUNCTION AND DEVELOPMENT

---[Excerpted from NHTSA 8-03]---

The Air Bag System for Frontal Crashes

The air bag system consists of three basic parts - an air bag module, crash sensors and a diagnostic unit. Some systems may also have an on/off switch, which allows the air bag to be deactivated.

The **Air Bag Module** contains both an inflator unit and the lightweight fabric air bag. The driver air bag module is located in the steering wheel hub, and the passenger air bag module is located in the instrument panel. When fully inflated, the driver air bag is approximately the diameter of a large beach ball. The passenger air bag can be two to three times larger since the distance between the right-front passenger and the instrument panel is much greater than the distance between the driver and the steering wheel.

The **Crash Sensors** are located either in the front of the vehicle and/or in the passenger compartment. Vehicles can have one or more crash sensors. The sensors are typically activated by forces generated in significant frontal or near-frontal crashes. Sensors measure deceleration, which is the rate at which the vehicle slows down. Because of this, the vehicle speed at which the sensors activate the air bag varies with the nature of the crash. Air bags are not designed to activate during sudden braking or while driving on rough or uneven pavement. In fact, the maximum deceleration generated in the severest braking is only a small fraction of that necessary to activate the air bag system.

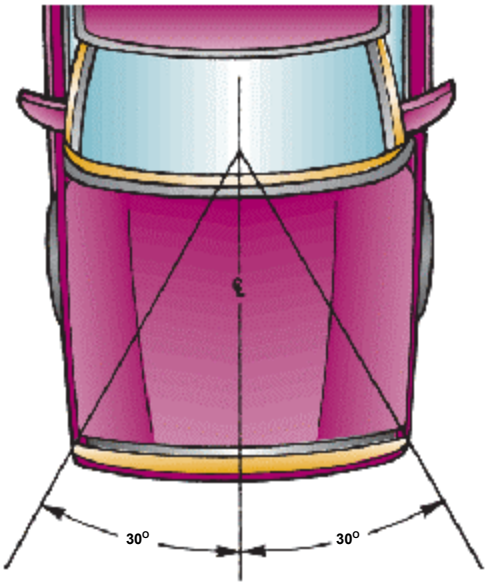
The **Diagnostic Unit** monitors the readiness of the air bag system. The unit is activated when the vehicle's ignition is turned on. If the unit identifies a problem, a warning light alerts the driver to take the vehicle to an authorized service department for examination of the air bag system. Most diagnostic units contain a device, which stores enough electrical energy to deploy the air bag if the vehicle's battery is destroyed very early in a crash sequence.

Some vehicles without rear seats, such as pick up trucks and convertibles, or with rear seats too small to accommodate rear-facing child restraints, have manual ON/OFF switches for the passenger air bag installed at the factory. ON/OFF switches for driver or passenger air bags may also be installed by qualified service personnel at the request of owners who meet government-specified criteria and who receive government permission.

When Air Bags Deploy

Air bags are typically designed to deploy in frontal and near-frontal collisions, which are comparable to hitting a solid barrier at approximately 8 to 14 miles per hour (mph). Roughly speaking, a 14 mph barrier collision is equivalent to striking a parked car of similar size across the full front of each vehicle at about 28 mph. This is because the parked car absorbs some of the energy of the crash, and is pushed by the striking vehicle. Unlike crash tests into barriers, real-world crashes typically occur at angles, and the crash forces usually are not evenly distributed across the front of the vehicle. Consequently, the relative speed between a striking and struck vehicle required to deploy the air bag in a real-world crash can be much higher than an equivalent barrier crash.

Because air bag sensors measure deceleration, vehicle speed and damage are not good indicators of whether or not an air bag should have deployed. Occasionally, air bags can deploy due to the vehicle's undercarriage violently striking a low object protruding above the roadway surface. Despite the lack of visible front-end damage, high deceleration forces may occur in this type of crash, resulting in the deployment of the air bag.



Angle of Frontal Impact

Most air bags are designed to automatically deploy in the event of a vehicle fire when temperatures reach 300 to 400 degrees Fahrenheit. This safety feature helps to ensure that such temperatures do not cause an explosion of the inflator unit within the air bag module.

Front air bags are not designed to deploy in side impact, rear impact or rollover crashes. Since air bags deploy only once and deflate quickly after the initial impact, they will not be beneficial during a subsequent collision. Safety belts help reduce the risk of injury in many types of crashes. They help to properly position occupants to maximize the air bag's benefits and they help restrain occupants during the initial and any following collisions. So, it is extremely important that safety belts always be worn, even in air bag-equipped vehicles.

When a Collision Occurs

When a crash occurs, the vehicle rapidly decelerates while its structure absorbs the majority of the crash forces. Unbelted occupants continue to move forward at the vehicle's original speed until the vehicle's interior (the steering wheel, instrument panel, windshield, etc.) stops their movement. Belted occupants come to a more gradual stop by being secured to the vehicle's structure. In severe crashes, even properly belted occupants may come into contact with the vehicle's interior.

Air bags supplement the safety belt by reducing the chance that the occupant's head and upper body will strike some part of the vehicle's interior. They also help reduce the risk of serious injury by distributing crash forces more evenly across the occupant's body.

