SEAT BELTS AND AIRBAGS

Mercedes-Benz

Competence in Safety.

A pioneer in automotive safety.

Mercedes-Benz has been passionate about making cars – each one even better than the last – from day one. Since the first models invented by Gottlieb Daimler and Karl Benz, cars have become not only faster but also more comfortable and considerably safer. And even though the volume of traffic on our roads has increased several-fold, the safety risks to the driving public remain relatively low thanks to the enormous progress made in the areas of active safety (accident prevention) and passive safety (minimizing injury during accidents). Mercedes-Benz has made key contributions in these fields with a safety development program spanning several decades. Safety-conscious design has always been and remains a vital aspect of Mercedes-Benz passenger car development.

Many new developments in automotive safety first saw the light of day in a Mercedes, often long before they appeared in other vehicles. As a result, the Mercedes-Benz brand has become synonymous with automotive safety around the world. Seat belts and air bags are perhaps two of the most well known – and still most effective – passive safety features. Mercedes-Benz first offered its customers 3-point seat belts in1968; and, in 1980 was the world's first automotive manufacturer to install front airbags in standard-production vehicles.

Understanding safety.

In order to understand how seat belts and air bags provide protection, it is important to realize what happens to vehicle occupants in an accident. Upon impact, a vehicle is either decelerated rapidly (when colliding with another vehicle or object) or accelerated (when hit by a moving object such as another vehicle). When the vehicle is decelerated or accelerated in this way, inertia always causes the occupants to move toward to the area of impact. Restraint systems are required to reduce the risk of contact between the occupants and the vehicle interior caused by this occupant movement. Such systems

primarily include seat belts, ideally supplemented by seat belt emergency tensioning devices with force limiters where appropriate, and with air bags.

The protective capabilities of these systems can only be fully realized if seat belts are used on every trip: always buckle up everyone and then drive. Wearing a seat belt alone can prevent many injuries or lessen the severity of injuries in various types of accidents, whereas an air bag on its own cannot provide the same degree of protection, since it is designed only to supplement the protective effect of the seat belt afforded to an occupant properly wearing a seat belt in certain types of accidents. Consequently, the air bag and related seat belt emergency tensioning device systems in Mercedes-Benz vehicles are called a Supplemental Restraint System ("SRS"). While the seat belts and air bags in combination provide substantial protection in accidents, injuries and even fatalities can nevertheless occur in accidents exceeding the protective capabilities of these safety systems. To name only one example, properly worn seat belts and deploying air bags even in combination cannot generally prevent the risk of injuries from intrusions into the passenger compartment.

Seat belts are vital.

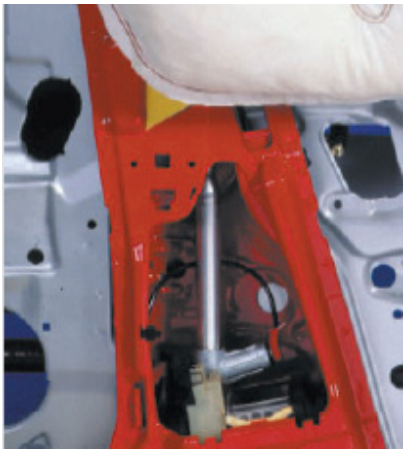
The seat belt is the single most important restraint system in the vehicle. When worn correctly, it reduces the possibility or severity of the occupant striking the interior of the vehicle or the likelihood that the occupant will be ejected from the vehicle in an accident. A properly worn seat belt also helps to hold the occupant in the proper position in relation to the air bag so that the occupant can benefit from its deployment, if required.

Furthermore, failure to properly wear a seatbelt increases the possibility of injury from a deploying air bag. All occupants must therefore properly fasten their seat belts before every trip. See your operator's manual for additional information regarding proper seat belt usage.

Emergency tensioning devices and seat belt force limiters.

The front and some outboard rear seat belts are equipped with emergency tensioning devices (ETDs), some with belt force limiters. When deployed in an accident, an ETD takes up slack on the seat belt to help increase the effectiveness of the seat belt by allowing restraining contact between the belt and occupant earlier in the accident sequence. However, an ETD cannot rectify incorrect seating positions, nor can it adjust incorrectly worn seat belts or pull occupants back into the seat backrest.

Seat belt height adjustment



ETD in installation position

If the seat belt is also equipped with a seat belt force limiter, the limiter, when activated, helps to reduce the peak force exerted by the seat belt on the occupant. The seat belt force limiter is also designed to work with a deploying front air bag by providing more even distribution of occupant restraining forces between the seat belt and air bag.

