



# Federal Aviation Administration

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## Memorandum

Date: November 23, 2015

To: Manager, Boeing Aviation Safety Oversight Office, ANM-100B

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Jim Voytilla, ANM-100B

Subject: INFORMATION: Equivalent Level of Safety Finding for Auxiliary Power System on Boeing Model 787-8/-9/-10 (Project Nos. TC6918SE-T, PS06-0496, PS06-0497, PS13-0546 and PS14-1031)

Memo No.: TC6918SE-T-P-19

Reg. Ref.: §§ 25.1023(b) and 25.1121(c)

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The purpose of this memorandum is to inform 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 Model 787-8 airplane.

This memo was subsequently revised to extend this ELOS to the Boeing Model 787-9 and 787-10 airplanes.

### Background

The Boeing Model 787 auxiliary power system (APS; commonly referred to as auxiliary power unit or APU) uses an eductor-type oil cooler that is mounted onto the exhaust duct to provide cooling of the APS oil by drawing APS compartment air across a heat exchanger. Title 14, Code of Federal Regulations (14 CFR) 25.1023 requires, in part, that each oil radiator air duct must be located so that, in case of fire, flames coming from normal openings of the engine nacelle cannot impinge directly upon the radiator. As it applies to the 787 APU installation, normal openings in the eductor design could allow an APU compartment fire to impinge directly upon the radiator. Section 25.1121 requires, in part, that exhaust system components and other hardware subject to high temperature from the exhaust system must be fireproof. This is generally accomplished by using materials that have been defined in Part 1 as inherently fireproof, such as steel. Rather than show the APS (Auxiliary Power System) aluminum oil cooler is fire-proof as required per §§ 25.1023(b) and 25.1121(c), Boeing has proposed to conduct an alternate fire test of the

aluminum oil cooler installation to demonstrate that it will not fail or create a hazardous condition when exposed to an APS compartment fire.

**Applicable regulation(s)**

§§ 21.21(b)(1), 25.1023(b), and 25.1121(c)

**Regulation(s) requiring an ELOS**

§§ 25.1023(b) and 25.1121(c)

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

The Boeing Model 787 auxiliary power system uses an eductor-type oil cooler that is mounted onto the exhaust duct to provide cooling of the APS oil by drawing APS compartment air across a heat exchanger by means of air entrainment by the exhaust flow. Because the oil cooler material is aluminum, the 787 oil cooler installation is provisioned with a fireproof shield that prevents direct impingement of fire from below. In addition, the 787 APS has automatic shutdown features that would activate upon an oil temperature exceedence or detection of an APS compartment fire.

**Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation**

The proposed certification fire testing would require the flame source per Advisory Circular (AC) 20-135 to impinge directly upon the oil cooler face during the first five minutes of the test with oil flowing through the oil cooler, and with the flame source impinging from below on the oil cooler flame shield during the following 10 minutes without oil flow through the oil cooler. This testing is expected to replicate the worst-case in service anticipated fire conditions. The APS system has an automatic shutdown feature where the shut down occurs following the detection of the fire or due to reaching the maximum oil temperature limit, whichever occurs first. In addition, the APS design prevents flow of oil to the oil cooler following an APS shutdown to preclude leakage of hazardous quantities of oil. Hence, if Boeing acceptably demonstrates that the APS oil cooler installation complies with the proposed fire tests, the installation will demonstrate an equivalent level of safety to direct compliance with the referenced regulations.

**FAA approval and documentation of the ELOS**

The FAA has approved the aforementioned Equivalent Level of Safety Finding in project Issue Paper P-19 or Administrative Collector Issue Paper G-6. This memorandum provides standardized documentation of the ELOS finding that is nonproprietary 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. This ELOS memorandum number must be listed in the type certificate data sheet under the certification basis section.

Equivalent Safety Findings have been made for the following regulation(s):  
14 CFR 1023(b) and 25.1121(c) (documented in TAD ELOS Memo TC6918SE-T-P-19).



Transport Airplane Directorate,  
Aircraft Certification Service

12/3/2015

Date

ELOS Originated by ACO:	Tom Thorson	ANM-140S
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