Product Knowledge Documentation
Air Bag System in Automobile

325 E. Eisenhower Parkway, Suite 4

Ann Arbor, MI 48108

(734) 761-4940

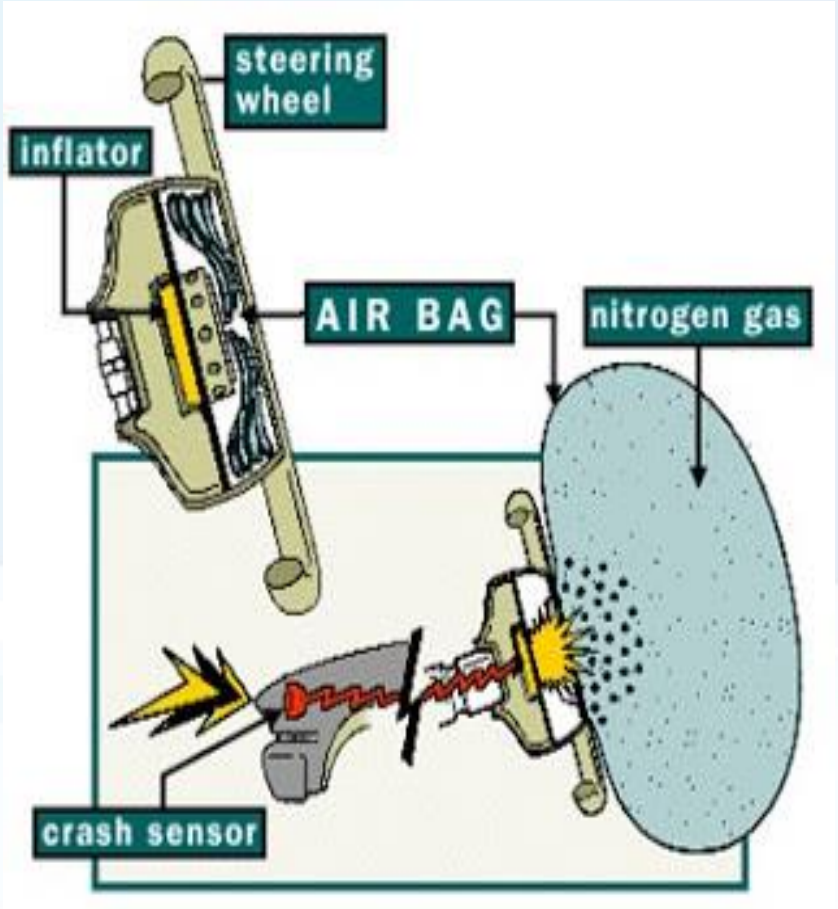
Omnex provides training, consulting and software solutions to the international market with offices in the USA, Canada, Mexico, Latin America, Germany, China (PRC), India, the Middle East and Thailand. Omnex offers over 200 training workshops in business, quality, environmental, laboratory, health & safety management systems and Lean Six sigma worldwide.

Internet email: info@omnex.com

Web: www.omnex.com

Introduction

- An airbag is an elastic bag or cushion like makeup which inflates and deflates quickly at some stage in certain types of car accidents.
- It is a safety device aimed at preventing or minimizing injury to passengers when such an accident occurs.
- To date, Statistics show that air bags reduce the risk of dying in a direct frontal crash by 30 percent.
- An air bag is a supplemental restraint system(SRS), because the air bag is designed to supplement the protection offered by seat belts. Seat belts are still needed to hold the occupant securely in place, especially in side impacts, rear impacts, and rollovers. Upon detecting a collision, air bags inflate instantly to cushion the exposed occupant with a big gas-filled pillow.



