

Confined Space Hazard Markings

Introduction of the FRS will result in NEA within the fuel tanks and the possibility of NEA in compartments adjacent to the fuel tanks if leakage from the tank or NEA supply lines were to occur. Lack of oxygen in these areas could be hazardous to maintenance personnel, the passengers, or flightcrew. These proposed special conditions introduce requirements to address this issue.

Affect of FRS on Auxiliary Fuel Tank System Supplemental Type Certificates

Boeing plans to offer a service bulletin that will install the FRS on existing in-service airplanes. Some in-service airplanes have auxiliary fuel tank systems installed that interface with the center wing tank. The Boeing FRS design is intended to provide inerting of the fuel tank volume of the 747 and does not include consideration of the auxiliary tank installations. Installation of the FRS on existing airplanes with auxiliary fuel tank systems may therefore require additional modifications to the auxiliary fuel tank system to prevent development of a condition that may cause the tank to exceed the 12 percent oxygen limit. The FAA will address these issues during development and approval of the service bulletin for the FRS.

Disposal of Oxygen-Enriched Air

The FRS produces both nitrogen-enriched air (NEA) and oxygen-enriched air (OEA). The OEA generated by the FRS could result in a fire hazard if not disposed of properly. The OEA produced in the proposed design is diluted with air from a heat exchanger, which is intended to reduce the OEA concentration to non-hazardous levels. Special requirements are included in these proposed special conditions to address potential leakage of OEA due to failures and safe disposal of the OEA during normal operation.

To ensure that an acceptable level of safety is achieved for the modified airplanes using a system that inertes heated fuel tanks with nitrogen-enriched air, special conditions (per § 21.16) are needed to address the unusual design features of a flammability reduction system. These proposed 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 proposed special conditions are applicable to the

Boeing Model 747-100/200B/200F/200C/SR/SP/100B SUD/400/400D/400F series airplanes. Should the type certificate be amended later to include any other model that incorporates the same or similar novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same or similar novel or unusual design feature, the special conditions would also apply to the other model under the provisions of § 21.101.

Conclusion

This action affects only certain novel or unusual design features on Boeing Model 747-100/200B/200F/200C/SR/SP/100B SUD/400/400D/400F series airplanes. It is not a rule of general applicability and affects only the applicant who applied to the FAA for approval of these features on the airplane.

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 Proposed Special Conditions

Accordingly, the Federal Aviation Administration (FAA) proposes the following special conditions as part of the type certification basis for Boeing Model 747-100/200B/200F/200C/SR/SP/100B SUD/400/400D/400F series airplanes, modified by Boeing Commercial Airplanes, to include a flammability reduction system (FRS) that uses a nitrogen generation system to inert the center wing tank with nitrogen-enriched air (NEA).

Compliance with these proposed special conditions does not relieve the applicant from compliance with the existing certification requirements.

I. Definitions.

(a) *Flammable*. With respect to a fluid or gas, flammable means susceptible to igniting readily or to exploding (14 CFR part 1, Definitions). A non-flammable ullage is one where the gas mixture is too lean or too rich to burn and/or is inert per the definition below. For the purposes of these special conditions, a fuel tank is considered flammable when the bulk fuel temperature within any compartment of the tank is within the flammable range for the fuel type being used.

(b) *Flash Point*. The flash point of a flammable fluid is defined as the lowest temperature at which the application of a flame to a heated sample causes the

vapor to ignite momentarily, or "flash." The test for jet fuel is defined in the ASTM specification, D56, "Standard Test Method for Flash Point by Tag Close Cup Tester."

(c) *Ignition Energy*. The minimum amount of energy required to ignite fuel vapors. The inert oxygen concentration levels, described below in the definition for inert, were established using approximately a 0.5 Joule spark.

(d) *Inert*. For the purpose of these special conditions, the tank is considered inert when the bulk oxygen concentration within each compartment of the tank is 12 percent or less at sea level up to 10,000 feet, then linearly increasing from 12 percent at 10,000 feet to 14.5 percent at 40,000 feet.

(e) *Inerting*. A process where a noncombustible gas is introduced into the ullage of a fuel tank so that the ullage becomes inert.

(f) *Monte Carlo Analysis*. An analytical tool that provides a means to assess the degree of flammability exposure time for a fuel tank. See Appendices 1 and 2 of these special conditions for specific requirements for conducting the Monte Carlo analysis.

(g) *Operational Time*. For the purpose of these special conditions, the time from the start of preparing the airplane for flight (that is, starting and connecting the auxiliary or ground power unit to the aircraft electrical system) through securing all power sources following flight termination.

(h) *Ullage, or Ullage Space*. The volume within the tank not occupied by liquid fuel at the time interval under evaluation.

(i) *Hazardous atmosphere*: An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a space), injury, or acute illness.

II. System Performance and Reliability

The FRS, for the airplane model under evaluation, must comply with the performance and reliability requirements as follows:

(a) The applicant must submit a Monte Carlo analysis, as defined in Appendices 1 and 2 of these special conditions that—

(1) Demonstrates that the overall fleet flammability exposure of each fuel tank with an FRS installed is equal to or less than 3 percent of operational time; and

(2) Demonstrates that neither the performance (when the FRS is operational) nor reliability (including all periods when the FRS is inoperative) contributions to the 3 percent overall fleet flammability exposure of a tank with an FRS installed are more than 1.8