[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2016-6925; Special Conditions No. 25-623-SC]

Special Conditions: Embraer S.A. Model EMB-545 and EMB-550 airplanes; Installation of an Airbag System to Limit the Axial Rotation of the Upper Leg on Single- and Multiple-Place Side-Facing Seats.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Embraer S.A. (Embraer) Model EMB-545 and EMB-550 series airplanes. These airplanes will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport-category airplanes. This feature is an airbag system designed to limit the axial rotation of the upper leg on single-place and multiple-place side-facing seats. 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: This action is effective on Embraer on [**INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER**]. We must receive your comments by [**INSERT DATE 45 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER**].

ADDRESSES: Send comments identified by docket number FAA-2016-6925 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, DC, 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, DC, between 9 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 Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New

Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Jayson Claar, FAA, Airframe and Cabin Safety Branch, ANM-115, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington 98057-3356; telephone 425-227-2194; facsimile 425-227-1320.

SUPPLEMENTARY INFORMATION:

The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions is impracticable because these procedures would significantly delay issuance of the design approval and thus delivery of the affected airplanes.

In addition, 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 publication in the **Federal Register**.

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

On March 26, 2015, Embraer applied for a type design change for their new Model EMB-545 and EMB-550 airplanes. These airplanes, currently approved under type certificate no.

TC00062IB, are conventional configurations with low wing and T-tail empennage. The primary structure is metal with composite empennage and control surfaces. The EMB-545 is designed for a maximum of 9 passengers and the EMB-550 is designed for a maximum of 12 passengers. Both are equipped with two Honeywell HTF7500-E medium-bypass-ratio turbofan engines mounted on aft-fuselage pylons.

Both airplane models have an interior configuration that includes single- and multiple-place side-facing seats (both seating configurations referred to as side-facing seats) that include an airbag system in the shoulder belt for these seats, per special conditions no. 25-495-SC; and an airbag system to limit the axial rotation of the upper leg (femur).

Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) 21.101, Embraer must show that the Model EMB-545 and EMB-550 airplanes meet the applicable provisions of the regulations listed in type certificate no. TC00062IB, or the applicable regulations in effect on the date of application for the change, except for earlier amendments as agreed upon by the FAA.

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 Model EMB-545 and EMB-550 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, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the Model EMB-545 and EMB-550 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 Model EMB-545 and EMB-550 airplanes will incorporate the following novel or unusual design features:

An airbag system designed to limit the axial rotation of the upper leg on single-place and multiple-place side-facing seats.

Discussion

The FAA has developed a methodology to address all fully side-facing seats (seats positioned in the airplane with the occupant facing 90 degrees to the direction of airplane travel), and documented those requirements in special conditions 25-495-SC specifically for these airplanes, including special conditions for the installation of airbag systems in shoulder belts. Special condition 2(e) of those special conditions contain safety criteria to address the potential for serious upper-leg injuries.

Serious leg injuries, such as femur fracture, can occur in aviation side-facing seats. Such injuries could threaten the occupant's life directly or eliminate the occupant's ability to evacuate the airplane. Limiting upper-leg axial rotation to a conservative limit of 35 degrees (approximately the 50-percentile range of motion) should limit the risk of serious leg injury. Research suggests that the angle of rotation can be determined by observing lower-leg flailing in typical high-speed video of the dynamic tests. Alternately, the anthropomorphic test dummy

could be instrumented to directly measure upper-leg axial rotation. This requirement complies with the intent of the § 25.562 (a) injury criteria in preventing serious leg injury.

To comply with special condition 2(e) on some seat positions, Embraer proposes to install leg-flail airbags. This airbag is not addressed in special conditions 25-495-SC. Therefore, the FAA must issue new special conditions to address this leg-flail airbag installation. These special conditions are similar to other special conditions previously issued for airbags.

