**[4910-13]**

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR Part 25**

**[Docket No. FAA-2013-0453; Special Conditions No. 25-489-SC]**

**Special Conditions:** The Boeing Company, Model 717-200 Series Airplanes; Seats with Inflatable Lapbelts.

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final special condition; request for comments.

**SUMMARY:** These special conditions are issued for the Boeing Model 717-200 series airplanes. These airplanes will have a novel or unusual design feature associated with seats with inflatable lapbelts. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

**DATES:** The effective date of these special conditions is June 12, 2013. We must receive your comments by **[insert a date 45 days after date of publication in the *Federal Register*]**.

**ADDRESSES:** Send comments identified by docket number **FAA-2013-0453** using any of the following methods:

- Federal eRegulations Portal: Go to http://www.regulations.gov/ and follow the online instructions for sending your comments electronically.

Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, D.C., 20590-0001.

Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 8 a.m. and 5 p.m., Monday through Friday, except federal holidays.

Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to http://www.regulations.gov/, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the *Federal Register* published on April 11, 2000 (65 FR 19477–19478), as well as at http://DocketsInfo.dot.gov/.

Docket: Background documents or comments received may be read at http://www.regulations.gov/ at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.

**FOR FURTHER INFORMATION CONTACT:** Alan Sinclair, FAA, Airframe and Cabin Safety Branch, ANM-115, Transport Airplane Directorate, Aircraft Certification Service, 1601

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## SUPPLEMENTARY INFORMATION:

The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions are unnecessary because the substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon issuance.

### Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

### Background

***Model 717-200 Series Airplanes***

On January 15, 2013, The Boeing Company (referred to as "Boeing" after this point) applied for a change to Type Certificate No. A6WE to install inflatable lapbelts on Boeing Model 717-200 series airplanes. The Model 717-200 series airplanes are narrow body airplanes with twin-jet rear-mounted engines. They are equipped with two Rolls-Royce Deutschland Ltd & Co KG BR700-715A1-30 or BR700-715C1-30 engines. The maximum takeoff weight is 121,000 pounds/154,885 kilograms. They have a 134 passenger and 6 crew member capacity.

The Model 717-200 series airplanes will use inflatable lapbelts, which are designed to limit the forward excursion of occupants in the event of an accident. This will reduce the potential for head injury, thereby reducing the head injury criteria (HIC) measurement. Inflatable lapbelts behave similarly to automotive inflatable airbags, but in these airplanes, the airbags are integrated into the lapbelts and they inflate away from the seated occupants. While inflatable airbags are now standard in the automotive industry, the use of inflatable lapbelts is novel for commercial aviation.

***Regulatory Requirements Applicable to Model 717-200 Series Airplanes***

Title 14, Code of Federal Regulations (14 CFR) 121.311(j) requires that no person may operate a transport category airplane type certificated after January 1, 1958, and manufactured on or after October 27, 2009, in passenger-carrying operations, after October 27, 2009, unless all passenger and flight attendant seats on an airplane operated under part 121 rules meet the requirements of § 25.562 in effect on or after June 16, 1988.

The Boeing Model 717-200 series airplanes are required to show compliance with certain aspects of § 25.562 as specified per Type Certificate Data Sheet (TCDS) A6WE. But Boeing Model 717-200 series airplanes manufactured on or after October 27, 2009, operated under part 121 must meet all of the requirements of § 25.562 for passenger and flight attendant seats. Thus, it is in the interest of installers to show full compliance to § 25.562, so that an operator under part 121 may be able to use the airplanes without having to do additional certification work. Also, some foreign civil airworthiness authorities have invoked these same operator requirements in the form of airworthiness directives.

Section 25.785 requires that occupants be protected from head injury by either ensuring that any object that could injure them is outside the striking radius of their heads or adding padding. Traditionally, this has required seats to be set back so that occupants' heads are 35 inches from any bulkhead or other rigid interior feature. If this is not practical, specified types of padding must be added. The relative effectiveness of these means of injury protection was not quantified. Amendment 25-64 to 14 CFR part 25, specifically § 25.562, created a new standard that quantifies required head injury protection.

Section 25.562 requires that for seat and restraint systems, applicants must use dynamic tests or analysis to demonstrate that persons do not suffer serious head injury under specific conditions. Section 25.562 also requires that protection must be provided or the seat must be designed so that the head impact does not exceed a HIC of 1,000 units. While the test conditions described for HIC are detailed and specific, it is the intent of the requirement that an adequate level of head injury protection be provided for passengers in a severe crash.