The ETD is designed to be activated only if the seat belt is fastened and the vehicle's ignition is on, during a frontal or rear-end collision generating a frontal deceleration or rear acceleration rate sufficient to meet the system's deployment threshold. ETDs in vehicles equipped with rollover sensors will also deploy during a lateral rollover if the sensor determines that potential additional protection can be provided.

In vehicles equipped with an occupant sensor for the front passenger seat, the ETD will only be activated if the sensor detects an occupant in the seat or if the seat belt is fastened.

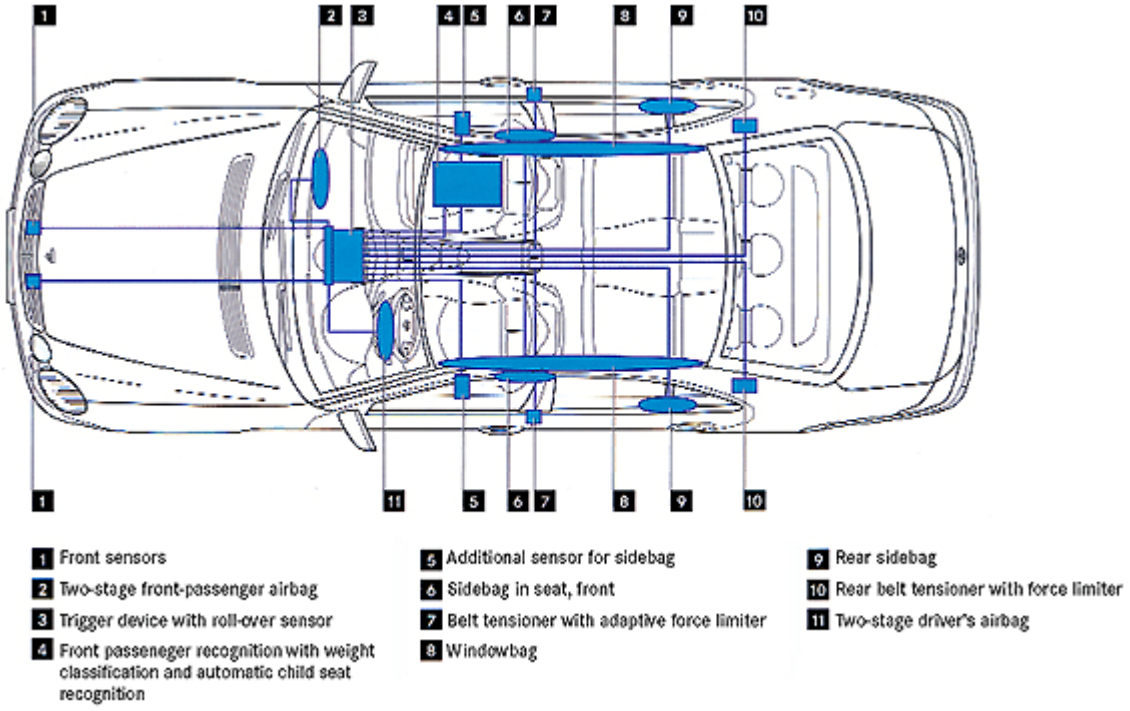
The driver-side ETD will only be activated if the belt is fastened. To operate at the speed necessary to increase belt effectiveness in an accident, the ETD is operated pyrotechnically and may thus release some harmless smoke into the passenger compartment. Upon activation of the ETD, the SRS indicator lamp comes on or a diagnostic code is stored in the SRS control unit.

Supplemental Restraint Systems.

What happens when an air bag is deployed?

During deployment, an air bag inflates within a small fraction of a second during the actual collision in order to provide the occupant with additional protection beyond that afforded by the seat belt. As inflation must be very rapid to afford protection in the very short accident sequence, deployment results with a relatively loud noise. When the occupant is properly positioned, contact between the occupant and the inflated air bag helps prevent or reduce the severity of the occupant's striking interior surfaces of the vehicle.

The front air bag or side impact air bag will deflate through vent holes or a permeable fabric after inflation in order to provide the intended occupant restraint. The gases that are used to inflate the air bag are hot when expelled from the inflator into the air bag itself and cool down relatively rapidly when they mix with the atmosphere within the vehicle. However, escaping gases can cause injury if body parts such as hands come into contact with them. Additionally, the inflator remains hot and should not be touched after inflation. Also, air bag inflation can result in some harmless smoke or dust being released into the passenger compartment.