The FAA has issued special conditions in the past for airbag systems on lap belts for some forward-facing seats. These special conditions for the airbag system in the shoulder belt are based on the previous special conditions for airbag systems on lap belts with some changes to address the specific issues of side-facing seats. The special conditions are not an installation approval. Therefore, while the special conditions relate to each such system installed, the overall installation approval is a separate finding, and must consider the combined effects of all such systems installed.

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 Model EMB-545 and EMB-550 airplanes. Should Embraer apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, these 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, because a delay would significantly affect the certification of the airplane, the FAA has determined that prior public notice and comment are unnecessary and impracticable, and good cause exists for adopting these special conditions upon publication in the **Federal Register**. 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 Embraer Model EMB-550 and Model-545 series airplanes.

In addition to the requirements of §§ 25.562 and 25.785, and special conditions no. 25-495-SC, the following special conditions are part of the type certification basis for the

Embraer Model EMB-545 and EMB-550 series airplanes with leg-flail airbags installed on side-facing seats.

1. For seats with a leg-flail airbag system, the system must deploy and provide protection under crash conditions where it is necessary to prevent serious injury. The means of protection must take into consideration a range of stature from a 2-year-old child to a 95th-percentile male. At some buttock popliteal length and effective seat-bottom depth, the lower legs will not be able to form a 90-degree angle relative to the upper leg; at this point, the lower leg flail would not occur. The leg-flail airbag system must provide a consistent approach to prevention of leg flail throughout that range of occupants whose lower legs can form a 90-degree angle relative to the upper legs when seated upright in the seat. Items that need to be considered include, but are not limited to, the range of occupants' popliteal height, the range of occupants' buttock popliteal length, the design of the seat effective height above the floor, and the effective depth of the seat-bottom cushion.
2. The leg-flail airbag system must provide adequate protection for each occupant regardless of the number of occupants of the seat assembly, considering that unoccupied seats may have an active leg-flail airbag system.
3. The leg-flail airbag system must not be 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 occur in service.
4. Deployment of the leg-flail airbag system must not introduce injury mechanisms to the seated occupant, or result in injuries that could impede rapid egress.

5. Inadvertent deployment of the leg-flail airbag system, during the most critical part of the flight, must either meet the requirement of § 25.1309(b), or not cause a hazard to the airplane or its occupants.
6. The leg-flail airbag system must not impede rapid egress of occupants from the airplane 10 seconds after airbag deployment.
7. The leg-flail airbag system must be protected from lightning and high-intensity radiated fields (HIRF). The threats to the airplane specified in existing regulations regarding lightning (§ 25.1316) and HIRF (§ 25.1317) are incorporated by reference for the purpose of measuring lightning and HIRF protection.
8. The leg-flail airbag system must function properly after loss of normal airplane electrical power, and after a transverse separation of the fuselage at the most critical location. A separation at the location of the leg-flail airbag system does not have to be considered.
9. The leg-flail airbag system must not release hazardous quantities of gas or particulate matter into the cabin.
10. The leg-flail airbag system installation must be protected from the effects of fire such that no hazard to occupants will result.
11. A means must be available to verify the integrity of the leg-flail airbag system's activation system prior to each flight, or the leg-flail airbag system's activation system must reliably operate between inspection intervals. The FAA considers that the loss of the leg-flail airbag system's deployment function alone (i.e., independent of the conditional event that requires the leg-flail airbag system's deployment) is a major-failure condition.

12. The airbag inflatable material may not have an average burn rate of greater than 2.5 inches per minute when tested using the horizontal flammability test defined in part 25, appendix F, part I, paragraph (b)(5).
13. The leg-flail airbag system, once deployed, must not adversely affect the emergency-lighting system (i.e., block floor-proximity lights to the extent that the lights no longer meet their intended function).

Issued in Renton, Washington, on July 21, 2016.

/s/

Michael Kaszycki
Acting Manager, Transport Airplane Directorate
Aircraft Certification Service
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