Safety Restraint Systems Examination

Investigators Guide
Safety Restraint Systems

Improvements in roadway and automobile designs have steadily reduced injury and death rates in this country. The terms "active" and "passive" are simple but important terms in the world of automotive safety. "Active safety" is used to refer to technology assisting in the prevention of a crash and "passive safety" to components of the vehicle (primarily airbags, seatbelts and the physical structure of the vehicle) that help to protect occupants during a crash. This focus of this guide will be on the examination of passive safety systems.

A seat belt or seatbelt, sometimes called a safety belt, is a safety harness designed to secure the occupant of a vehicle against harmful movement that may result from a collision or a sudden stop. As part of an overall automobile passive safety system, seat belts are intended to reduce injuries by stopping the wearer from hitting hard interior elements of the vehicle, or other passengers (the so-called second impact), and in the correct position for the airbag to deploy and prevent the passenger from being thrown from the vehicle. Seat belts also absorb energy by being designed to stretch during any sudden deceleration, so that there is less speed differential between the passenger's body and their vehicle interior, and also to spread the loading of impact on the passenger’s body.

Types of seatbelt

Lap

An adjustable strap that goes over the waist. This type of belt is frequently found in older cars. Until recently, it has been used on some newer vehicles in rear or rear middle seats. These types of belt are also found on some coaches. Passenger aircraft seats also use lap seat belts to help prevent injuries while still allowing passengers to adopt a brace position.

Sash

A "sash" or shoulder harness is an adjustable strap that goes diagonally over the vehicle occupant's outboard shoulder and is buckled inboard of his or her lap. The shoulder harness may attach to the lap belt tongue, or it may have a tongue and buckle completely separate from those of the lap belt. Shoulder harnesses of this separate or semi-separate type were installed in conjunction with lap belts in the outboard front seating positions of many vehicles. However, if the shoulder
strap is used without the lap belt, the vehicle occupant is likely to "submarine", or slide forward in the seat and out from under the belt, in a frontal collision.

**Three-point**

Similar to the lap and sash belts, but has one single continuous length of belt. Both three-point and lap-and-sash belts help spread out the energy of the moving body in a collision over the chest, pelvis, and shoulders.

Until the 1980s, three-point belts were commonly available only in the front seats of cars; the back seats were only often fitted with lap or sash belts. Evidence of the potential of lap belts to cause separation of the lumbar vertebrae and the sometimes associated paralysis, or "seat belt syndrome", led to a revision of passenger safety regulations. Since September 1, 2007, all new cars sold in the U.S. require a lap and shoulder belt in the center rear seat.

When investigating a serious crash it becomes important to inspect the safety restraint systems on vehicles involved. It is useful for crash team members to become familiar with the components of the different systems. Careful inspection will reveal important clues as to the occupants position and use status of onboard safety equipment. The information in this manual will assist you in your inspection.

**Webbing marks**

In crashes there could be marks on the tongue and on the webbing. On the webbing there are striations and on the D-ring abrasions and melting plastics. Such webbing marks will be produced only if big forces were occurred and not under normal conditions. These big forces produce enough heat for these marks.

The first two pictures (a) and (b) below have a polished and a smooth area on the D-ring. For the first consideration this effects must be from the crash but these marks are from general use of the driver or passenger. In case of a crash the material of the D-ring would be found in the seat belt as well.

In the pictures (c) and (d) the material of the seat belt is daubed in the D-ring. Picture (e) shows the weaving pattern of the seatbelt on the D-ring. The force wasn’t very high and the crash not severe. Picture (f) shows the microscopic photo of the daubed seat belt material. (g) and (h) demonstrate material of the seat belt on the D-ring whereby in picture (i) and (j) striations are on the belt. Such characteristics can be arguments that the seat belt was used if the driver or
passenger doesn’t tell the truth. Broken glass causes such traces shown in pictures (k) and (l) if a window breaks and is pitched into the passenger’s compartment.

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<th>Swivel D-ring, tongue</th>
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On the webbing there are many different traces, which are caused during a crash or of daily use. In picture (a) and (b) the belt was often penned in the door and this was the reason of those marks. The investigator has to be very careful if he looks at such marks.

If seat belts are used incorrect marks could occur as well (c) and (d). In picture (e) and (f) the seat belt was penned in due to incorrect use. Image (g) demonstrates striations on the seat belt which are rather from a watch, a ring, etc. than from clothes whereby in image (f) the striations are from melted filament of clothes.