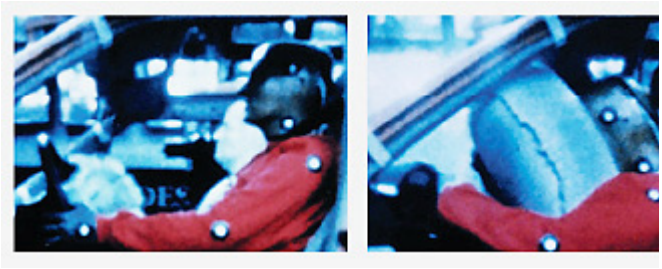
Available restraint systems for the E-Class (W 211)

Since air bags inflate with considerable speed and force, you can be injured by an air bag, especially if you are unbelted, out of position or too close to a deploying air bag. With respect to front air bags, the proper seating position is as far away as possible from the air bag (consistent with proper operation of vehicle controls for the driver) and with the occupant's back against the seat backrest, which should be in a nearly upright position. With respect to door mounted side air bags, occupants should avoid leaning against the vehicle's door, and should never allow children to do so. Please see operator's manual and labels in the vehicle for further information about children and air bags and use of child restraints.

Criteria for an ETD / air bag deployment.

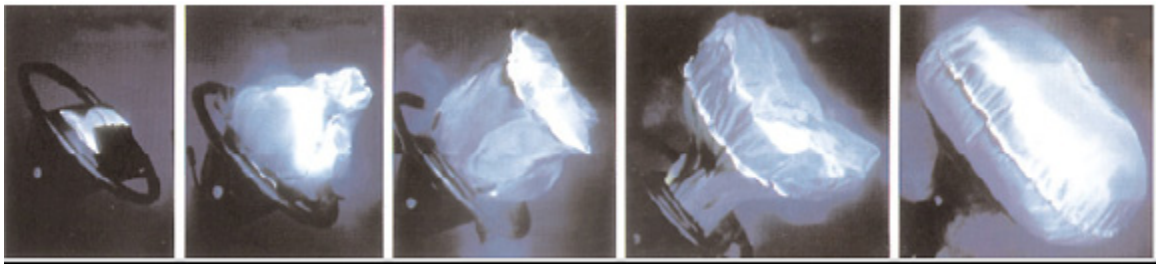
In order to determine whether to deploy, an electronic control unit evaluates the intensity, duration and direction of the vehicle deceleration or acceleration during the very earliest phase of the collision. The deployment thresholds are variable and are adapted in response to the intensity of the vehicle acceleration or deceleration rate sensed early in the collision. To be able to protect occupants who begin moving during the early portion of a crash sequence, the system's determination whether to deploy an ETD(s) and / or air bag(s) must be anticipatory since deployment has to happen very early in the collision.

Vehicle deceleration or acceleration rate and impact force direction are determined based on the force distribution, the collision angle, the deformation characteristics of the vehicle and the state, mass and deformability of the object with which the vehicle collides.



Vehicle damage is neither a determinative factor for an ETD / air bag deployment nor an indication that an ETD / air bag should have been deployed. This means that even if a vehicle appears severely damaged in an accident, an ETD / air bag deployment threshold is not necessarily met. An impact may be of a type that results in substantial damage to the vehicle but does not involve stiff structural parts, thus resulting in a deceleration rate below the system deployment threshold. Conversely, air bags can deploy even if the vehicle damage in an accident is relatively slight. Thus, a lower speed collision involving relatively stiff vehicle structures may reach the deceleration threshold for deploying an ETD / air bag. Furthermore, the vehicle speed at the start of the collision and the injuries suffered during a collision do not indicate whether an air bag should have deployed, since the severity of the load to and physical injuries experienced by occupants often depend on the type of collision, the deformation characteristics of the object involved in the collision, and the overall severity of the collision.

Front Supplemental Restraint System deployment logic.
If the seat belt is worn by a front seat occupant, only the emergency tensioning device for that seat belt is deployed in an impact generating a frontal longitudinal deceleration rate meeting the system's first deployment threshold. The respective front air bag is only deployed in addition to the ETD if a second, higher deployment threshold is met. If the seat belt is not worn by a front seat occupant, then the risk of injury from a deploying air bag is much greater than for a belted occupant. Never rely on the presence of an air bag to avoid wearing your seat belt.



Driver and front passenger air bags.
The driver's front air bag is located in the center of the steering wheel, and the front passenger air bag is housed above the glove compartment (or in place of the glove compartment in older models). They can be recognized by the "SRS" or "SRS AIRBAG" or "AIRBAG" lettering. Driver and passenger front air bags are designed primarily to help reduce the risk and/or severity of contact between the seat-belted driver's and front passenger's head and chest and the interior components in front of them. The driver front air bag inflates in front of the steering wheel. The passenger front air bag inflates in front of and above the glove compartment.

