

# Rules and Regulations

Federal Register

Vol. 70, No. 162

Tuesday, August 23, 2005

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## DEPARTMENT OF TRANSPORTATION

### Federal Aviation Administration

#### 14 CFR Part 25

[Docket No. NM326; Special Conditions No. 25-295-SC]

#### Special Conditions: Boeing Model 777 Series Airplanes; Side-Facing Single-Occupant Seats Equipped With Inflatable Lapbelts

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

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

**SUMMARY:** These special conditions are issued for the Boeing Model 777 series airplanes. This airplane will have a novel or unusual design feature associated with side-facing single-occupant seats equipped with inflatable lapbelts. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for these design features. These special conditions contain the additional safety standards 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 August 9, 2005. Send your comments on or before October 7, 2005.

**ADDRESSES:** Comments on these special conditions may be mailed in duplicate to: Federal Aviation Administration, Transport Airplane Directorate, Attn: Rules Docket (ANM-113), Docket No. NM326, 1601 Lind Avenue, SW., Renton, Washington 98055-4056; or delivered in duplicate to the Transport Airplane Directorate at the above address. Comments must be marked: Docket No. NM326. Comments may be inspected in the Rules Docket weekdays, except Federal holidays, between 7:30 a.m. and 4 p.m.

#### FOR FURTHER INFORMATION CONTACT:

Alan Sinclair, FAA, Airframe/Cabin Safety Branch, ANM-115, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue, SW., Renton, Washington 98055-4056; telephone (425) 227-2195, facsimile (425) 227-1232.

**SUPPLEMENTARY INFORMATION:** The FAA has determined that notice and opportunity for prior public comment hereon are impracticable because these procedures would significantly delay issuance of the approval design and thus delivery of the affected aircraft. 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 issuance.

#### Comments Invited

We invite interested persons to participate in this rulemaking by submitting 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 ask that you send us two copies of written comments.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning these special conditions. The docket is available for public inspection before and after the comment closing date. If you wish to review the docket in person, go to the address in the **ADDRESSES** section of this preamble between 7:30 a.m. and 4 p.m., Monday through Friday, except Federal holidays.

We will consider all comments we receive on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay. We may change these special conditions in light of the comments we receive.

If you want the FAA to acknowledge receipt of your comments on these special conditions, include with your comments a pre-addressed, stamped postcard on which the docket number appears. We will stamp the date on the postcard and mail it back to you.

#### Background

On July 26, 2004, Boeing Commercial Airplanes, P.O. Box 3707, Seattle, Washington 98124, applied for a type certificate design change to install single-occupant side-facing seats equipped with inflatable lapbelts in Boeing Model 777 series airplanes. The Model 777 series airplane is a swept-wing, conventional-tail, twin-engine, turbofan-powered transport category airplane.

#### Type Certification Basis

Under the provisions of 14 CFR 21.101, Boeing Commercial Airplanes must show that the Model 777 series airplanes, as changed, continue to meet the applicable provisions of the regulations incorporated by reference in Type Certificate No. T00001SE 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. T00001SE are as follows: 14 CFR part 25, Amendments 25-1 through 25-82 for the Model 777-200 and Amendments 25-1 through 25-86 with exceptions for the Model 777-300. The U.S. type certification basis for the Model 777 is established in accordance with §§ 21.29 and 21.17 and the type certification application date. The U.S. type certification basis is listed in Type Certificate Data Sheet No. T00001SE.

If the Administrator finds that the applicable airworthiness regulations (i.e., part 25 as amended) do not contain adequate or appropriate safety standards for Boeing Model 777 series airplanes because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

In addition to the applicable airworthiness regulations and special conditions, the Boeing Model 777 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.

Special conditions, as appropriate, are issued in accordance with 14 CFR 11.19 after public notice, as required by § 11.38, and become part of the type certification basis in accordance with § 21.101(b)(2).

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 under the provisions of § 21.101(a)(1).

#### Novel or Unusual Design Features

The Boeing Model 777 offers interior arrangements which include single-occupant side-facing seat installations. These arrangements include a unique "pod" style of side-facing seats that use inflatable lapbelts instead of standard belts for occupant restraint. Side-facing seats are considered a novel design for transport category airplanes that include Amendment 25–64 in the certification basis, and were not considered when those airworthiness standards were established.

The existing regulations do not provide adequate or appropriate safety standards for occupants of side-facing seats. In order to provide a level of safety that is equivalent to that afforded occupants of forward- and aft-facing seats, additional airworthiness standards, in the form of special conditions, are necessary. These special conditions supplement part 25 and, more specifically, supplement §§ 25.562 and 25.785. The requirements contained in these special conditions consist of both test conditions and injury pass/fail criteria.