When there is a moderate to severe frontal crash that requires the frontal air bag to deploy, a signal is sent to the inflator unit within the air bag module. An igniter starts a reaction, which produces a gas to fill the air bag, making the air bag deploy through the module cover. Some air bag technologies use nitrogen gas to fill the air bag while others may use argon gas. The gases used to fill air bags are harmless.

From the onset of the crash, the entire deployment and inflation process takes only about 1/20th of a second, faster than the blink of an eye. Because a vehicle changes speed so fast in a crash, air bags must inflate rapidly if they are to help reduce the risk of the occupant hitting the vehicle's interior.

After a Deployment

Once an air bag deploys, deflation begins immediately as the gas escapes through vents in the fabric. Deployment is frequently accompanied by the release of dust-like particles in the vehicle's interior. Most of this dust consists of cornstarch or talcum powder, which are used to lubricate the air bag during deployment. Small amounts of sodium hydroxide may initially be present. This chemical can cause minor irritation to the eyes and/or open wounds; however, with exposure to air, it quickly turns into sodium bicarbonate (common baking soda). Depending on the type of air bag system, potassium chloride (a table salt substitute) may also be present.

For most people, the only effect the dust may produce is some minor irritation of the throat and eyes. Generally, minor irritations only occur when the occupant remains in the vehicle for many minutes with the windows closed and no ventilation. However, some people with asthma may develop an asthmatic attack from inhaling the dust. With the onset of symptoms, asthmatics should treat themselves as advised by their doctor, then immediately seek medical treatment.

Once deployed, the air bag cannot be reused and should be replaced by an authorized service department. Because the air bags only deploy once, do not drive the vehicle until the air bags have been replaced.

Air Bag Contact Injuries

Air bags must inflate very rapidly to be effective, and therefore come out of the steering wheel hub or instrument panel with considerable force, generally at a speed over 100 mph. Because of this initial force, contact with a deploying air bag may cause injury. These air bag contact injuries, when they occur, are typically very minor abrasions or burns.

More serious injuries are rare; however, serious or even fatal injuries can occur when someone is very close to, or in direct contact with an air bag module when the air bag deploys. Such injuries may be sustained by unconscious drivers who are slumped over the steering wheel, unrestrained or improperly restrained occupants who slide forward in the seat during pre-crash braking, and even properly restrained drivers who sit very close to the steering wheel. Never attach objects to an air bag module or place loose objects on or near an air bag module, since they can be propelled with great force by a deploying air bag, potentially causing serious injuries.

An unrestrained or improperly restrained occupant can be seriously injured or killed by a deploying air bag. The National Highway Traffic Safety Administration (NHTSA) recommends drivers sit with at least 10 inches between the center of their breastbone and the center of the steering wheel. Children 12 and under should always ride properly restrained in a rear seat. Never put a rear-facing infant restraint in the front seat of a vehicle with a front passenger air bag. A rear-facing infant restraint places an infant's head close to the air bag module, which can cause severe head injuries or death if the air bag deploys.

New Technologies

Advanced Air Bag Technologies

Many advanced air bag technologies are being developed to tailor air bag deployment to the severity of the crash, the size and posture of the vehicle occupant, belt usage and how close that person is to the air bag module. Many of these systems will use multi-stage inflators that deploy less forcefully in stages in moderate crashes than in very severe crashes. Occupant sensing devices let the air bag diagnostic unit know if someone is occupying a seat in front of an air bag, whether the person is an adult or a child, whether a seat belt or child restraint is being used and whether the person is forward in the seat and close to the air bag module. Based on this information and crash severity information, the air bag is deployed at either a high force level, a less forceful level or not at all.

For evaluating advanced air bag systems, laboratory tests utilizing a family of crash test dummies will be required. In addition to tests using a dummy representing an average adult male, future air bag systems will be tested with a small adult female dummy and dummies representing one, three and six year old children. These new NHTSA requirements are being phased in over the next several years with some vehicles already in production.

However, even with advanced air bag technologies, children ages 12 and under should always ride in a rear seating position in an appropriate restraint system.

Side and Rollover Air Bags

Many new vehicles are also equipped with side air bags. While there are several types of side air bags, all are designed to reduce the risk of injury in moderate to severe side impact crashes. These air bags are generally located in the outboard edge of the seat back, in the door or in the roof rail above the door.

Seat and door-mounted air bags all provide upper body protection. Some also extend upwards to provide head protection. Two types of side air bags, known as inflatable tubular structures and inflatable curtains, are specifically designed to reduce the risk of head injury and/or help keep the head and upper body inside the vehicle. A few vehicles are now being equipped with a different type of inflatable curtain designed to help reduce injury and ejection from the vehicle in rollover crashes. Read your owner's manual for specific information about the air bags in your vehicle.

While side air bags are smaller than front air bags, they must deploy very rapidly. Close proximity of a child's head, neck or chest to a side air bag may cause serious injury. Therefore, it is important never to lean up against or rest against a side air bag. Seat belts (or child restraints as appropriate) should always be worn to avoid possible injury by keeping enough distance between the occupant and the side air bag module.

If you transport children and are thinking about buying a car with side air bags in rear seating positions, check the vehicle and child restraint manufacturers' recommendations for child restraint use in that vehicle.

----------[Excerpted from NHTSA 8-03]----------