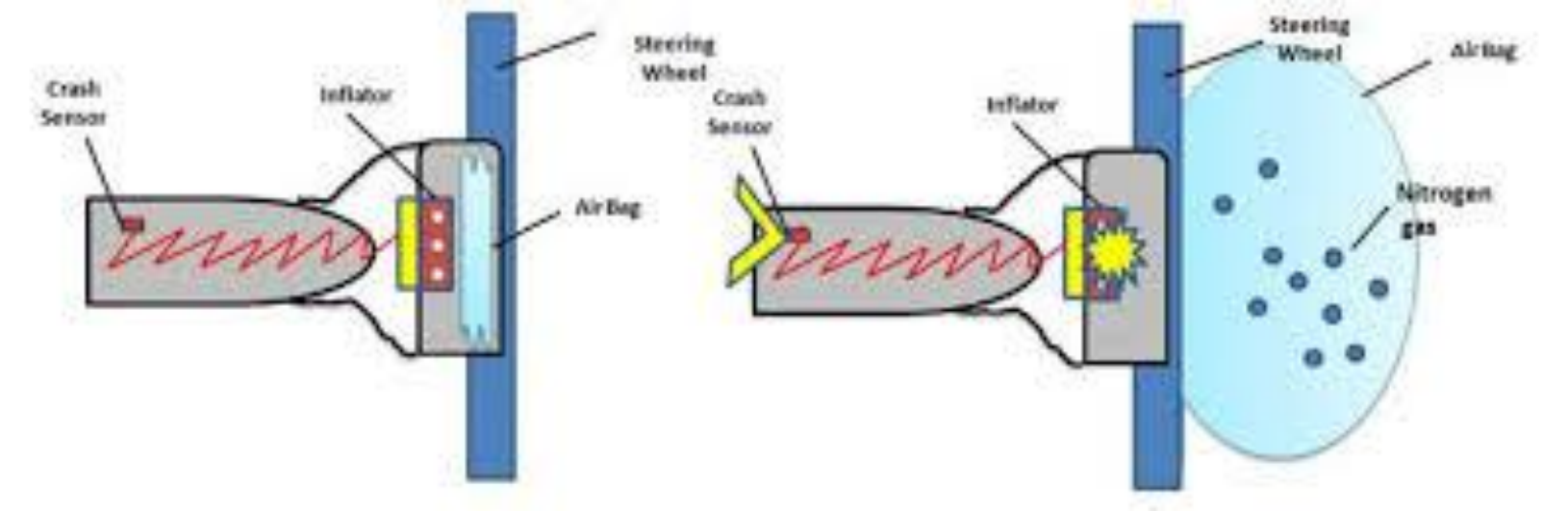
History

- The **airbag** specified for automobile use traces it origins to air-filled bladders as early as 1941. John W. Hetrick, an industrial engineer and member of the United States Navy, designed the original safety cushion commonly referred to as an airbag.
- In 1967, a breakthrough occurred in the development of airbag crash sensors when Allen K. Breed invented a mechanically-based ball-in-tube component for crash detection, an electromechanical sensor with a steel ball attached to a tube by a magnet that would inflate an airbag under a 30 milli-second window. Sodium azide instead of compressed air was also used for the first time during inflation. Breed Corporation then marketed this innovation first to Chrysler.
- In the 1980's the first commercial air bags appeared in automobiles.Since 1988, all new cars have been required to have air bags on both driver and passenger sides (Light Trucks came under the rule in 1999).

Working principle of Airbags

- The first stage of the airbag deployment is the accident itself. The collision, be it frontal or lateral, activates an array of sensors in the vehicle, including accelerometers, impact sensors, side pressure sensors, brake pressure sensors, and seat occupancy sensors. All these sensors are in intimate connection with the ACU (Airbag Control Unit). The unit decides if and how to deploy the airbags. When the ACU detects that the deployment threshold has been reached, it initiates the inflation stage.
- Each airbag incorporates a pyrotechnic device, known as an initiator or electric match, consisting of an electrical conductor cocooned in combustible material. A current pulse heats up the conductor, which in turn ignites the combustible material. This igniter triggers the chemical reaction that actually fills the nylon fabric airbag with gas. The large volume of gas then forces the airbag out of the steering wheel and/or dashboard at a speed of up to 200 mph or 322 mph, the whole process taking about 0.04 seconds.
- The last stage of the airbag process is the deflation, which occurs almost immediately after the inflation is completed. The gas escapes through the special vents.

Block Diagram for Air bags Working



Airbags Classification

Based on the location of airbags itcan be classified as follow

1. Internal Airbags
2. External Airbags

Types of Internal Airbags

1. Front Airbags
2. Side Airbag
3. Knee Airbag
4. Rear Curtain Airbag
5. Center Airbag

1.Front Airbags

These airbags have become a must-have for all automotive manufacturers. Mounted on the steering wheel on the driver, and on the dashboard for the front passenger.

2. Side Airbag

Side Airbags protect you against the risk of collision from the side. There are two types of Side Airbags 1.Torso Airbags 2.Curtain Airbags.

