Federal Aviation Administration

Memorandum

Date: June 16, 2014

To: Manager, Transport Standards Staff, International Branch, ANM-116

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Stephen Happenny, ANM-112

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Pneumatic Systems – Harmonized 25.1438 on an Airbus Model A350-900 airplane (FAA Project Number TC0544IB-T)

ELOS Memo #: TC0544IB-T-ES-10

Reg. Ref.: § 25.1438

This memorandum informs the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate (TAD) on the establishment of an equivalent level of safety (ELOS) finding for the Airbus Model A350-900 airplane.

Background

Airbus has requested to adopt section 25.1438 for pressurization and pneumatic systems as proposed by the Mechanical Systems Harmonization Working Group (MSHWG) to the Aviation Rulemaking Advisory Committee (ARAC) rather than comply with Title 14, Code of Federal Regulations (14 CFR) section 25.1438. The MSHWG group has provided a report to the ARAC committee, which proposes a new pneumatic and pressurisation harmonized rule. This report has been approved by the ARAC and was sent to the FAA via letter on December 20, 1999. It is currently under review by FAA and European Aviation Safety Agency (EASA) to support the publication of an EASA NPA and a FAR NPRM.

FAA believes that compliance to the proposed regulation demonstrates an improved level of safety; however, since the proposed means of compliance does not meet these requirements in the literal sense, an ELOS finding is needed.

Applicable regulations

§ 25.1438

Regulation requiring an ELOS finding

§ 25.1438

Description of compensating design features or alternative standards which allow the granting of the ELOS finding (including design changes, limitations or equipment need for equivalency)

The alternative standards that provide an ELOS to the regulations not complied with are as follows:

25.1438 Pneumatic Systems

(a) This requirement applies to pneumatic systems and elements (components and ducting) served by gas storage devices such as, evacuation, water systems, accumulators and/or pressurized gas from compressors such as engine and APU bleed air, air conditioning, pressurization, engine starting, ice protection, and pneumatic actuation systems. Design compliance may be in the form of analysis, test, or combination of analysis and test. All foreseen normal and failure mode combinations of environmental loads (installation, thermal, vibration, and aerodynamic), pressures, temperatures, material properties, and dimensional tolerances must be considered. This requirement is not applicable to portable gas storage devices.

(b) Each element of the system must be designed to operate without detrimental permanent deformation or increase in design leakage that would prevent the element from performing its intended function. For demonstrating compliance, the following factors are to be applied to the pressure at the associated temperature for the most critical of the following conditions. The pressure must be applied long enough to ensure complete expansion of the test element. After being subjected to the above conditions and on normal operating conditions being restored, the element should operate as designed.
   1) 1.5 times maximum normal operating pressure
   2) 1.33 times the failure pressure occurring in the probability range between 10E-03 to 10E-05 failures per flight hour
   3) 1.0 times the failure pressure occurring in the probability range between 10E-05 and 10E-07 failures per flight hour
   4) 1.0 times the maximum normal operating pressure in combination with the limit structural loads.

(c) Each element of the system must be designed to operate without rupture or increase in design leakage, that is likely to endanger the airplane or its occupants. For demonstrating compliance, the following factors are to be applied to the pressure at the associated temperature for the most critical of the following conditions. The pressure must be applied

long enough to ensure complete expansion of the test element. After being subjected to the above conditions and on normal operating conditions being restored, the element need not operate normally.

1) 3.0 times maximum normal operating pressure. Except for pressurization system elements which shall use a factor of 2.0 time maximum normal operating pressure
2) 2.66 times the failure pressure occurring in the probability range between 10E-03 to 10E-05 failures per flight hour
3) 1.5 times the failure pressure occurring in the probability range between 10E-05 to 10E-07 failures/flight hour is applicable to components. Except for ducting which shall use a factor of 2.0 times the failure pressure occurring in the probability range between 10E-05 to 10E-07 failures per flight hour
4) 1.0 times the failure pressure occurring in the probability range 10E-07 and 10E-09 failures per flight hour
5) 1.5 times the maximum normal operating pressure in combination with the 1.0 times the ultimate structural loads.

(d) If the failure of an element can result in a hazardous condition, it must be designed to withstand the fatigue effects of all cyclic pressures, including transients, and associated externally induced loads and perform as intended for the design life of the element under all environmental conditions for which the airplane is certified.

(e) In addition, each gas storage device installed on an airplane must meet the requirement of this rule and not cause hazardous effects by exploding.

Explanation of how design features or alternative standards provide an ELOS to that intended by the regulation

FAA considers that the proposed new paragraph 25.1438, as proposed by the MSHWG to the ARAC, provides an improvement in the level of safety. The current version of § 25.1438 does not require the applicant to demonstrate compliance to the rules using the worst possible combination of temperature and pressure. In addition, the current version of § 25.1438 does not require the applicant to consider stress loads on pneumatic system components from pressure and temperature changes in combination with vibration and external loads. System failure conditions and requirements to address fatigue, material properties, and gas storage device requirements have been incorporated into the proposed regulation. Thus, compliance to the proposed regulation will afford an improved level of safety and an ELOS relative to the current version of § 25.1438. The proposed rule provides an improved level of safety without affecting the current industry practice. In addition, the harmonized § 25.1438 combines the requirements of § 25.1438, EASA certification specifications (CS) 25.1438 and 25.1436 into one harmonized rule and eliminates the need for CS 25.1436 and the EASA acceptable means of compliance (AMC) 25.1438.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in the Model A350-900 issue paper ES-10, titled “Pneumatic Systems – Harmonized 25.1438.” In addition, because the issue paper

follows the corresponding EASA certification review item (CRI) F-33, the FAA has accepted this CRI as the basis for a finding of an ELOS.

This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The TAD has assigned a unique ELOS memorandum number (see front page) to facilitate archiving and retrieval of this ELOS finding. This ELOS memorandum number should be listed in the type certificate data sheet under the Certification Basis section in accordance with the statement below:

An ELOS Finding has been made for the following regulation:
§ 25.1438, Pressurization and pneumatic systems. (documented in ELOS Memo TC0544IB-T-ES-10)

Original signed by
Victor Wicklund June 16, 2014

Transport Airplane Directorate Date
Aircraft Certification Service

ELOS Originated by: International Branch	Project Engineer: Stephen Happenny	Routing Symbol: ANM-112