

IAI Bedek's Freighter Conversions Smoke Detection Systems

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Abstract

Israel Aerospace Industries (IAI) Bedek Aviation Group holds Supplemental Type Certificates (STCs) for the following special freighter conversions: B747-100BDSF, -200BDSF, -400BDSF, B737-300BDSF, -400BDSF and B767-200BDSF, -300BDSF.

As a part of the conversion and to comply with the latest FAR/CS 25.858(a) requirements of smoke detection, the "one-minute" rule, Bedek Aviation in collaboration with Siemens SAS (France) - Siemens CoC for Airborne Systems, developed unique state-of-the-art 2-Line Replaceable Units (LRUs) smoke detection systems, single and dual loop logic (with automatic reconfiguration to single loop), based on "ducted" or "ambient" Multi-Criteria, FAA TSO C1d smoke detectors, with CAN Bus (Controller Area Network) communication technology. The smoke detection systems have a discrimination capability to enable rejection of false alarm sources such as fog, condensation, dust and insecticides. The systems were developed following the guidelines of aviation industry standards, including RTCA DO-160E, DO-178B, DO-254, SAE ARP 4754 and SAE ARP 4761.

The smoke detection systems are integrated into the existing aircraft systems to provide the standard fire alerts and fault indications via the fire warning master caution and annunciation. The smoke detection systems contain Built-In Test Equipment (BITE) capabilities.

Considering the probability of a fire event to be less than $1.7E-07$ per flight-hour, the fire protection systems reliability and compliance with safety requirements of FAR/CS 25.1309 were demonstrated. Flight continuation in the event of a system fault due to the very low probability of system fault is approved (total loss of smoke detection in combination with a fire is less than $1.0E-09$ per flight-hour).

In-flight tests showed that smoke is detected after 30 to 35 seconds. If a fire occurs, the flight crew starts the fire emergency procedures. The main deck cargo compartment ventilation is shut down and the aircraft is depressurized to suppress the fire. Halon is discharged to extinguish fire in the lower compartments.

Smoke penetration tests were performed to show compliance with FAR/CS 25.858(a) by filling the main deck cargo compartment with smoke per FAA AC25-9A guidelines. No in-flight smoke penetrations to the occupied areas (flight deck and supernumerary area) were observed. Tests were repeated for the lower compartments.

No inadvertent smoke warning was observed, in compliance with FAR/CS 25.855(i).

Master Minimum Equipment Lists (MMELs) were certified to operate even in faulty conditions and to dispatch in case of smoke detector(s) or power failures.