1.Side Torso Airbag: Side torso airbag. Side-impact airbags or side torso airbags (side thorax/abdomen airbags) are a category of airbag usually located in the seat or door panel, and inflate between the seat occupant and the door. These airbags are designed to reduce the risk of injury to the pelvic and lower abdomen regions.

2.Curtain airbag : These are side airbags that protect the head. They immediately activate during a side impact crash and deploy atop the door rails above the side windows. They work by cushioning between the driver or the passenger and the window. They stay in place to protect the head when the car rolls over.

3. . Knee Airbag

These airbags are usually situated underneath the steering wheel and glove compartment and can protect a driver or passenger from suffering knee injuries such as bruising or breaking a bone.

4. Rear Curtain Airbag

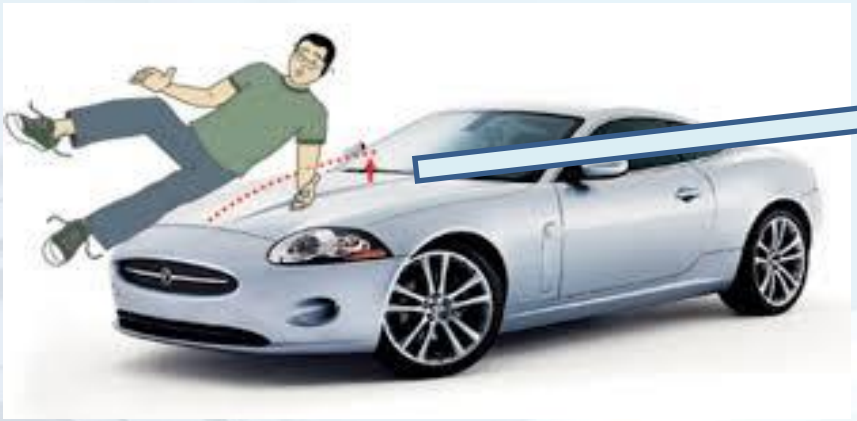
- These are designed to protect the driver's and passenger's heads in a side impact crash.
- The curtain airbag activates instantaneously in the event of a side impact crash, deploying from the top of the door rails above the side window. They form a cushion between the driver or passenger and the window and stay in place if the car rolls over to protect their head.

5.Center Airbag

- The center airbag is mounted between the driver seat & front passenger seat.
- It prevent the collision of passenger with one another after the occurrence of accident.

External Airbags

- These **airbags** are installed **outside** the car, at the bottom of the windshield and will deploy when the sensors detect a collision with a pedestrian. Whether installed on self-driving, connected or conventional cars, pedestrian **airbags** will enhance road safety.



Properties of Airbags

Airbags must have following properties

1. High Tensile strength
2. Good heat stability
3. High Tear strength
4. Low Air permeability
5. Free of knots, splices, spots and broken ends.
6. Good Heat capacity
7. Good Folding behavior
8. Better Energy absorption
9. Good Coating adhesion
10. Functionality at extreme hot and cold conditions
11. Package ability
12. Reduced skin abrasion (softness)

Manufacturing process of Airbags

Material used for Airbag ,Inflator & Propellant

- **Main parts of airbag module are Airbag , Inflator & Propellant**
- **Airbag:** Nylon 6, Nylon 6.6 Woven fabric (coated & non coated)
- **Inflator:** Stamped stainless steel or cast aluminium
- **Propellant :** In the form of black pellets is primarily sodium azide combined with oxidizer.

Manufacturing of propellant

1 The propellant consists of sodium azide mixed together with an oxidizer, oxidizer helps the sodium azide to burn when ignited.

2 The sodium azide and the oxidizer are then carefully blended under sophisticated computerized process control. Because of the possibility of explosions, the powder processing is done in isolated bunkers.

