

Important Facts about the AmSafe® Seatbelt Airbag System

Is it safe to buckle a child in an airbag-equipped general aviation seat?

The Federal Aviation Administration has certified the AmSafe Seatbelt Airbag System for use by occupants who fall within the range of the 5th percentile/female and the 95th percentile/male. If the child meets the standard age/weight requirements for seat occupancy (no safety seat needed), then he or she may occupy the middle or rear seat positions with the AmSafe Seatbelt Airbag System enabled. As the airbag deploys away from the occupant, a child who is not required to use a child seat can safely occupy a seat with the airbag system. The AmSafe Seatbelt Airbag System should not be used with a child seat. If a child safety seat is required for an infant or child, then you must disable the airbag system by attaching the child seat buckle that comes with the rear seat airbag system. This child seat buckle is for rear seat use only and is not to be used on middle seats or the co-pilot seat.

Can you assure me that hard landings or turbulence won't deploy the airbag?

The crash sensor in the Electronics Module Assembly (EMA) will respond only to a forward-impact motion at a high G-force sustained for a defined time interval. The sensor is mechanically prevented from deploying the system from forces in any direction except towards the rear of the aircraft (i.e., significant longitudinal deceleration). Hard landings (students' hard landings included) consist of two elements: down motion at a potentially high G-force, and longitudinal deceleration with a relatively low G-force. The down motion does not affect the crash sensor, no matter how high the G-force. Landing longitudinal deceleration (hard braking) is a relatively low G-force. If the longitudinal deceleration exceeds the deployment criteria (high G-force and sustained time interval), then it is a crash event and the airbag will deploy to prevent occupant injury. In addition, the crash sensor ignores turbulence from side to side and up-and-down motion. The crash sensor evaluates only deceleration in the longitudinal direction of the aircraft. Extensive testing to D0-160D substantiates the EMA's lack of vulnerability to hard-landing and turbulent conditions. Each EMA has two crash sensors in series to make it impossible that a single point of failure would trigger the sensor. Crash sensors are tested at the manufacturer 100% to perform within the AmSafe specification to fire only during the appropriate conditions. Once the crash sensors have been accepted by our quality department and assembled within an EMA, the firing time is again tested to ensure the sensors perform within the stated criteria.

All general aviation pilots, most co-pilots, and many passengers fly with headsets. Has AmSafe tested Anthropomorphic Test Devices (ATDs) with headsets to ensure there is no interference with the headset cables, etc., during airbag deployments? What are the possible implications of the headset cable routing, cable jack location, etc., for the deployment of the airbag?

AmSafe has statically deployed the airbag with a range of occupants (using ATDs) wearing headsets and has varied the routing/location of the associated headset cable. We have demonstrated that no matter where the cord or cable is placed, there is no hazard or impact to the airbag deployment if pilots or passengers use a headset.

The airbag part of the lap belt isn't centered on the seat occupant, particularly in the bench seat installations. It appears the bag will deploy to the side rather than in front of the occupant. Is this the case?

The AmSafe Seatbelt Airbag is engineered to be self-centering even if the lap belt is not centered on the occupant. As the airbag inflates, it unfolds itself towards the center of the occupant. Remember that each installation is developed and tested for the maximum occupant size requirement, from the 5th percentile/female to the 95th percentile/male.

What shape is the deployed airbag?

The airbag has various shapes, each unique to the aircraft installation and designed to provide maximum occupant protection. A typical shape for a fully deployed airbag for a three-point application would be a rectangular form.

Has this system really been tested in a new aircraft, or just on a universal sled with aircraft seats?

AmSafe used representative aircraft cabin configurations to demonstrate how to install the airbag properly and how to exit the aircraft. We conduct dynamic sled tests with aircraft seats for dynamic and static testing. The dynamic sled setup simulates the scope critical to proper airbag performance. These test setups meet the Federal Aviation Administration requirements for testing the AmSafe Airbag System for certification. The airbag system has performed as designed in incidents not requiring the airbag deployment as supplemental protection (validating sensor threshold design) and during serious accidents where the airbag provided the protection necessary to reduce or eliminate injury to the occupant.

Is the factory-delivered impact sensor for bag deployment still adequate if I put my airplane on floats?

