

## **JAR 25.1309 Equipment, systems and installations**

(a) The equipment, systems, and installations whose functioning is required by the JAR and national operating regulations must be designed to ensure that they perform their intended functions under any foreseeable operating conditions. (See ACJ's Nos. 1 and 2 to JAR 25.1309.) However, systems used for non-essential services need only comply so far as is necessary to ensure that the installations are neither a source of danger in themselves nor liable to prejudice the proper functioning of any essential service.

(b) The aeroplane systems and associated components, considered separately and in relation to other systems, must be designed so that (see ACJ's Nos. 1 and 3 to JAR 25.1309) —

(1) The occurrence of any failure condition [ which would prevent the continued safe flight and] landing of the aeroplane is extremely improbable, and

(2) The occurrence of any other failure condition which would reduce the capability of the aeroplane or the ability of the crew to cope with adverse operating conditions is improbable.

(c) Warning information must be provided to alert the crew to unsafe system operating conditions, and to enable them to take appropriate corrective action. Systems, controls, and associated monitoring and warning means must be designed to minimise crew errors which could create additional hazards. (See ACJ's Nos. 1,4 and 8 to JAR 25.1309.)

(d) Compliance with the requirements of subparagraph (b) of this paragraph must be shown by analysis, and where necessary, by appropriate ground, flight, or simulator tests. The analysis must consider (see ACJ No. 1 to JAR 25.1309)—

(1) Possible modes of failure, including malfunctions and damage from external sources.

(2) The probability of multiple failures and undetected failures.

(3) The resulting effects on the aeroplane and occupants, considering the stage of flight and operating conditions, and

(4) The crew warning cues, corrective action required, and the capability of detecting faults.

(e) Each installation whose functioning is required for certification and that requires a power supply, is an 'essential load' on the power supply. The power sources and the system must be able to supply the following power loads in probable operating

combinations and for probable durations (see ACJ's Nos. 5 and 6 to JAR 25.1309);

(1) Loads connected to the system with the system functioning normally.

(2) Essential loads, after failure of any one prime mover, power converter, or energy storage device.

(3) Essential loads after failure of —

(i) Any one engine on two-engined aeroplanes; and

(ii) Any two engines on three-or-more engined aeroplanes.

After the failure of any two engines on a three-engined aeroplane, those services essential to airworthiness must continue to function and perform adequately within the limits of operation implied by the emergency conditions. (See ACJ No. 7 to JAR 25.1309.)

(4) Essential loads for which an alternate source of power is required by any applicable JAR or national operating regulations, after any failure or malfunction in any one power supply system, distribution system, or other utilisation system.

(f) In determining compliance with sub-paragraphs (e) (2) and (3) of this paragraph, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operation authorised. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on aeroplanes with three or more engines.

(g) In showing compliance with sub-paragraphs (a) and (b) of this paragraph with regard to system and equipment design and installation, critical environmental conditions including vibration and acceleration loads, handling by personnel and where appropriate fluid pressure effects, must be considered. For power generation, distribution and utilisation equipment required by or used for certification, the ability to provide continuous safe service under foreseeable environmental conditions may be shown by environmental tests, design analysis or reference to previous comparable service experience on other aeroplanes.