



Federal Aviation Administration

Memorandum

Date: July 8, 2015

To: Manager, Project Support Branch, ACE-112

From: Manager, Small Airplane Directorate, ACE-100

Prepared by: Ruth Hirt, Project Support Branch, ACE-114

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding to
14 CFR 23.1326(b)(1) for the Korea Aerospace Industries Model KC-100 Pitot
Heat Indication Systems

ELOS Memo#: ACE-15-12

Regulatory Ref: 14 CFR 23.1326(b)(1), amendment 23-59

This memorandum informs the certificate management airplane certification office of an evaluation made by the Accountable Directorate on the establishment of an equivalent level of safety finding for the Model KC-100 airplanes.

Background:

Amendment 23-49 added § 23.1326. The section was proposed under Notice of Proposed Rulemaking (NPRM), [Notice No. 94-21](#), issued on 07/14/94. Section 23.1326 published as a final rule in the [Federal Register](#) on 02/9/1996 ([61 FR 5151](#)) and became effective on 03/11/96.

Section 23.1323(d) states:

“If certification for instrument flight rules or flight in icing conditions is requested, each airspeed system must have a heated pitot tube or an equivalent means of preventing malfunction due to icing.”

Furthermore, § 23.1326 introduction paragraph, in pertinent part, states:

“If a flight instrument pitot heating system is installed to meet the requirements specified in §23.1323(d), an indication system must be provided to indicate to the flight crew when that pitot heating system is not operating.”

This rule requires a caution annunciation whenever the pitot heat is off or there is a failed heating circuit in the pitot tube heater. The second annunciation is fully justified in that it represents a failure condition. The first annunciation can have a positive safety effect if it causes pilots to activate the pitot heat in all environmental conditions. This eliminates the loss of the pitot static system because of the pilot error of failing to operate pitot heat when conditions warrant it. AC 23-17C states:

“A caution annunciation when the pitot heat is off has two negative issues as follows:

a. It violates the “dark cockpit” where caution and warning lights only represent failure conditions.

b. Adherence to a “dark cockpit” will cause pitot heat operation in all environmental conditions, which will shorten the life of the system.”

KAI designed the pitot heat for the KC-100 to operate when the Outside Air Temperature (OAT) is at 5°C or below. Korea Aerospace Industries (KAI) installs a pitot heat indication system described in the Statement of Issue, section II of project issue paper S-2, and proposes an ELOS finding to § 23.1326(b)(1).

The capability of the technology in the KC-100 airplane eliminates the continuous amber caution indication by providing an obvious indication that pitot heat is required (when OAT is at 5°C or below). The current requirement necessitates a continuous amber indication that becomes an annoyance during normal VFR or non-icing IFR flight and is in conflict with the “dark cockpit” concept used to enhance pilot awareness and safety. This continuous indication may also desensitize the pilot to additional caution messages that may occur in flight.

ELOS guidance for part 23 certified airplanes is contained in Advisory Circular (AC) 23-17C, Systems and Equipment Guide for Certification of Small Airplanes. AC 23-17C states, *“An airplane design that does not include a caution annunciation when the Pitot heat is Off may be eligible for an ELOS finding that preserves a “dark cockpit” provided a placard or flight manual prescribes when to operate the pitot heat.”* It further clarifies it “may be eligible” as follows:

“1. Commuter category airplanes are not eligible.

2. Airplanes approved for Flight into Known Icing per 14 CFR, part 23, § 23.1419 are not eligible.

3. Airplanes with service ceilings or maximum operating altitudes above 18,000 feet are not eligible because 18,000 feet represents the bottom of controlled airspace. If a plane can fly at or above 18,000 feet, it must be certified for Instrument Flight Rules (IFR) operation.

4. The eligibility of other IFR approved airplanes, including those with the service ceilings below 18,000 feet, is determined jointly by the ACOs and the Small Airplane Standards Office.”

However, AC 23-17C also states, “Airplane that are not eligible for the ELOS described above may be eligible for a different ELOS if their design has compensating features other than placards or AFM limitations.” The compensating features implemented by KAI are an amber caution message “Pitot Heat Required” when OAT falls to 5 °C or below as described above and the primary display shows a master caution indication in the flightcrew’s primary field of vision. The flightcrew must acknowledge the “Pitot Heat Required” caution message. The applicant believes these compensating features justifies an ELOS finding to § 23.1326(b)(1), which preserves a “dark cockpit” presentation of the pitot heat indication system.

The KC-100 is a class I, non-commuter category airplane and not approved for Flight into Known Icing. The KC-100 designed service ceiling is above 18,000 feet.

Applicable regulation:

Section 23.1326, amendment 23-51 states:

“If a flight instrument pitot heating system is installed to meet the requirements specified in §23.1323(d), an indication system must be provided to indicate to the flight crew when that pitot heating system is not operating. The indication system must comply with the following requirements:

(a) The indication provided must incorporate an amber light that is in clear view of a flightcrew member.

(b) The indication provided must be designed to alert the flight crew if either of the following conditions exist:

(1) The pitot heating system is switched “off.”

(2) The pitot heating system is switched “on” and any pitot tube heating element is inoperative.”

Regulations requiring an ELOS finding:

14 CFR 23.1326(b)(1), amendment 23-59

Description of compensating design features or alternative Methods of Compliance (MoC) which allow the granting of the ELOS (including changes, limitations, or equipment needed for equivalency):

The pitot heat indication system designed for the KC-100 airplane performs its functions and alerts the flightcrew as follows:

- When the pitot tube heat switch is placed in the “off” position and the OAT is above 5°C, there is no annunciation.

- An amber annunciation (i.e., “Pitot Heat Required”) will be displayed and acknowledged by the flightcrew if the pitot tube heat switch is in the “off” position and the OAT is at 5°C or below. In addition, the primary display shows a master caution indication in the flightcrew’s primary field of vision.

- A caution annunciation (i.e., “Pitot Heat Inop”) will occur if the pitot tube heat switch is placed in the “on” position and the system is not using power.

Explanation of how design features or alternative Methods of Compliance (MoC) provide an equivalent level of safety intended by the regulation:

The KC-100’s pitot heat indication system does not always alert the flightcrew when the pitot heating system is switched "off" as required by § 23.1326(b)(1). However, an amber annunciation (i.e., “Pitot Heat Required”) will be displayed and acknowledged by the flight crew if the pitot tube heat switch is in the “off” position, and the OAT is at 5°C or below. In addition, the primary display shows a master caution indication in the flightcrew’s primary field of vision.

FAA approval and documentation of the ELOS finding:

The FAA has approved the aforementioned equivalent level of safety finding in project issue paper S-2. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Accountable Directorate 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 (TCs & ATCs) or in the Limitations and Conditions section of the STC. An example of an appropriate statement is provided below.

Equivalent Level of Safety Findings has been made for the following regulation(s):

14 CFR 23.1326(b)(1), Pitot heat indication systems, amendment 23-59
(documented in ELOS Memo ACE-15-12)

//SIGNED//

July 8,2015

Earl Lawrence, Manager, Small Airplane Directorate,
Airplane Certification Service

Date

ELOS Originated by: Programs & Procedures (Advanced Technology) Branch	Ruth Hirt	Routing Symbol: ACE-114
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