It is irrelevant to the system if the aircraft has wheels or floats; it will work properly with either. Even if floats result in faster deceleration than if the plane were landing on a hard surface, this faster deceleration is below the deployment threshold of the system. If the “crash event” criteria of the crash sensors are met (massive longitudinal deceleration for a sustained period of time), the airbag system will deploy. In other words, if the aircraft’s landing deceleration is well above the normal operating envelope and above the level where the standard restraint will protect the occupants, airbag protection will be needed. AmSafe has done extensive testing to define an appropriate crash threshold for airbag deployment. This threshold offers the best protection for the occupant in a crash and ensures that the airbag doesn’t deploy for events such as a hard landing, aircraft vibration, turbulence, etc.

AmSafe Airbag Maintenance

Must I replace the entire AmSafe Seatbelt Airbag System every seven years? A statement included in the Supplemental Instructions for Continued Airworthiness (SICA) and Supplemental Maintenance Manual (SMM) seems to indicate this.

You need to remove and refurbish only the inflator and EMA—not the entire airbag system.

- Inflators (ROI and ACH types) must be replaced within 10 years of the date of manufacture.
- EMAs must be refurbished within seven years of the date of manufacture.
- EMAs must be replaced within 14 years of the date of manufacture.

The Original Equipment Manufacturer (OEM) must outline the refurbishment/return procedure because the OEM will control the process. The SICA and the SMM define the service life and the Return Material Authorization (RMA) process. However, since these documents were written specifically for the OEM, the OEM is responsible for creating the instructions for the service centers. Service centers should return EMAs and inflators to the OEM for refurbishment. The OEM should use the RMA procedure detailed in “Warranty and Return Information” to send the EMA or inflator back to AmSafe for refurbishment. The seatbelt airbag and interface cable do not have a defined service life. You should replace this equipment if a visual inspection indicates a problem or if the diagnostic check indicates a failed component.

If an AmSafe Airbag installation fails the diagnostic test, is it acceptable to fly the aircraft with a non-operational airbag until replacement parts are provided?

Yes, you may fly the aircraft without an active AmSafe Seatbelt Airbag System because the restraint is a Technical Standard Order (TSO)-certified restraint with the airbag installed as supplemental protection. However, the Original Equipment Manufacturer (OEM) and AmSafe have decided you must replace defective parts as soon as possible in the event of a system diagnostic failure.

Does the life limit of a component that needs to be replaced or refurbished begin on the AmSafe Airbag’s manufacturing date? Or does it start on the date the component is installed on the aircraft?

The life limit is based on the AmSafe Seatbelt Airbag System’s date of manufacture. For example, if an inflator is in inventory for a year, and a customer purchases a kit for installation on his/her aircraft, the limit of use (replacement) for that component is now nine years versus the advertised refurbishment limit of ten years. Customers should inspect the inflator’s product label annually to ensure compliance to the life limit. AmSafe allows for a grace period of up to six months to accommodate a lag between a component’s installation on an Original Equipment Manufacturer’s aircraft and its return for refurbishment.

AmSafe recommends that the system diagnostic be completed anytime a seat is removed/replaced. Pilots/owners regularly remove and replace seats in their aircraft to accommodate a variety of cargo items. If the pilot/owner removes and replaces a seat, is it necessary to complete a diagnostic check?

AmSafe and the Original Equipment Manufacturer (OEM) agree that it’s highly recommended that an authorized service center performs a system functional test if you remove and replace or disconnect and reconnect system components. This is the only way to verify system functionality. This should be completed at the earliest possible opportunity; you shouldn’t wait until the annual test.

When/if an AmSafe Seatbelt Airbag System component is determined to be defective or must be replaced because it's at the end of its service life, is it possible to dispose of the component according to the appropriate regulatory requirements rather than ship components back to the Original Equipment Manufacturer (OEM) /AmSafe for disposal? Is it not more cost-effective to scrap used/failed components instead of utilizing resources to store/ship components at each respective location?

You must dispose of inflators as HAZMAT materials (see the pictorials on the last page for a diagram of inflators for Part 23 Aircraft: ROI and ACH). All aircraft owners should have the inflators installed/removed only at authorized OEM service centers. There are too many safety issues with an OEM disposing of inflator assemblies; on the other hand, AmSafe is trained to dispose of them safely.