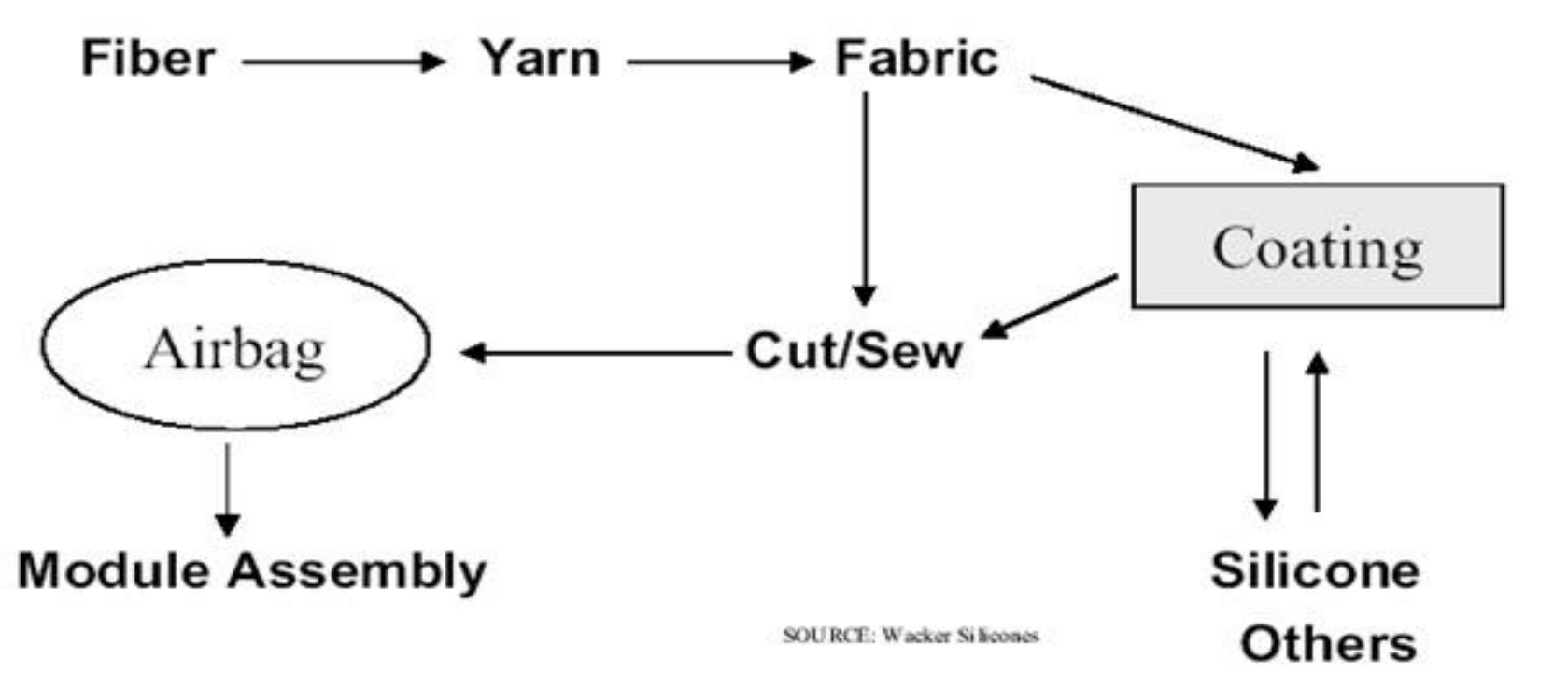
3 After blending, the propellant mixture is sent to storage. Presses are then used to compress the propellant mixture into disk or pellet form.

Assembly of Inflator

- The inflator components metal canister, the filter assembly—stainless steel wire mesh with ceramic material inside—and initiator (or igniter) are assembled.
- The inflator sub-assembly is combined with the propellant and an initiator to form the inflator assembly. Laser welding (using CO gas) is used to join stainless steel inflator sub-assemblies, while friction ,inertial welding is used to join aluminum inflator sub-assemblies.
- Laser welding entails using laser beams to weld the assemblies together, while friction inertial welding involves rubbing two metals together until the surfaces become hot enough to join together

Air Bag

- The woven nylon fabric is used for airbag. The air bag fabric is then die cut to the proper shapes and sewn, internally and externally, to properly join the two sides. After the air bag is sewn, it is inflated and checked for any imperfections.



Airbag Module

- An airbag module is the assembly of propellant, inflator & airbag.
- The air bag assembly is then mounted to the tested inflator assembly. Then the air bag is folded and the breakaway plastic horn pad cover is installed.
- The remaining components of the air bag system ,the crash sensors, the diagnostic monitoring unit, the steering wheel connecting coil, and the indicator lamp are combined with the air bag module during vehicle assembly. All the components are connected and communicated through a wiring harness

THANK YOU

Info-in@Omnex.com

Are there any Questions?