Because §§ 25.562 and 25.785 and associated guidance do not adequately address seats with inflatable lapbelts, the FAA recognizes that appropriate pass/fail criteria need to be developed that do fully address the safety concerns specific to occupants of these seats.

***Advantages of Inflatable Lapbelts***

Inflatable lapbelts have two potential advantages over other means of head-impact protection. First, they can provide significantly greater protection than energy-absorbing pads, and, second, they can provide essentially equivalent protection for all occupants, regardless of stature. These are significant advantages from a safety standpoint, because inflatable lapbelts will likely provide a level of safety that exceeds the minimum standards of the Code of Federal

Regulations. Conversely, inflatable lapbelts in general are active systems and must be relied upon to activate properly when needed, as opposed to energy-absorbing pads or upper torso restraints that are passive and always available. Therefore, the potential advantages must be balanced against this and other potential disadvantages to develop standards for this design feature.

***Unique Concerns for Inflatable Lapbelts in Airplanes***

While the automotive industry has extensive experience demonstrating the benefits of using inflatable airbags, the airplane environment presents unique and additional challenges. From the standpoint of a passenger safety system, inflatable lapbelts are unique in that they are both active and entirely autonomous devices. In automobiles, airbags are a supplemental system and work in conjunction with upper torso restraints. In airplanes, inflatable lapbelts are the sole means of injury protection for occupants, i.e., they are not used in conjunction with additional restraints. In addition, automobile crash events have more definable beginnings and ends, and they do not typically last as long as aviation crash events, which can simplify the activation logic.

The airplane-operating environment is also quite different from that of automobiles in terms of both the interior design and the exterior environment in which the airplane operates. Airplane cabin furnishings potentially receive greater wear and tear and unanticipated abuse conditions (for example, because of galley loading and damage from passenger baggage). Airplanes also operate at altitudes where exposure to high-intensity radiomagnetic fields (HIRF) could affect the lapbelts' activation system.

The FAA considers inflatable lapbelts to have two primary safety concerns: first, that they perform properly under foreseeable operating conditions, and second, that they do not perform (i.e., activate) in a manner or at times that would result in a hazard to the airplane or occupants. This latter point has the potential to be the more rigorous of the requirements, owing to the active nature of the system. The discussion below addresses how these special conditions address the specific issues raised by these two general concerns.

## Type Certification Basis

Under the provisions of § 21.101 Boeing must show that the Model 717-200 series airplanes, as changed, continue to meet the applicable provisions of the regulations incorporated by reference in Type Certificate No. A6WE or the applicable regulations in effect on the date of application for the change. The regulations incorporated by reference in the type certificate are commonly referred to as the "original type certification basis." The regulations incorporated by reference in Type Certificate No. A6WE are as follows: part 25 of the Federal Aviation Regulations as amended by Amendments 25-1 through 25-82, except where superseded. The U.S. type certification basis for the Model 717-200 series airplanes is established in accordance with 14 CFR 21.29 and 21.17 and the type certification application date. The U.S. type certification basis is listed in Type Certificate No. A6WE.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Boeing Model 717-200 series airplanes because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, the special conditions would also apply to the other model.

In addition to the applicable airworthiness regulations and special conditions, the Model 717-200 series airplanes must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type-certification basis under § 21.101.

## Novel or Unusual Design Features

The Boeing Model 717-200 series airplanes will incorporate the following novel or unusual design features: inflatable lapbelts on certain seats of the Model 717-200 series airplanes to reduce the potential for head injury in the event of an accident. Inflatable lapbelts work similarly to automotive airbags, except the airbags are integrated with the lapbelts of the restraint system.

The CFR states the performance criteria for head injury protection in objective terms. However, none of these criteria are adequate to address the specific issues raised concerning seats with inflatable lapbelts. The FAA has therefore determined that, in addition to the requirements of part 25, special conditions are needed to address requirements particular to installation of seats with inflatable lapbelts.

Accordingly, in addition to the passenger injury criteria specified in § 25.785, these special conditions are proposed for the Boeing Model 717-200 series airplanes equipped with inflatable lapbelts. Other conditions may be developed, as needed, based on further FAA review and discussions with the manufacturer and civil aviation authorities.