All the available evidences described above should give information. In the area of driver’s seat and the steering wheel, dashboard, side carpeting and centre control stand are traces visible which are caused by an crash. Fiber from clothes of the driver could be melt with the car interior lining. Similar traces could occur on the passenger’s side of the vehicle of course. If the vehicle was fitted with airbags and they were deployed there could be traces as well. There could be biological traces on windows or roof interior which give information about contacts. On the webbing there could be clothing fiber which is good information of source if the person was belted or not.
Often it is very difficult to find out the driver of the vehicle. If no eyewitnesses are available, the evidences described above should give information. In the area of the driver's seat and the steering wheel, dashboard, side carpeting, and center control stand are traces visible which are caused by the crash. Fiber from the driver's clothes could be melted with the car interior lining. Similar traces could occur on the passenger's side of the vehicle. If the vehicle was fitted with airbags and they were deployed, there could be traces as well. There could be biological traces on windows or roof interior, which give information about contacts. On the webbing, there could be clothing fiber that is good information of source if the person was belted or not.

Some cars are equipped with seat allocation recognition systems. The reason for the development of such systems was the high and unnecessary economic costs for deployed airbags. For a velocity range between 20 and 30 mph, most of the vehicles could be repaired. In most of these crashes, no passenger is in the car, but the passenger airbag deployed anyway. One of the essential requirements of these systems was a fail-safe behavior. In case of an error in the system, the airbag should deploy even if there is no passenger on the seat.

Sensor Systems which are available:

- Capacitive measurement systems
- UHF-sensors
- Thermal infrared sensors
- Optical recognition systems
- Ultrasonic systems
- Piezoelectric cable
- Resistance strain gauges on bending bar
- Force Sensing Resistor (FSR)
Extend and Retract

In a typical seatbelt system, the belt webbing is connected to a mechanism retractor. The central element in the retractor is a spool, which is attached to one end of the webbing. Inside the retractor, a spring applies a rotation force, or torque, to the spool. This works to rotate the spool so it winds up any loose webbing.

When you pull the webbing out, the spool rotates counter-clockwise, which turns the attached spring in the same direction. Effectively, the rotating spool works to untwist the spring. The spring wants to return to its original shape, so it resists this twisting motion. If you release the webbing, the spring will tighten up, rotating the spool clockwise until there is no more slack in the belt.

The retractor has a locking mechanism that stops the spool from rotating when the car is involved in a collision. There are two sorts of locking systems in common use today:
• systems **triggered by the belt's movement**

The first sort of system locks the spool when the car rapidly **decelerates** (when it hits something, for example). The diagram below shows the simplest version of this design.

![Diagram of mechanism](image)

The central operating element in this mechanism is a weighted pendulum. When the car comes to a sudden stop, the inertia causes the pendulum to swing forward. The pawl on the other end of the pendulum catches hold of a toothed ratchet gear attached to the spool. With the pawl gripping one of its teeth, the gear can't rotate counter-clockwise, and neither can the connected spool. When the webbing loosens again after the crash, the gear rotates clockwise and the pawl disengages.
The second kind of system locks the spool when something jerks the belt webbing. The activating force in most designs is the speed of the spool rotation. The diagram shows a common configuration.

The central operating element in this design is a centrifugal clutch -- a weighted pivoting lever mounted to the rotating spool. When the spool spins slowly, the lever doesn't pivot at all. A spring keeps it in position. But when something yanks the webbing, spinning the spool more quickly, centrifugal force drives the weighted end of the lever outward.

The extended lever pushes a cam piece mounted to the retractor housing. The cam is connected to a pivoting pawl by a sliding pin. As the cam shifts to the left, the pin moves along a groove in the pawl. This pulls the pawl into the spinning ratchet gear attached to the spool. The pawl locks into the gear's teeth, preventing counter-clockwise rotation.

In some newer seatbelt systems, a pretensioner also works to tighten the belt webbing. In the next section, we'll see how these devices work.

**Load Limiters**

In severe crashes, when a car collides with an obstacle at extremely high speed, a seatbelt can inflict serious damage. As a passenger's inertial speed increases, it takes a greater force to bring the passenger to a stop. In other words, the faster you're going on impact, the harder the seatbelt will push on you.

