

Appendix B: Boeing 787 Type Certification Special Conditions 25-359-SC

The FAA issued the following nine special conditions, in place of the electrical equipment and installation requirements of 14 *Code of Federal Regulations* (CFR) 25.1353(c)(1) through (c)(4), for the design and installation of lithium-ion batteries as part of the type certification basis for the Boeing 787-8:

- (1) Safe cell temperatures and pressures must be maintained during any foreseeable charging or discharging condition and during any failure of the charging or battery monitoring system not shown to be extremely remote. The lithium-ion battery installation must preclude explosion in the event of those failures.
- (2) Design of the lithium-ion batteries must preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.
- (3) No explosive or toxic gases emitted by any lithium-ion battery in normal operation, or as the result of any failure of the battery charging system, monitoring system, or battery installation not shown to be extremely remote, may accumulate in hazardous quantities within the airplane.
- (4) Installations of lithium-ion batteries must meet the requirements of 14 CFR 25.863(a) through (d).
- (5) No corrosive fluids or gases that may escape from any lithium-ion battery may damage surrounding structure or any adjacent systems, equipment, or electrical wiring of the airplane in such a way as to cause a major or more severe failure condition, in accordance with 14 CFR 25.1309(b) and applicable regulatory guidance.
- (6) Each lithium-ion battery installation must have provisions to prevent any hazardous effect on structure or essential systems caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.
- (7) Lithium-ion battery installations must have a system to control the charging rate of the battery automatically, so as to prevent battery overheating or overcharging, and,
 - (i) A battery temperature sensing and over-temperature warning system with a means for automatically disconnecting the battery from its charging source in the event of an over-temperature condition, or,

(ii) A battery failure sensing and warning system with a means for automatically disconnecting the battery from its charging source in the event of battery failure.

(8) Any lithium-ion battery installation whose function is required for safe operation of the airplane must incorporate a monitoring and warning feature that will provide an indication to the appropriate flight crewmembers whenever the state-of-charge of the batteries has fallen below levels considered acceptable for dispatch of the airplane.

(9) The Instructions for Continued Airworthiness required by 14 CFR 25.1529 must contain maintenance requirements for measurements of battery capacity at appropriate intervals to ensure that batteries whose function is required for safe operation of the airplane will perform their intended function as long as the battery is installed in the airplane. The Instructions for Continued Airworthiness must also contain procedures for the maintenance of lithium-ion batteries in spares storage to prevent the replacement of batteries whose function is required for safe operation of the airplane with batteries that have experienced degraded charge retention ability or other damage due to prolonged storage at a low state of charge.

The FAA noted that these special conditions were “not intended to replace 14 CFR 25.1353(c) in the certification basis of the Boeing 787-8 airplane” and that the special conditions applied “only to lithium-ion batteries and their installations.” The FAA also noted that the requirements of 14 CFR 25.1353(c) remained in effect “for batteries and battery installations of the Boeing 787-8 airplane that do not use lithium-ion batteries.”