DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA–2020–0720; Special Conditions No. 25–786–SC]

Special Conditions: The Boeing Company Model 787 Series Airplane; Seats With Pretensioner Restraint Systems

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for The Boeing Company (Boeing) Model 787 series airplane. This airplane 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 design feature is pretensioner restraint systems installed on passenger 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: Effective April 26, 2021.

FOR FURTHER INFORMATION CONTACT: Shannon Lennon, Human-Machine Interface Section, AIR–626, Technical Innovation Policy Branch, Policy and Innovation Division, Aircraft Certification Service, Federal Aviation Administration, 2200 South 216th Street, Des Moines, Washington 98198; telephone and fax 206–231–3209; email *shannon.lennon@faa.gov.*

SUPPLEMENTARY INFORMATION:

Background

On November 8, 2018, Boeing applied for a change to Type Certificate No. T00021SE for pretensioner restraint systems installed on passenger seats in the Model 787 series airplane. This airplane is a twin-engine, transport-category airplane with passenger seating capacity of 420 and a maximum takeoff weight of 557,000 pounds.

Type Certification Basis

Under the provisions of title 14, Code of Federal Regulations (14 CFR) 21.101, Boeing must show that the Model 787 series airplane, as changed, continues to meet the applicable provisions of the regulations listed in Type Certificate No. T00021SE 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 (*e.g.,* 14 CFR part 25) do not contain adequate or appropriate safety standards for Boeing Model 787 series airplane 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 Boeing Model 787 series airplane 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 787 series airplane will incorporate the following novel or unusual design features:

Forward-facing seats incorporating a shoulder harness with pretensioner device, otherwise known as a pretensioner restraint system, which is intended to protect the occupants from head injuries.

Discussion

Boeing will install, in the Model 787 series airplane, forward-facing seats that incorporate a shoulder harness with a pretensioner system at each seat place for head-injury protection.

Shoulder harnesses have been widely used on flight-attendant seats, flight-deck seats, in business jets, and in general-aviation airplanes to reduce occupant head injury in the event of an emergency landing. Special conditions, pertinent regulations, and published guidance exist that relate to other restraint systems. However, the use of pretensioners in the restraint system on transport-airplane seats is a novel design.

The pretensioner restraint system utilizes a retractor which eliminates slack in the shoulder harness and pulls the occupant back into the seat prior to impact. This has the effect of reducing forward translation of the occupant, reducing head arc, and reducing the loads in the shoulder harness.

Pretensioner technology involves a step-change in loading experienced by the occupant for impacts below and above that at which the device deploys, because activation of the shoulder harness, at the point at which the pretensioner engages, interrupts upper-torso excursion. This could result in the head injury criteria (HIC) being higher at an intermediate impact condition than that resulting from the maximum impact condition corresponding to the test conditions specified in § 25.562. See condition 1 in these special conditions.

The ideal triangular maximum-severity pulse is defined in Advisory Circular (AC) 25.562–1B, ''Dynamic Evaluation of Seat Restraint Systems and Occupant Protection on Transport Airplanes.'' For the evaluation and testing of less-severe pulses for purposes of assessing the effectiveness of the pretensioner setting, a similar triangular pulse should be used with acceleration, rise time, and velocity change scaled accordingly. The magnitude of the required pulse should not deviate below the ideal pulse by more than 0.5g until 1.33 t1 is reached, where t1 represents the time interval between 0 and t1 on the referenced pulse shape as shown in AC 25.562–1B. This is an acceptable method of compliance to the test requirements of the special conditions.

Additionally, the pretensioner might not provide protection, after actuation, during secondary impacts. Therefore, the case where a small impact is followed by a large impact should be addressed. If the minimum deceleration severity at which the pretensioner is set to deploy is unnecessarily low, the protection offered by the pretensioner may be lost by the time a second, larger impact occurs.

Conditions 1 through 4 ensure that the pretensioner system activates when intended, to provide the necessary protection of occupants. This includes protection of a range of occupants under various accident conditions. Conditions 5 through 10 address maintenance and reliability of the pretensioner system, including any outside influences on the mechanism, to ensure it functions as intended.