Some seatbelt systems use load limiters to minimize belt-inflicted injury. The basic idea of a load limiter is to release a little more excess belt webbing when a great deal of force is applied to the belt. The simplest load limiter is a fold sewn into the belt webbing. The stitches holding the fold in place are designed to break when a certain amount of force is applied to the belt. When the stitches come apart, the webbing unfolds, allowing the belt to extend a little bit more.

More advanced load limiters rely on a torsion bar in the retractor mechanism. A torsion bar is just a length of metal material that will twist when enough force is
applied to it. In a load limiter, the torsion bar is secured to the locking mechanism on one end and the rotating spool on the other. In a less severe accident, the torsion bar will hold its shape, and the spool will lock along with the locking mechanism. But when a great deal of force is applied to the webbing (and therefore the spool), the torsion bar will twist slightly. This allows the webbing to extend a little bit farther.

Over the years, seatbelts have proven to be far and away the most important safety device in cars and trucks. They are by no means infallible, however, and car safety engineers see a lot of room for improvement in today’s design. In the future, cars will be outfitted with better belts, better air bags and, most likely, completely new safety technology. Of course, the government will still have to address the biggest problem with safety devices -- getting people to use them.

The Pretensioner

The idea of a pretensioner is to tighten up any slack in the belt webbing in the event of a crash. Whereas the conventional locking mechanism in a retractor keeps the belt from extending any farther, the pretensioner actually pulls in on the belt. This force helps move the passenger into the optimum crash position in his or her seat. Pretensioners normally work together with conventional locking mechanisms, not in place of them.

There are a number of different pretensioner systems on the market. Some pretensioners pull the entire retractor mechanism backward and some rotate the spool itself. Generally, pretensioners are wired to the same central control processor that activates the car’s air bags. The processor monitors mechanical or electronic motion sensors that respond to the sudden deceleration of an impact. When an impact is detected, the processor activates the pretensioner and then the air bag.

Some pretensioners are built around electric motors or solenoids, but the most popular designs today use pyrotechnics to pull in the belt webbing. The diagram below shows a representative model.
When the gas is ignited, the pressure pushes the piston up to rotate the retractor.

The central element in this pretensioner is a chamber of combustible gas. Inside the chamber, there is a smaller chamber with explosive igniter material. This smaller chamber is outfitted with two electrodes, which are wired to the central processor.

When the processor detects a collision, it immediately applies an electrical current across the electrodes. The spark from the electrodes ignites the igniter material, which combusts to ignite the gas in the chamber. The burning gas generates a great deal of outward pressure. The pressure pushes on a piston resting in the chamber, driving it upward at high speed.

A rack gear is fastened to one side of the piston. When the piston shoots up, the rack gear engages a gear connected to the retractor spool mechanism. The speeding rack rotates the spool forcefully, winding up any slack belt webbing.

**Locking retractors**

Most modern seat belts are stowed on spring-loaded reels called retractors equipped with inertial locking mechanisms that stop the belt from extending off the reel during severe deceleration. There are two main types of inertial seat belt
lock. A webbing-sensitive lock is based on a centrifugal clutch activated by rapid acceleration of the strap (webbing) from the reel. The belt can be pulled from the reel only slowly and gradually, as when the occupant extends the belt to fasten it. A sudden rapid pull of the belt — as in a sudden braking or collision event — causes the reel to lock, restraining the occupant in position. A vehicle-sensitive lock is based on a pendulum swung away from its plumb position by rapid deceleration or rollover of the vehicle. In the absence of rapid deceleration or rollover, the reel is unlocked and the belt strap may be pulled from the reel against the spring tension of the reel. The vehicle occupant can move around with relative freedom while the spring tension of the reel keeps the belt taut against the occupant. When the pendulum swings away from its normal plumb position due to sudden deceleration or rollover, a pawl is engaged, the reel locks and the strap restrains the belted occupant in position.

Some belts incorporate both vehicle- and webbing-sensitive inertial locks.

**Pretensioners and webclamps**

![Pyrotechnic pretensioner diagram](image-url)
Seatbelts in many newer vehicles are also equipped with "pretensioners" and/or "Webclamps".

- Pretensioners preemptively tighten the belt to prevent the occupant from jerking forward in a crash. Mercedes-Benz first introduced pretensioners on the 1981 S-Class. In the event of a crash, a pretensioner will tighten the belt almost instantaneously. This reduces the motion of the occupant in a violent crash. Like airbags, pretensioners are triggered by sensors in the car's body, and most pretensioners use explosively expanding gas to drive a piston that retracts the belt. Pretensioners also lower the risk of "submarining", which is when a passenger slides forward under a loosely worn seat belt. An alternative approach being looked at by major car companies is the CG-Lock technology whereby the occupant is held in position via the lap belt in order to prevent the passenger from coming out of position in the event of a crash. Some systems also pre-emptively tighten the belt in fast accelerations and strong decelerations even if no crash has happened.