#### Discussion

Section 25.785(b), "Seats, berths, safety belts, and harnesses," requires that "each seat \* \* \* at each station designated as occupiable during takeoff and landing must be designed so that a person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of the inertia forces specified in §§ 25.561 and 25.562." Additionally, § 25.562, "Emergency landing dynamic conditions," requires dynamic testing of all seats occupied during takeoff and landing. The relative forces and injury mechanisms affecting the occupants of side-facing seats during an emergency landing are different from those of standard forward- or aft-facing seats, or seats equipped with conventional restraint systems.

*Side-facing Seats:* Amendment 25–64, which adopted § 25.562, enhances occupant protection during emergency landing conditions. Although the rule

was written with forward- and aft-facing seats in mind, the orientation of the seat does not change the relevant test conditions, and the rule applies to all seats regardless of orientation.

The dynamic test conditions included in § 25.562 are directly applicable to side-facing seats. However, for injury pass/fail criteria, the orientation of the seat may be significant. For forward-, aft-, and side-facing seats the injury criteria are currently limited to head, spine, and femur loads. The head and lumbar loads are critical but the femur load is not critical. For a side-facing seat, additional injury parameters may be identified and evaluation of those parameters would be necessary to provide an acceptable level of safety.

When evaluating side-facing seats the following should be taken into consideration:

1. The isolation of one occupant from another. Occupants should not rely on impact with other occupants to provide energy absorption; body-to-body impacts are unacceptable.
2. The restraint system and the retention of occupants in the seat. Addressing this concern may necessitate providing a means of restraint for the lower limbs as well as the torso. Failure to limit the forward (in the airplane's coordinate system) travel of the lower limbs may cause the occupant to come out of the restraint system or produce severe injuries due to the resulting position of the restraint system and/or twisting (torsional load) of the lower lumbar spinal column.
3. The load limit in the torso in the lateral direction. Human tolerance for side-facing seats differs from that for forward- or aft-facing seats.

The automotive industry has developed test procedures and occupant injury criteria appropriate for side impact conditions. The criteria includes limiting lateral pelvic accelerations and using the "Thoracic Trauma Index," which is defined in 49 CFR 571.214. Use of the Side Impact Dummy (SID) identified in 49 CFR part 572, subpart F, rather than the Hybrid II dummy identified in 49 CFR part 572, subpart B, is required to evaluate these parameters. The Hybrid II dummy is used in the current § 25.562 test. Testing with a SID is the best means available to assess the injury potential of a sideward impact condition. Such an evaluation is considered necessary to provide an acceptable level of safety for side-facing seats.

The side-facing seat special conditions have been determined to result in a level of safety equivalent to that provided by the injury pass/fail

criteria in § 25.562 for forward- or aft-facing seats.

*Inflatable Lapbelts:* From the standpoint of a passenger safety system, the inflatable lapbelt is unique because it is both an active and entirely autonomous device. While the automotive industry has good experience with airbags, which are similar to inflatable lapbelts, the conditions of use and reliance on the inflatable lapbelt as the sole means of injury protection in an airplane are quite different. In automobile installations, the airbag is a supplemental system that works in conjunction with an upper torso restraint. In addition, an automobile crash is more definable and is typically shorter in duration, which can simplify the activation logic of the airbag. The airplane operating environment is also quite different from automobiles and includes the potential for greater wear and tear and unanticipated abuse conditions (due to galley loading, passenger baggage, etc.). Airplanes also operate where exposure to high intensity electromagnetic fields could affect the inflatable lapbelt activation system.

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

#### Applicability

As discussed above, these special conditions are applicable to the Boeing Model 777. Should the Boeing Company 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 under the provisions of § 21.101.

#### Conclusion

This action affects only certain novel or unusual design features on the Boeing Model 777 airplane. It is not a rule of general applicability, and it affects only the applicant who applied to the FAA for approval of these features on the airplane.

Under standard practice, the effective date of final special conditions would be 30 days after the date of publication in the **Federal Register**; however, as the certification date for the Boeing Model 777 series airplanes is imminent, the

FAA finds that good cause exists to make these special conditions effective upon issuance.

#### 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 the Boeing Model 777 airplane.

In addition to the airworthiness standards of §§ 25.562 and 25.785, the minimum acceptable standards for dynamic certification of Boeing Model 777 single-occupant side-facing seats are as follows:

#### Additional Injury Criteria

(a) *Existing Criteria:* All injury protection criteria of § 25.562(c)(1) through (c)(6) apply to the occupant of a side-facing seat. Head Injury Criterion (HIC) assessments are only required for head contact with the seat and/or adjacent structures.