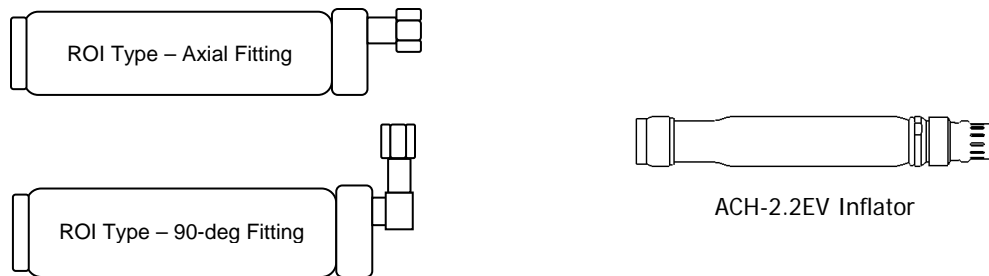
Consider the following:

- 1) The inflators must be deployed before you can dispose of them. It is unsafe for an OEM or service center to attempt to break down, destroy, or dismantle any inflator unit. OEMs have not been trained in this procedure and it's dangerous for them to try. They must not attempt this under any circumstance.
- 2) An OEM or service center cannot dispose of inflators because they are HAZMAT materials. They need to be shipped to a collection firm that is approved to accept these units. Both AmSafe and TRW ship inflators to AutoLiv in Salt Lake City for disposal.
- 3) It is recommended that the OEM or service center ship all inflator units back to AmSafe for disposal, since we do this already and are knowledgeable about the necessary procedures. Disposing of one unit requires taking the same precautions and is covered under the same regulatory requirements as disposing of one hundred units.

The logbooks show an expiration date for each belt. What refurbishment is required at that time, and how much will it cost?

AmSafe has determined a service life with refurbishment time for the Electronics Module Assembly (EMA) and inflator components of the AmSafe Seatbelt Airbag System. The seatbelt airbag assembly's service life is "On Condition," which means that the wear and tear of each individual seatbelt airbag assembly will be different depending on the use (and abuse) for a particular installation. The Supplemental Maintenance Manual (SMM) and Supplemental Instructions for Continued Airworthiness (SICA) provide detailed guidelines to help you determine if you need to replace the restraint. The aircraft OEM will determine the cost of refurbishment items.

Inflators for Part 23 Aircraft



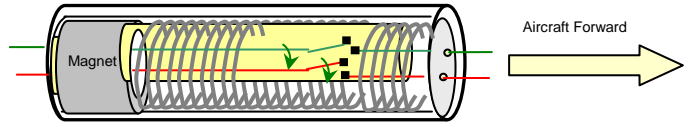
AmSafe Airbag System Specifics

When production aircraft are being delivered with the AmSafe Seatbelt Airbag System installed, will the safety caps for the inflators be included with the aircraft or must the service centers have spares on site in case an inflator needs to be removed/shipped/returned for whatever reason?

It depends. For ROI inflator assemblies, safety caps and approved shipping containers are required if you want to ship any inflator product back to AmSafe for whatever reason. You can handle this situation in a couple of ways. Inflators will be shipped to the Original Equipment Manufacturer (OEM) with proper safety caps. The OEM or service centers can then collect and inventory these safety caps when the inflators are installed. If a return is necessary, you may use the inventoried safety caps. AmSafe can also sell additional safety caps to the OEM service centers if they are misplaced or if they run out. ACH-type inflators, on the other hand, do not need shipping caps because they are designed to be thrust neutral. You must use UN POP shipping containers to ship these inflators back to AmSafe.

Please describe the sensor function and explain the trigger mechanism internal to the Electronics Module Assembly (EMA).

Here is a simplified schematic of the crash sensor:



The sensing circuit uses redundant crash sensors. In order for deployment to occur, the magnet has to push forward against a spring with enough force to close two open magnetic switches; a severe longitudinal deceleration sustained over a period of approximately 30-40 ms along the length of the aircraft is required to do this. The crash-sensor design eliminates inadvertent deployments due to operational conditions such as in-flight turbulence (up and down motion doesn't move the magnet), hard landings (up and down motion doesn't move the magnet), hard brake application (typical hard braking deceleration is less than 1 G), or hitting small runway objects (up and down motion doesn't move the magnet).

When we were developing and certifying the AmSafe Seatbelt Airbag System, we extensively evaluated and tested the effects of external environments (such as electromagnetic interference, lightning, vibration, temperature, and humidity) and internal components (such as the spring and magnet). The system has been tested and certified to the highest required levels for aircraft airbag systems. The AmSafe crash sensor design has been in use in the automotive industry for many years and is installed in millions of cars. There has never been a reported inadvertent deployment caused by the crash sensor, or any reported spring or magnet failure.