- Webclamps clamp the webbing in the event of an accident and limit the distance the webbing can spool out (caused by the unused webbing tightening on the central drum of the mechanism) these belts also often incorporate an energy management loop ("rip stitching") which is when the lower part of the webbing is looped and stitched with a special stitching. The function of this is to "rip" at a predetermined load, which reduces the load transmitted through the belt to the occupant, reducing injuries to the occupant.

Safety Belt Use/Non-use

It's imperative to determine whether or not vehicle occupants were wearing safety belts at the time of the crash. Do not simply accept motorists’ statements; attempt to verify their statements through physical evidence, if possible. In serious crashes where vehicles are significantly damaged, sufficient energy forces are often exerted on the belted occupants so that obvious physical evidence on the belt systems creates excellent indicators of safety belt use.

Closely examine the belt webbing where it routes through the “D-ring” and at the latch plate for load forces such as burn marks, stretching, discoloration or brittleness. If the belt is made with a stitched loop design or a “replace me” tag, note if the stitching has been shredded or torn apart and if the tag is pulled out of its normal position. Note the condition of the metal-like “D-ring” and sliding latch
plate for burn-abrasion marks made by the webbing. These are all excellent indicators that the safety belt was being worn at the time of the crash. Likewise, a close inspection of the interior contact points with the occupants’ obvious injuries may also determine if the belt was worn during the collision.

Rollover Crashes

In rollover crashes, investigators should note and match the damage to the vehicle with the contact or touchdown points on the highway/pavement surfaces. These points can yield valuable information on the placement, location and path of travel of the vehicle during its crash sequence. In some instances on level surfaces, the trailing side of a vehicle in a rollover will sustain the most surface-to-vehicle contact damages. This is due to the compression and extension of the vehicle’s tires, shock absorbers and springs during the sudden weight shift associated with a rollover, which causes the vehicle’s leading side to tuck underneath the vehicle’s mass.

Pay particular attention to the physical evidence at the initial point of the roll to try and determine the cause of the tip-over. For instance, did the tire’s sidewall separate from the wheel bead, causing the vehicle to be tripped in a similar manner as striking a curb or furrowing in soft turf? Note the characteristics of any tire marks leading up to the rollover point. If the vehicle rolls over in gravel or grass, the presence of small mounds of stone or earth are usually located at the terminal end of the sliding furrow marks, indicating that a tripping action occurred. Attempt to determine if there was an ejection or partial ejection of any of the occupants. Note physical dimensions of the occupants. Does the seat position and witness marks on the belts match the story about positions and orientations. Does the mechanism of injury seem right to support statements and theories. When well documented, such items can assist the thorough investigator in reconstructing a traffic crash.

Airbag control unit

There are three parts to an air bag system. First, there is the bag itself, which is made of thin, nylon fabric and folded into the steering wheel, dash board, door, side panel, console. Then there is the sensor that tells the bag to inflate. It detects a collision force equal to running into a brick wall at 10 to 15 miles per hour. Furthermore there is a microcontroller which consists of CPU, analogue/digital transducer, storage unit and communication interface. Storage unit consists of a read memory (ROM), read and write memory (RAM) and an electric delectable and programmable storage unit (EEPROM).

Data which are stored in airbag control units (EEPROM):
- System and failure status before and during collision
- Troubles which occurred during impact
- Error times
- Battery voltage
- Energy reserve voltage
- Reference voltage
- Sensor testing results
- Ignition circle error
- Warning lights errors

To get such information it is necessary to contact to car manufacturer. In case of legal action a search warrant will be necessary.