Driver and/or front passenger air bags are deployed in an accident generating a longitudinal vehicle deceleration rate meeting the system's deployment thresholds sensed early in the collision. The front air bag deployment can differ depending on seat belt usage.

In vehicles equipped with a BabySmart™ air bag deactivation system (recognized by the BabySmart™ label on the right front door by the instrument panel), the front passenger air bag is only enabled and thus capable of deploying if the PASSENGER AIR BAG OFF indicator lamp is not lit. When the indicator lamp in these vehicles is off, the system does not recognize that a BabySmart™ child seat is installed on the front passenger seat. When the indicator lamp in these vehicles is lit, the system does recognize a BabySmart™ child seat in use, and the passenger front air bag will not deploy. In vehicles equipped with an occupancy sensor for the front passenger seat, the front passenger air bag is only enabled and thus capable of deploying if the sensor detects a certain minimum weight on the seat, or if the seat belt buckle is fastened.

Note: Vehicles equipped with an occupant classification system are not equipped with the BabySMART™ system.

A front air bag will not be deployed in a lateral rollover unless the rollover also generates a longitudinal deceleration rate meeting the system's deployment threshold sensed early in the collision.

Special features of dual-stage front air bags.

If the vehicle is equipped with dual-stage front air bags, the front air bag is initially inflated with a single inflator when a first activation threshold is reached. If a second threshold is reached, within the few milliseconds in which the determination to deploy is made, a second inflator provides additional inflation to increase the inflation rate of the air bag to help address the higher deceleration rate sensed with respect to the accident. If the vehicle is equipped with a front passenger weight classification system, the body weight of the front passenger is taken into account along with the accident severity and the seat belt status when calculating the air bag inflation rate.

Knee air bags supplement the function of the knee bolster in head-on collisions that exceed the deployment threshold.

Advanced Systems.

Special features of an Occupant Classification System.

If your vehicle is equipped with an Occupant Classification System (OCS), it automatically turns the passenger front air bag on or off based on the classified occupant size category, determined by weight sensor readings from the front passenger seat.

The system is not designed to deactivate a side impact air bag or window curtain air bag.

If OCS classified the occupant sitting in the front passenger seat as an adult, the passenger front air bag will be enabled and deploy in an accident meeting the respective air bag deployment criteria. If OCS classified the front passenger seat occupant as a small occupant, depending on weight, the passenger front air bag may or may not be enabled.

The passenger front air bag will be disabled and the PASS AIR BAGOFF indicator lamp is lit, if the system:

- classified the front passenger seat occupant as child-sized at a certain weight level or
- classified the front passenger seat as empty.

In order for OCS to classify the front seat passenger as it is intended to operate, the front passenger seat occupant must always be seated and belted properly (seat back nearly upright, back against the seatback and feet on the floor). In addition, any circumstance that results in the system misreading the passenger seat occupant's correct weight category must be avoided (for example transferring the passenger weight to the armrest by leaning on it, attaching objects to the seatback or putting items under, on or around the seat or seat back). You need to make sure that the passenger front seat has clearance in all directions at all times. Otherwise the OCS may not be able to properly approximate

the occupant's size category, which could cause the system to activate the passenger front air bag even though it should have been deactivated, or vice versa.

Use the PASS AIR BAG OFF indicator lamp to determine whether the passenger front air bag is deactivated. The PASS AIR BAG OFF indicator lamp will illuminate after the ignition is turned on. It will continue to illuminate if the front passenger seat is unoccupied.

On vehicles equipped with OCS, deactivation of the passenger front air bag can occur as a result of various factors, such as an empty seat or an occupant who does not meet a certain minimum weight, or foreign objects interfering with the system.

Demonstration of available airbags in the M-Class (W 163). The accident-specific circumstances determine which airbag(s), if any, will deploy.

Side impact air bags.

A side impact air bag is designed to help further protect the thorax(that is, upper body, but not the head, neck or arms) of the occupant sitting on the impacted side of the vehicle in a collision generating a lateral (sideways) vehicle acceleration / deceleration rate meeting the system's deployment threshold sensed early in the collision. In such cases, the side impact air bag deploys in the area of the door below the side window (door mounted side impact air bag) or directly next to the affected seat (seat backrest mounted side air bag). Side impact air bag installation positions vary depending on the vehicle model. See the operator's manual for further details.

