

Consultation paper
Equivalent Safety Finding

Doc. No. : CPTS-0000371

Issue : 1

Date : 11 March 2024

Proposed ☒ Final ☐

Deadline for comments: 01 APR 2024

SUBJECT : Auxiliary power unit air inlet system fire compliance

REQUIREMENTS incl. Amdt. : CS 25J1103(b)(2) at Amdt. 28¹

ASSOCIATED IM/MoC : Yes ☐ / No ☒

ADVISORY MATERIAL :

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¹ This ESF may be applied to the listed certification specifications at the amendment or JAR 25 change used for the original type certification basis of the basic aircraft as defined in the relevant EASA TCDS.

INTRODUCTORY NOTE:

The following Equivalent Safety Finding (ESF) has been classified as important and as such is subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

NOTE: This equivalent safety finding has been developed by the Federal Aviation Administration and the applicant under the form of an Equivalent Level of Safety as per the US framework. EASA considers the approach depicted in the FAA paper acceptable and has incorporated the material into this consultation paper to comply with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.).

ABBREVIATIONS:

APU	Auxiliary Power Unit
APUC	APU Controller
T2	(APU) air inlet temperature
P2	(APU) air inlet pressure

IDENTIFICATION OF ISSUE:


EASA received a request for an equivalent safety finding (ESF) with CS 25J1103(b)(2) at Amdt. 23 (the amendment of the applicable certification basis for the associated certification project) for some components of the auxiliary power unit (APU) air inlet system.

Compliance with this Certification Specification requires that ducts for auxiliary power units must be *"fireproof within the APU compartment and for a sufficient distance upstream of the APU compartment to prevent hot gases reverse flow from burning through the APU air intake system ducts and entering any other compartment or area of the aeroplane in which a hazard would be created resulting from the entry of hot gases. [...]"*

The application received by EASA foresees components in the APU air inlet system that will not be demonstrated to be fireproof.

These components include the forward and aft barrel seals, the load compressor interface, the aircraft inlet to plenum interface seal, the speed sensors, the air inlet temperature (T2) sensor penetration, the air inlet pressure (P2) tube penetration, and the drain fitting.


These elements of the APU air inlet system do not directly comply with CS 25J1103(b)(2).

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The applicant proposed a set of compensating factors intended to provide an equivalent level of safety with that required by CS 25J1103(b)(2).

Considering all the above, the following Equivalent Safety Finding is proposed.



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M-TS-0000371

Equivalent Safety Finding

Auxiliary power unit air inlet system fire compliance

1. APPLICABILITY

This ESF is applicable to CS 25 Large Aeroplanes with Auxiliary Power Unit (APU) installed.

1.1 AFFECTED CS

CS 25J1103(b)(2) at Amendment 28.

2. STATEMENT OF EQUIVALENT SAFETY FINDING

In lieu of direct compliance with the CS identified in chapter 1.1, and provided that the below compensating factors are complied with, the APU air inlet system ducts within the APU compartment and for a sufficient distance upstream of the APU compartment may include components that will not be demonstrated to be fireproof.

3. COMPENSATING FACTORS

- 1) The APU inlet system is contained entirely within the APU fire zone. It does not extend into any other area of the aircraft.
- 2) The APU Controller (APUC) will initiate an automatic shutdown of the APU immediately upon detection of a fire in the compartment through the fire detection system.
- 3) An overheat in the inlet would be detected by multiple sensors with immediate action:
 - a. The APUC includes an automatic protective shutdown for APU air inlet overheat as detected by the air inlet temperature (T2) sensor. The T2 sensor will initiate an APU automatic shutdown if it detects reverse flow or inlet air temperatures greater than 350 degrees F (176.7°C) for 5 seconds. This automatic shutdown is active in both attended and unattended APUC control modes.
 - b. Software display and/or crew procedures will be implemented to not allow APU restart following an inlet overheat detection from the T2 sensor.
 - c. An extreme environmental event in the inlet would drive an Exhaust Gas Temperature (EGT) exceedance. Any fire that would pose a risk to the inlet system could be considered an extreme environmental event. A fire in the inlet would result in hot intake air consumption by the APU Engine. Significant engine temperature exceedance will be detected by the EGT sensors. If this event were to occur, the APU Engine is automatically shutdown in unattended mode and instructs the crew to shutdown in attended mode through a cockpit alert.
- 4) The APU T2 sensor wiring is qualified to be fire resistant.
- 5) The areas of the inlet system that have not been shown to be fireproof will be shown to be fire resistant by test per AC 20-135 or ISO2685 from the inside and outside directions.