Finally, there is the inflation system. Air bags are actually inflated by the equivalent of a solid rocket booster. Sodium azide ($\text{NaN}_3$) and potassium nitrate ($\text{KNO}_3$) react very quickly to produce a large pulse of hot nitrogen gas. This gas inflates the bag, which literally bursts out of the steering wheel or dashboard as it expands. About a second later, the bag is already deflating (it has holes in it) in order to get out of your way.
**Driver Side Airbag:**

The driver side airbag is made up of several components. A cylinder filled with gas, the steal housing, airbag pack and the vinyl airbag cover. When the airbag module receives a deployment signal the igniter switch starts a chemical reaction which then inflates the airbag pack in fractions of a second.
Driver Airbag Styles:

There are many types of driver airbags. The most popular are shown above. The single stage-airbag has a single plug or connector and a dual-stage has two plugs with four wires that leads to a single connector. Also, there are three spoke and four spoke driver side airbags. See illustrations above for an example of the two.
Knee Airbags:

The knee airbag, also known as the knee bolster, was designed to reduce the lower limb loads on impact. Although limb injuries are not fatal, the knee airbag has proven to reduce severe injuries to the lower extremities on impact with the dashboard. Although, knee airbags are found mostly on high-end luxury models they are slowly becoming commonplace on some mid-level models as well.

Why Is My Airbag Light On or Flashing?

There are a number of reasons why the airbag light has come on or is flashing. This manual will cover a few explanations that may help you identify where the problem may have originated. First and foremost, if the airbag light is on or flashing, the SRS system is inactive. Therefore, if you get into a crash, the airbag/s will not deploy leaving you unprotected. As you read through the information below, suggestions will be provided that may help you solve your airbag light problem.
**Airbag Battery Backup Depleted**
A common problem that signals an airbag warning light to turn on or flash, is that your cars battery might have drained recently and the airbag battery backup depleted. This will often correct itself once the battery charge is fully restored.

**Airbag Clock Spring Needs Replacing**

The airbag clock springs main function is to maintain continuity with the drivers airbag and the electrical wiring. It maintains continuity by coiling in and out as the steering wheel turns. After many years of use the thin circuit bands my become brittle or worn and cause the drivers airbag to have an intermittent connection. If this occurs a DTC or Soft-Code will be reported to the airbag control module and the airbag warning light will turn on or flash. This is a popular problem on older model vehicles. The only way to determine if your clock-spring is damaged is to have a repair shop diagnose your airbag warning light with a scan-tool. The scan-tool will provide the technician with a DTC code and advise him if the clock-spring needs replacement.

**Airbag Module Got Wet or Corroded**

A common location for the airbag module in many vehicles is underneath the driver or passenger seat. Therefore, even in light water damaged vehicles the module will short-out or corrode after being exposed to moisture. A shorted module will immediately general a DTC airbag code and your airbag light will flash a warning. Water damaged modules should be replaced as they will often produce unexplained and continued errors.
Airbag Control Module Types:

During a collision the airbag control module receives information from the impact sensor, which then, relays a signal to deploy the airbags. The airbag sensor is then locked until it is either replaced or reprogrammed. Each vehicle can have many types of modules depending on which SRS features were equipped with the car. On start-up, the module checks the SRS system and reports any errors.

Did the driver report that the “air bag” (or SRS) light had been on for weeks just prior to this crash? There have been several known cases where this situation existed as deployed without a valid reason or failed to deploy during a crash event. If the SRS light is on that’s an indication of a malfunction in the air bag system. It should be checked immediately. Police vehicles should be deadlined as the first opportunity. Without the air bags working properly you are putting yourself at risk and the risk of other passengers.
A LOOK AT THE FUTURE

Feds Will Require Side Curtain Airbags by 2013

The National Highway Traffic Safety Administration (NHTSA) will require automakers to equip all vehicles with side curtain air bags that provide head and torso protection in side-impact crashes by 2013. Safety advocates said it was a good start. There is current research that is looking into placing airbags in other locations on-board vehicles in an attempt to passively restrain all occupants inside a vehicle regardless if a safety belt system was in use. There are also outside designs to protect pedestrians in collisions.
System Composition and Functionality

- The Motorcycle Airbag System is made up of the following main components:
- The airbag module, containing the airbag and inflator, positioned in front of the rider
- The airbag ECU, positioned on the right side of the airbag module, which analyzes impacts and determines whether or not to inflate the airbag
- Four crash sensors, attached on both sides of the front fork to detect changes in acceleration caused by frontal impacts
Inflated Airbag

Location of Principal Components

- Airbag Module
- Airbag ECU
- Crash Sensors

Airbag module
- Stored in front of the rider, the airbag module is comprised of the following components:
  - The airbag, which inflates to absorb some of the rider's kinetic energy
  - The airbag, which inflates to absorb some of the rider's kinetic energy
  - A lid, which covers the other components stored in the airbag module, and which opens when the airbag is deployed
  - A retainer box, which contains and secures the airbag and inflator
**Airbag**
The airbag is made of the same type of material as automobile airbags: a strong nylon with an inner coating of silicon. Reaching a volume of some 150 liters when filled with the nitrogen gas used in deployment, the airbag is designed with a V-shaped back to help secure the rider in position. To prevent the airbag from going forward along with the rider, it is secured to the motorcycle with tethers. And to further cushion the impact of the airbag with the rider, deflation vents are located on each side of the back of the airbag.