The lateral acceleration / deceleration rate required to deploy the side impact air bag must be sensed by the system even earlier in the accident sequence for side-impact collisions than for frontal collisions, as the distance between the occupant and the object involved is much smaller in the side-impact collisions. Side impact air bags are designed to deploy:

- in an accident generating a lateral (that is, sideways) vehicle deceleration / acceleration rate meeting the system's deployment threshold sensed early in the collision,
- on the side of the vehicle receiving the impact;
- independent of the deployment of front air bags or ETDs (if also deployed as a result of the forces generated by the accident).

In vehicles equipped with an occupancy sensor for the front passenger seat, the front passenger side impact air bag is only enabled, and thus capable of deploying, if the occupancy sensor detects a certain minimum weight in the seat or if the seat belt buckle is fastened. However, the side impact air bag on the passenger side will still deploy in circumstances calling for deployment even if the PASSENGER AIR BAG OFF indicator lamp is lit. Side impact air bags will not deploy in lateral rollovers unless and until the rollover generates a lateral vehicle deceleration or acceleration rate meeting the system's deployment threshold.

Head protection systems.
Your vehicle may be equipped with either window curtain air bags(installed in the roof frame in sedans, station wagons and light trucks)or head-thorax side air bags (with a larger air bag area than the side impact air bag and designed to reach the occupant's head) installed in the seat backs of convertibles.

Window curtain air bags.
Your Mercedes-Benz vehicle may be equipped with window curtain air bags (as optional or standard equipment, typically in sedans or coupes but not in convertibles) that are designed to help increase head protection for the occupant sitting on the impacted side of the vehicle where the system's deployment threshold has been met. The window curtain air bag deploys in the area of the side windows. Window curtain air bags are deployed:

- in an accident generating a lateral vehicle deceleration / acceleration rate meeting the system's deployment threshold sensed early in the collision,
- on the side of the vehicle receiving the impact,
- independently of the deployment of front air bags or ETDs (if also activated as a result of the forces generated by the accident).

In vehicles with a BabySmart™ air bag deactivation system (recognized by the BabySmart™ label on the right front door by the instrument panel), the window curtain air bag on the passenger side will remain enabled and thus capable of deploying in circumstances calling for deployment even if the PASSENGER AIR BAG OFF indicator lamp is lit due to the proper installation of a BabySmart™ child seat. Similarly, in vehicles equipped with OCS, the system does not disable the window curtain air bags when it disables the passenger front air bag.

In vehicles with rollover sensors, window curtain air bags are designed to deploy in lateral rollovers meeting certain pre-set parameters. In that circumstance, window curtain air bags will be activated on both sides of the vehicle.

Head-thorax side air bags.
Convertibles may be equipped with head-thorax side air bags instead of window curtain air bags. Head-thorax side air bags, when deployed, are designed to help protect the head and thorax of the occupant sitting on the side of the vehicle sustaining an impact generating a deceleration / acceleration rate meeting the system's deployment threshold. The head-thorax side air bag deploys in the area forward of the front seat back of the affected side of the vehicle.

Head-thorax side air bags are deployed:

- in the event of an accident generating a lateral acceleration / deceleration rate exceeding the system's deployment threshold sensed early in the collision,
- on the side of the vehicle receiving the impact, independently of the deployment of front air bags or ETDs (if also activated as a result of the forces generated by the accident).

In vehicles with a BabySmart™ air bag deactivation system (recognized by the BabySmart™ label on the right front door by the instrument panel), the head-thorax side air bag on the passenger side will remain enabled and thus capable of deploying in circumstances calling for deployment even if the PASSENGER AIR BAG OFF indicator lamp on the center console is lit due to the proper installation of a BabySmart™ child seat. Similarly, in vehicles equipped with OCS, the system will not disable the head-thorax side air bag when it disables the passenger front air bag.

We hope we have given you a helpful insight into some of the safety engineering in place in your vehicle and wish you many hours of safe driving in your Mercedes-Benz. Always review the safety features and warnings contained in your vehicle's operator's manual.

This brochure describes features generally found in new Mercedes-Benz vehicles at the time this brochure was produced. Not all of the systems described are available for all Mercedes-Benz models. In addition, some of the safety systems described are not part of the standard equipment for certain Mercedes-Benz vehicles. Detailed information showing which of the systems described are standard equipment, optional equipment, or are available for your particular Mercedes-Benz passenger car model can be obtained from current model series brochures. This publication went to press on September 30, 2004. We reserve the right to make modifications in vehicle and system design and brochure content without notice.
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