## Discussion

The FAA considers inflatable lapbelts to have two primary safety concerns: first, that they perform properly under foreseeable operating conditions, and second, that they do not perform (i.e., activate) in a manner or at times that would result in a hazard to the airplane or occupants.

### *Effective for Wide Range of Occupants*

Inflatable lapbelts should be effective for a wide range of occupants. The FAA has historically considered the range from the fifth percentile female to the ninety-fifth percentile male as the range of occupants that must be taken into account. In this case, the FAA is proposing consideration of a broader range of occupants, due to the nature of the lapbelt installation and its close proximity to the occupant. In a similar vein, these persons could have assumed the brace position for accidents in which an impact is anticipated. Test data indicate that occupants in the brace position do not require supplemental protection, and so it would not be necessary to show that inflatable lapbelts will enhance the brace position. However, the inflatable lapbelts must not introduce any hazards when they deploy into seated, braced occupants.

Another area of concern is children in these seats whether lap-held, in approved child safety seats, or occupying the seat directly. Although specifically prohibited by the FAA

operating regulations, the use of the supplementary loop belt ("belly belt") may be required by other civil aviation authorities, and should also be considered with the end goal of meeting those regulations. Similarly, if the seat is occupied by a pregnant woman, the installation needs to address such usage, either by demonstrating that it will function properly, or by adding appropriate limitation on usage.

***No Resulting Hazards from Proper Functioning***

To be an effective safety system, inflatable lapbelts must function properly and must not introduce any additional hazards to occupants as a result of their functioning. There are several areas where inflatable lapbelts differ from traditional occupant protection systems and require special conditions to ensure adequate performance.

Inflatable lapbelts are essentially single-use devices. As a result, they could potentially deploy under crash conditions that are not sufficiently severe as to require head injury protection from the inflatable lapbelts. Since crashes are frequently composed of a series of impacts before the airplane comes to rest, if a larger impact follows the initial impact, the inflatable lapbelts could be rendered useless. Other safety devices such as energy absorbing pads or upper torso restraints tend to provide continuous protection regardless of severity or number of impacts in a crash event. Therefore, the inflatable lapbelts should provide protection when required and they should not expend their protection during a less severe impact. Also, it is possible to have several large impact events during the course of a crash, but there will be no requirement for the inflatable lapbelts to provide protection for multiple impacts.

Each occupant's restraint system is designed to provide protection for only that occupant. However, unoccupied seats that may have active lapbelts are also a concern. It will be necessary

to show that the required protection is provided for each occupant, regardless of the number of occupied seats.

***Impact on Egress***

Since the inflatable lapbelts likely have a large volume displacement, the inflated bags could potentially impede egress of passengers. Since the bags deflate to absorb energy, it is likely that the inflatable lapbelts would be deflated at the time that persons would be trying to leave their seats. Nonetheless, it is appropriate to specify a time interval after which the inflatable lapbelts may not impede rapid egress. Ten seconds has been chosen as a reasonable time, since this corresponds to the maximum time allowed for an exit to be opened (in accordance with § 25.809). In actuality, it is unlikely that a flight attendant would be able to prepare an exit this quickly, especially in an accident that is severe enough to deploy the inflatable lapbelts. Furthermore, the inflatable lapbelts will likely deflate much more quickly than ten seconds.

It is even more critical that the inflatable lapbelts do not impede rapid egress in the emergency exit row seats. Section 25.813 clearly requires that there must be an unobstructed passageway from the main aisle to the exit and that there must be no interference in opening the exit. The restraint system must not impede access to and the opening of the exit. In some cases, such as a Type III over-wing hatch, a passenger is the one who will open the exit. These lapbelts should be evaluated in the exit row under existing regulations (§§ 25.809 and 25.813) and guidance material. The inflatable lapbelts must also be evaluated in post-crash conditions. They should be evaluated using representative restraint systems in the bag deployed condition.

This evaluation includes reviewing the access to and opening of the exit, specifically looking for obstructions in the egress path and any interference in opening the exit. Each unique interior configuration must be considered (e.g., passageway width and single, or dual passageways with the outboard seat removed). If restraints create any obstruction or interference, they could impede rapid egress. If these restraint systems are installed at exit door rows, it is likely that project-specific guidance will be necessary.