**Inflator**
Similar in structure to the inflator used in a passenger-side automobile airbag, the inflator is a metal container and encloses an electronic ignition device, ignition agent, nitrogen gas ignition agent and other components. The inflator instantaneously responds to an electronic impulse from the airbag ECU, initiating the flow of nitrogen gas to inflate the airbag.

**Lid**
The lid is on the surface of the motorcycle and covers the airbag system components stored in the retainer box. During deployment, the pressure of the gas released by the inflator causes this lid to open.

**Airbag ECU**
The airbag ECU continuously monitors the data received from the crash sensors, and by comparing this data to standard vehicle behavior determines whether or not it is necessary to deploy the airbag. The data from each of the two sets of two sensors is evaluated independently, and if, according to the data of both sets of sensors, vehicle behavior deviates from standards to a certain predetermined
degree, an electronic signal is sent to the airbag inflator, which causes the airbag to inflate. This design endows the airbag system with a high degree of reliability. In the event of an accident, even if power to the airbag ECU is completely or partially disrupted, a backup power source and circuitry are available to help maintain the system's functionality.

In addition, the airbag ECU has a diagnostic function that enables it to detect faults in the system. In case a problem is detected, a light located adjacent to the instrument gauges illuminates to alert the rider.

**Crash Sensors**
The crash sensors are attached to the front fork for earliest possible frontal impact detection. No alteration of the structure of the motorcycle is needed. To optimize the accuracy of collision detection, a set of four sensors are arranged-two on each side of the front fork. Thus mounted, these sensors are designed to detect acceleration changes with a high degree of precision and reliability even when a collision is accompanied by swerving.

In the unlikely event that one of the sensors malfunctions, the other sensors can provide backup functionality to help prevent unnecessary deployment of the airbag. When the motorcycle's ignition switch is on, the crash sensors continuously measure acceleration and relay this data to the airbag ECU.
Collision Recognition Process

System Operational Flow

Deployment Conditions
The airbag is designed to deploy in the case of a frontal collision in which the rider could be thrown forward from the motorcycle.

System Operation
When a frontal collision occurs, the crash sensors convey the data they generate to the airbag ECU, which determines if a collision has occurred and whether or not it is necessary to inflate the airbag. If the calculations performed by the ECU indicate that airbag deployment is necessary, the ECU sends an electronic signal to the airbag inflator, which instantaneously responds by releasing nitrogen gas to inflate the airbag. To help the inflated airbag absorb some of the forward momentum of the rider, the gas is allowed to escape slowly from two vents, one on each side of the airbag.

This chain of events takes only approximately 0.15 seconds from start to finish, less than the blink of a human eye (about 0.2 seconds).

(Side collision with a stationary vehicle (Honda Accord) at 50km/h)
Operational Flow

1. Crash sensors
2. Airbag ECU
3. Inflator activated
4. Airbag deployed
5. Energy absorption

Impact begins
Collision recognized
- Inflator activated
- Inflation gas released
- Lid opened
- Airbag inflated

Airbag deployment complete
- Rider’s kinetic energy absorbed by airbag
- Deflation via vents

Rider kinetic energy absorption finishes

Crash Test Video

Computer Simulation
In summery, the Motorcycle Airbag System is comprised of the airbag module, which includes the airbag and the inflator; crash sensors, which monitor acceleration changes; and an ECU, which performs calculations to instantly determine when a collision is occurring. When a severe frontal collision occurs, the four crash sensors mounted on the front fork measure the change in acceleration caused by the impact and convey this data to the airbag ECU, which determines that a collision is occurring and whether or not it is necessary to inflate the airbag. If the calculations performed by the ECU indicate that airbag deployment is necessary, the ECU sends an electronic signal to the airbag inflator, which instantaneously responds by inflating the airbag. Inflating rapidly after the impact, the airbag can absorb some of the forward energy of the rider, reducing the velocity at which the rider may be thrown from the motorcycle and helping lessen the severity of injuries caused by the rider colliding with another vehicle or with the road.