(b) *Body-to-Wall/Furnishing Contact:* Under the load condition defined in § 25.562(b)(2), the seat must be installed immediately aft of a structure such as an interior wall or furnishing that will support the pelvis, upper arm, chest, and head of an occupant seated next to the structure. A conservative representation of the structure and its stiffness must be included in the tests. It is recommended, but not required, that the contact surface of this structure be covered with at least two inches of energy absorbing protective padding (foam or equivalent), such as Ensolute.

(c) *Thoracic Trauma:* Under the load condition defined in § 25.562(b)(2), Thoracic Trauma Index (TTI) injury criterion must be substantiated by dynamic test or by rational analysis based on previous test(s) of a similar seat installation. Testing must be conducted with a Side Impact Dummy (SID), as defined by Title 49 Code of Federal Regulations (CFR) part 572, Subpart F, or its equivalent. The TTI must be less than 85, as defined in 49 CFR part 572, Subpart F. The SID TTI data must be processed as defined in Federal Motor Vehicle Safety Standard (FMVSS) part 571.214, section S6.13.5.

(d) *Pelvis:* Under the load condition defined in § 25.562(b)(2), pelvic lateral acceleration must be shown by dynamic test or by rational analysis based on

previous test(s) of a similar seat installation to not exceed 130g. Pelvic acceleration data must be processed as defined in FMVSS part 571.214, section S6.13.5.

(e) *Shoulder Strap Loads:* Where upper torso straps (shoulder straps) are used for occupants, tension loads in individual straps must not exceed 1,750 pounds. If dual straps are used for restraining the upper torso, the total strap tension loads must not exceed 2,000 pounds.

(f) *Neck Injury Criteria:* The seating system must protect the occupant from experiencing serious neck injury.

#### Inflatable Lapbelt Conditions

(a) If inflatable lapbelts are used as the means of occupant restraint on single place side-facing seats, the requirements of existing Special Conditions 25-04-03-SC (1-14), "Boeing Model 777 Series Airplanes; Seats with Inflatable Lapbelts" are incorporated by reference except for special conditions 1 and 3, which are replaced by (b) and (c) below.

(b) 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, neck, thoracic, and pelvic lateral acceleration injury from body-to-wall/furnishing contact. The means of protection must take into consideration a range of stature from two-year-old child to ninety-fifth percentile male. The inflatable lapbelt must provide a consistent approach to energy absorption throughout the range. In addition, the following situations must be considered:

1. The seat occupant is holding an infant.
2. The seat occupant is a child in a child restraint device.
3. The seat occupant is a child not using a child restraint device.
4. The seat occupant is a pregnant woman.

(c) 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 injury protection.

**Note:** The existing means of controlling HIC, TTI and pelvic lateral acceleration result in a progressive reduction of injury severity for impact conditions less than the maximum specified by the requirements. However, airbag technology involves a step change in protection for impacts below and above that at which the airbag deploys. This could result in one or more of the injury criteria

being higher at an intermediate impact condition than that resulting from the maximum. The step change in injury protection is acceptable, provided that the injury criteria values for any intermediate impact (whether or not the inflatable lapbelt delays) do not exceed the maximum allowed by the requirements.

#### Additional Test Requirements

(a) One longitudinal test with the SID Anthropomorphic Test Dummy (ATD), undeformed floor, no yaw, and with all lateral structural supports (armrests/walls).

Pass/fail injury assessments: The TTI and pelvic acceleration.

(b) One longitudinal test with the Hybrid II ATD, deformed floor, with 10 degrees yaw, and with all lateral structural supports (armrests/walls).

Pass/fail injury assessments: The HIC; upper torso restraint load, restraint system retention, and pelvic acceleration.

(c) Vertical (14 G's) test is to be conducted with modified Hybrid II ATDs with existing pass/fail criteria.

**Note:** It must be demonstrated that seats installed on plinths or pallets meet all applicable requirements. Compliance with the guidance contained in FAA Policy Memorandum PS-ANM-100-2000-00123, dated February 2, 2000, titled "Guidance for Demonstrating Compliance with Seat Dynamic Testing for Plinths and Pallets" will be acceptable to the FAA.

Issued in Renton, Washington, on August 9, 2005.

**Ali Bahrami,**

Manager, Transport Airplane Directorate, Aircraft Certification Service.

[FR Doc. 05-16745 Filed 8-22-05; 8:45 am]

BILLING CODE 4910-13-P

## DEPARTMENT OF TRANSPORTATION

### Federal Aviation Administration

#### 14 CFR Part 25

[Docket No. NM307; Special Conditions No. 25-296-SC]

**Special Conditions: Embraer Model ERJ 190 Series Airplanes; Sudden Engine Stoppage, Interaction of Systems and Structures, Operation Without Normal Electrical Power, Electronic Flight Control Systems, Automatic Takeoff Thrust Control System (ATTCS), and Protection From Effects of High Intensity Radiated Fields (HIRF)**

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

**ACTION:** Final special conditions.