The 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.

Discussion of Comments

The FAA issued Notice of Proposed Special Conditions No. 25–20–08–SC for the Boeing Model 787 series airplane, which was published in the **Federal Register** on October 30, 2020 (85 FR 68801). No comments were received, and the special conditions are adopted as proposed.

Applicability

As discussed above, these special conditions are applicable to the Boeing Model 787 series airplane. 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, these special conditions would apply to that model as well.

Conclusion

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

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

Authority Citation

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(f), 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 the Boeing Model 787 series airplane.

In addition to the requirements of § 25.562, forward-facing passenger seats with pretensioner restraint systems must meet the following:

1. Head Injury Criteria (HIC)

The HIC value must not exceed 1000 at any condition at which the pretensioner does or does not deploy, up to the maximum severity pulse that corresponds to the test conditions specified in § 25.562. Tests must be performed to demonstrate this, taking into account any necessary tolerances for deployment.

When an airbag device is present in addition to the pretensioner restraint system, and the anthropomorphic test device (ATD) has no apparent contact with the seat/structure but has contact with an airbag, a HIC unlimited scored in excess of 1000 is acceptable, provided the HIC15 score (calculated in accordance with 49 CFR 571.208) for that contact is less than 700.

ATD head contact with the seat or other structure, through the airbag, or contact subsequent to contact with the airbag, requires a HIC value that does not exceed 1000.

2. Protection During Secondary Impacts

The pretensioner activation setting must be demonstrated to maximize the probability of the protection being available when needed, considering secondary impacts.

3. Protection of Occupants Other Than 50th Percentile

Protection of occupants for a range of stature from a 2-year-old child to a 95th percentile male must be shown. For shoulder harnesses that include pretensioners, protection of occupants other than a 50th percentile male may be shown by test or analysis. In addition, the pretensioner must not introduce a hazard to passengers due to the following seating configurations:

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 pregnant woman.

4. Occupants Adopting the Brace Position

Occupants in the traditional brace position when the pretensioner activates must not experience adverse effects from the pretensioner activation.

5. Inadvertent Pretensioner Actuation

a. The probability of inadvertent pretensioner actuation must be shown to be extremely remote (*i.e.,* average probability per flight hour of less than 10^{-7}).

b. The system must be shown to be not susceptible to inadvertent pretensioner actuation as a result of wear and tear, nor inertia loads resulting from in-flight or ground maneuvers likely to be experienced in service.

c. The seated occupant must not be seriously injured as a result of inadvertent pretensioner actuation.

d. Inadvertent pretensioner actuation must not cause a hazard to the airplane, nor cause serious injury to anyone who may be positioned close to the retractor or belt (*e.g.,* seated in an adjacent seat or standing adjacent to the seat).

6. Availability of the Pretensioner Function Prior to Flight

The design must provide means for a crewmember to verify the availability of the pretensioner function prior to each flight, or the probability of failure of the pretensioner function must be demonstrated to be extremely remote (*i.e.,* average probability per flight hour of less than 10^{-7}) between inspection intervals.

7. Incorrect Seat Belt Orientation

The system design must ensure that any incorrect orientation (twisting) of the seat belt does not compromise the pretensioner protection function.

8. Contamination Protection

The pretensioner mechanisms and controls must be protected from external contamination associated with that which could occur on or around passenger seating.

9. Prevention of Hazards

The pretensioner system must not induce a hazard to passengers in case of fire, nor create a fire hazard, if activated.

10. Functionality After Loss of Power

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

Issued in Kansas City, Missouri, on March 17, 2021.

Patrick R. Mullen,

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. FAA–2020–0846; Project Identifier MCAI–2020–00806–T; Amendment 39–21411; AD 2021–03–08]

RIN 2120–AA64

Airworthiness Directives; Airbus SAS Airplanes

AGENCY: Federal Aviation Administration (FAA), Department of Transportation (DOT).

ACTION: Final rule.

SUMMARY: The FAA is adopting a new airworthiness directive (AD) for certain