***Availability When Needed***

These special conditions include requirements to ensure that inflatable lapbelts operate in the aviation environment. These special conditions also incorporate requirements to ensure that the inflatable lapbelts are protected from HIRF and meet the requirements of § 25.1316. Existing regulations regarding lightning, § 25.1316, and the existing HIRF special condition for the Boeing Model 717-200 series aircraft, Special Conditions No. 25-ANM-60 (57 FR 34511, August 5, 1992), are also applicable.

Since inflatable lapbelts will be electrically powered, the system could possibly fail if the fuselage separates. Since this system is intended as crash/post-crash protection means, failure due to fuselage separation is not acceptable. As with emergency lighting, the system should function properly if such a separation occurs at any point in the fuselage. Inflatable lapbelts will rely on electronic sensors for signaling and pyrotechnic charges for activation so that they are available when needed.

***Prevention of Inadvertent Activation***

Inflatable lapbelts could be susceptible to inadvertent activation, causing them to deploy in a potentially unsafe manner. The consequences of such deployment must be considered in

establishing the reliability of the system. Therefore, Boeing must substantiate that if the lapbelts inadvertently deploy, they will not create a hazard to the airplane. If this cannot be substantiated, then Boeing must demonstrate that inadvertent deployment is an extremely improbable occurrence (i.e., less than $10^{-9}$ per flight hour). Also, if the lapbelts are inadvertently deployed, the effects on passengers or crew members who are standing or sitting close by should also be considered. A minimum reliability level will have to be established for this case, depending upon the consequences, even if the effect on the airplane is negligible.

In-service and outside environmental conditions could increase the potential for inadvertent activation. The cumulative effects of wear and tear must also be considered so that it does not increase the likelihood of an inadvertent deployment to an unacceptable level. To mitigate the effects of such cumulative damage, it is necessary to develop an appropriate inspection interval and self-test capability. Environmental conditions, such as lightning and HIRF, could potentially affect inflatable lapbelt systems. To demonstrate compliance in such conditions, it is first necessary to determine whether the lapbelts are critical or essential systems. If inadvertent deployment could cause a hazard to the airplane, inflatable lapbelts are considered a critical system; if inadvertent deployment could cause injuries to persons, the inflatable lapbelts are considered an essential system. Finally, the inflatable lapbelt installation should be protected from the effects of fire, so, for example, a rupture of the pyrotechnic squib does not create an additional hazard.

***Flammability***

Special Conditions No. 25-187-SC (66 FR 52017, October 12, 2001) issued for the Boeing Model 777 series airplanes was the first special conditions to address flammability of the

airbag material. The Boeing Model 717-200 series airplanes will use the similar airbag material in their inflatable lapbelts. During the development of inflatable lapbelts, the manufacturer was unable to develop a fabric that would meet the inflation requirements for the bag and the flammability requirements of part I(a)(1)(ii) of appendix F to part 25. The fabrics that were developed that meet the flammability requirement did not produce acceptable deployment characteristics. However, the manufacturer was able to develop a fabric that meets the less stringent flammability requirements of part I(a)(1)(iv) of appendix F to part 25 and has acceptable deployment characteristics.

Part I of appendix F to part 25 specifies the flammability requirements for interior materials and components. Appendix F does not explicitly reference inflatable restraint systems, because they did not exist when the flammability requirements were written. The existing requirements are based on both material types, as well as use, and have been specified in light of the state-of-the-art materials available to perform a given function. In the absence of a specific reference, the default requirement would be for the type of material used to construct the inflatable restraint, which is a fabric in this case. However, in issuing special conditions, the FAA must also consider the use of the material and whether the default requirement is appropriate. In this case, the specialized function of the inflatable restraints means that highly specialized materials are needed.

The standard normally applied to fabrics is a 12-second vertical ignition test. However, materials that meet this standard do not perform adequately as inflatable restraints. Since the safety benefits of the inflatable restraints are very significant, the flammability standard appropriate for these devices should not screen out suitable materials, thereby effectively

eliminating use of inflatable restraints. The FAA will need to establish a balance between the safety benefit of the inflatable restraints and flammability performance. At this time, the 2.5-inch per minute horizontal test is considered to provide that balance. As materials standards and technology change (which is expected), the FAA may change this standard in subsequent special conditions to account for improved materials.

As discussed previously, the following special conditions can be characterized as addressing either the safety performance of the system or the system's integrity against inadvertent activation. Because a crash requiring use of the inflatable lapbelts is a relatively rare event, and because the consequences of an inadvertent activation are potentially quite severe, these latter requirements are probably the more rigorous from a design standpoint.

