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The most common design element of the car's passive safety system are seat belts. Their use reduces the likelihood and severity of injuries from impacts with hard parts of the car body, glass, with other passengers (so-called secondary impacts). Fastened seat belts ensure the effective operation of airbags.

pending on the number of attachment points, the following types of seat belts are distinguished: two-, three-, four-, five- and six-point.

Two-point seat belts (Fig. 1) are now found as the middle belt in the back seat of some older cars and in passenger seats on airplanes. A two-way seat belt is a lap belt that runs across the waist and is secured on both sides of the seat.



Fig. 1. Two-point seat belt

Three-point seat belts (Fig. 2) are the main type of seat belt and are installed on all modern cars. The three-point diagonal-lap seat belt has a V-shaped arrangement, which ensures an even distribution of the energy of the moving body on the chest, pelvis and shoulders. The first serial three-point seat belts were offered by Volvo in 1959. Let's consider the design of the three-point belt as the most common.



Fig. 2. Three-point seat belt

A three-point seat belt consists of a strap, a buckle and a retractor.

The seat belt strap is made of durable material and is attached to the body using special devices at three points: on the pillar, on the threshold and on a special rod with a lock. To adapt the belt to the height of a particular person, many designs provide for adjustment of the upper attachment point in height.

The lock provides for the locking of the seat belt and is installed near the car seat. A movable metal tongue is made on the strap to connect with the lock. In order to remind about the need to use the seat belt, the lock design provides for a switch, which is included in the circuit of the audiovisual signaling system. The warning occurs with the help of a signal lamp on the dashboard and an audible signal. The algorithm of this system differs among different car manufacturers.

The retractor provides forced unwinding and automatic winding of the seat belt. It is attached to the car body pillar. The reel is equipped with an inertial

locking mechanism that stops the movement of the belt in the reel in the event of an accident. Two locking methods are used - as a result of the movement (inertia) of the car and as a result of the movement of the seat belt itself. The belt can be pulled out of the reel drum only slowly, without acceleration.

Modern cars are equipped with seat belts with tensioners.

Four-point seat belts (Fig. 3) are installed on sports cars and have four attachment points to the seat.



Fig. 3. Four-point seat belt

Five-point seat belts (Fig. 4) are used in sports cars and to secure children in child car seats. They include two lap belts, two shoulder belts, and one belt located between the legs.

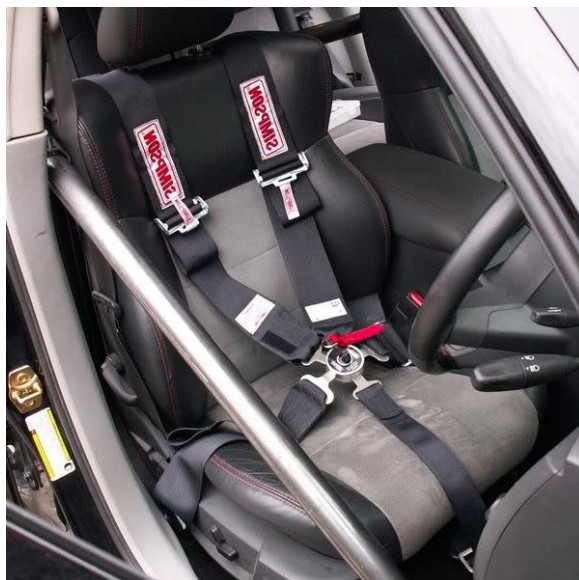


Fig. 4. Five-point seat belt

Six-point seat belts have two straps between the legs, which provides a more secure fixation of the racing car driver.

A promising design is inflatable seat belts (Fig. 5), which are filled with gas during an accident. They increase the area of contact with the passenger and, accordingly, reduce the load on the person. The inflatable section can be either shoulder or shoulder and waist. As tests show, this design of the seat belt provides additional protection against side impact.



Fig. 5. Inflatable seat belts

Ford offers this option in Europe for the fourth-generation Ford Mondeo. Inflatable seat belts are installed for rear-seat passengers. The system is designed to reduce head, neck and chest injuries in the event of a crash for rear-seat passengers, who are often children and the elderly, who are particularly susceptible to such injuries. In everyday use, the inflatable seat belts function in the same way as normal seat belts and are compatible with child seats.

In the event of an accident, a signal is sent from the impact sensor to the safety system control unit, the unit transmits a signal to open the locking valve of the carbon dioxide cylinder located under the seat, the valve opens and the gas, previously in a compressed state, fills the seat belt cushion. The belt quickly unfolds to distribute the impact force over the body surface, which is five times

greater than in the case of standard seat belts. The activation time of the belts is less than 40 ms.

In the new Mercedes-Benz S-Class W222, the company expands its protection options for rear seat passengers. The PRE-SAFE Rear Seat Package combines seat belt tensioners and seat belt airbags (Beltbag) with front seat airbags. The combined use of these devices reduces passenger injuries by 30% in an accident compared to a conventional system. The belt airbag is a seat belt webbing that can inflate and thus reduce the risk of passenger injury in a frontal collision by reducing the load on the chest. The reclining seat is equipped as standard with an airbag hidden under the soft seat cushion upholstery. This airbag prevents a reclining passenger from sliding under the seat belt in an accident (so-called "diving"). Thus, Mercedes-Benz specialists managed to design a comfortable seat with a reclining backrest, which in the event of an accident will provide a higher level of safety than a seat where the backrest tilts as a result of the seat cushion moving forward.

As a measure against non-use of seat belts, automatic seat belts (Fig. 6) have been offered since 1981. They automatically secure the passenger when the door is closed (engine is started) and release him/her when the door is opened (engine is stopped). As a rule, the movement of the shoulder belt is automated, which moves along the edges of the door frame. The lap belt is secured manually. Due to the complexity of the design and the inconvenience of getting into the car, automatic seat belts are currently practically not used.



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