Finally, it should be noted that the special conditions are applicable to the inflatable lapbelt system as installed. The special conditions are not an installation approval. Therefore, while the special conditions relate to each such system installed, the overall type certificate or supplemental type certificate approval is a separate finding and must consider the combined effects of all such systems installed. For the reasons discussed above, these special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

## Applicability

As discussed above, these special conditions are applicable to the Model 717-200 series airplanes. Should Boeing apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

## Conclusion

This action affects only certain novel or unusual design features on one model series of airplanes. It is not a rule of general applicability.

The substance of these special conditions has been subjected to the notice and comment period in several prior instances and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, the FAA has determined that prior public notice and comment are unnecessary and good cause exists for adopting these special conditions upon issuance. The FAA is requesting comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above.

## List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

## The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Boeing Model 717-200 series airplanes equipped with inflatable lapbelts.

1. Seats with Inflatable Lapbelts. It must be shown that the inflatable lapbelt will deploy and provide protection under crash conditions where it is necessary to prevent serious head injury. The means of protection must take into consideration a range of stature from a two-year-old child to a ninety-fifth percentile male. The inflatable lapbelt must provide a consistent

approach to energy absorption throughout that range of occupants. In addition, the following situations must be considered:

a. The seat occupant is holding an infant.

b. The seat occupant is a child in a child restraint device.

c. The seat occupant is a child not using a child restraint device.

d. The seat occupant is a pregnant woman.

2. The inflatable lapbelt must provide adequate protection for each occupant regardless of the number of occupants of the seat assembly, considering that unoccupied seats may have active seatbelts.

3. The design must prevent the inflatable lapbelt from being either incorrectly buckled or incorrectly installed such that the inflatable lapbelt would not properly deploy. Alternatively, it must be shown that such deployment is not hazardous to the occupant, and will provide the required head injury protection.

4. It must be shown that the inflatable lapbelt system is not susceptible to inadvertent deployment as a result of wear and tear, or inertial loads resulting from in-flight or ground maneuvers (including gusts and hard landings), and other operating and environmental conditions (vibrations, moisture, etc.) likely to be experienced in service.

5. Deployment of the inflatable lapbelt must not introduce injury mechanisms to the seated occupant, or result in injuries that could impede rapid egress. This assessment should include an occupant who is in the brace position when it deploys and an occupant whose belt is loosely fastened.

6. It must be shown that inadvertent deployment of the inflatable lapbelt, during the most critical part of the flight, will either not cause a hazard to the airplane or its occupants, or it meets the requirement of § 25.1309(b).

7. It must be shown that the inflatable lapbelt will not impede rapid egress of occupants 10 seconds after its deployment.

8. The system must be protected from lightning and high intensity radiomagnetic fields (HIRF). The threats specified in existing regulations regarding lightning, § 25.1316, and existing HIRF special conditions for the Boeing Model 717-200 series airplanes, Special Conditions No. 25-ANM-60, are incorporated by reference for the purpose of measuring lightning and HIRF protection.

9. Inflatable lapbelts, once deployed, must not adversely affect the emergency lighting system (e.g., block proximity lights to the extent that the lights no longer meet their intended function).

10. The inflatable lapbelt must function properly after loss of normal aircraft electrical power, and after a transverse separation of the fuselage at the most critical location. A separation at the location of the lapbelt does not have to be considered.

11. It must be shown that the inflatable lapbelt will not release hazardous quantities of gas or particulate matter into the cabin.

12. The inflatable lapbelt installation must be protected from the effects of fire such that no hazard to occupants will result.

13. There must be a means for a crew member to verify the integrity of the inflatable lapbelt activation system prior to each flight, or it must be demonstrated to reliably operate

between inspection intervals. The FAA considers the loss of the airbag system deployment function alone (i.e., independent of the conditional event that requires the airbag system deployment) to be a major failure condition.

14. The inflatable material may not have an average burn rate of greater than 2.5 inches/minute when tested using the horizontal flammability test as defined in 14 CFR part 25, appendix F, part I, paragraph (b)(5).

Issued in Renton, Washington, on June 12, 2013.

/s/ *Jeffrey E. Duven*

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[FR Doc. 2013-14322 Filed 06/14/2013 at 8:45 am; Publication Date: 06/17/2013]