



# Federal Aviation Administration

---

---

## Memorandum

Date: [June 23, 2016](#)

To: Manager, New York ACO, ANE-170

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Leung Lee, ANE-171

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Acceptable High Temperature Physiological Environment During Failure Conditions on Models BD-700-2A12 and -2A13 airplanes, FAA Project #s AT7180NY-T\AT7285NY-T

ELOS Memo #: AT7180NY-T-GA-ES-06

Regulatory Ref: Title 14, Code of Federal Regulations, (14 CFR) §§25.831(g)

---

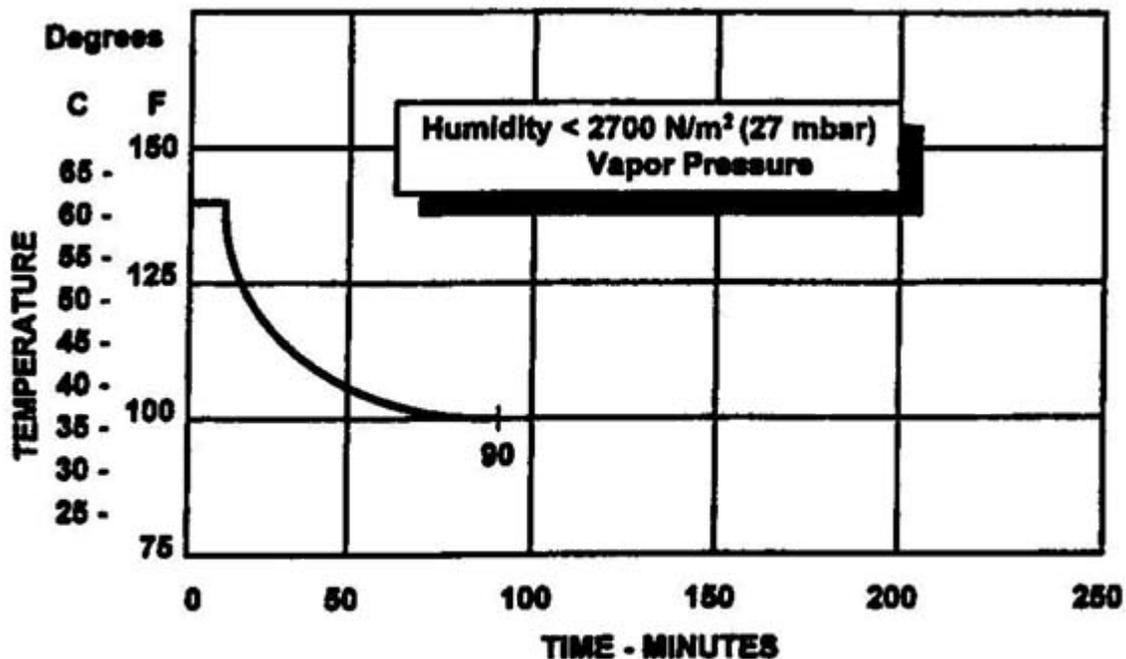
---

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 Bombardier Inc. Models BD-700-2A12 and -2A13 airplanes.

### **Background**

For certification of Models BD-700-2A12 and -2A13 airplanes, Bombardier Inc. has requested an ELOS finding against §§ 25.831(g). Title 14, Code of Federal Regulations (14 CFR) Part 25 Section 25.831(g), Amendment 25-89, requires that “the exposure time at any given temperature must not exceed the values shown in the following graph after any improbable failure condition.” Bombardier Inc. has requested a Finding of Equivalent Safety based on a demonstration of compliance with the draft rule and associated means of compliance developed by the Aviation Rulemaking Advisory Committee (ARAC) Mechanical Systems Harmonization Working Group (MSHWG), and published in its final report dated July 24, 2003.

## TIME-TEMPERATURE RELATIONSHIP



## TIME-TEMPERATURE RELATIONSHIP

]

Section 25.831(g) at Amendment 25-89 requires that the airplane must be designed so that, following an improbable failure, occupants will not be exposed to a cabin temperature and humidity level that exceeds the values shown on the above graph. The graph depicts a temperature - time history that provides strict time limits for a given temperature and limits the humidity level to less than 27 millibars vapor pressure.

The intent of §§ 25.831 (g) regulation is to ensure the flight deck and cabin crew's ability to perform their assigned tasks by ensuring the crews are provided a safe working environment and to not compromise safe flight and landing of the aircraft. Specifically § 25.831 (g) ensures that in the event of the ventilation system failures the temperature and humidity within the airplane shall not exceed values that are hazardous to the occupants. The regulation incorporates a time-temperature relationship containing a single-point humidity requirement.

Bombardier Inc. has found this requirement difficult or impossible to comply with under the assumption of loss of all conditioned airflow for flight following failure, including descent and landing. The fixed humidity level of 27 mbar often exceeded at lower altitudes at and near sea level for airport ambient conditions. Thus, this requirement would prohibit the use of outside air to ventilate the airplane during high humidity conditions above 27 mbar.

### Applicable regulation(s)

§§ 25.831 (g)

## **Regulation(s) requiring an ELOS finding**

§§ 25.831 (g) at Amendment 25-89

### **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)**

Bombardier Inc. has followed the ARAC recommended rulemaking to preserve a tolerable environment using a new, performance-based standard. The ARAC Mechanical Systems Harmonization Working Group (MSHWG) Final Report, dated July 24, 2003, recommended a demonstration of compliance with the draft rule and associated means of compliance developed by the ARAC MSHWG which shows that:

“The airplane design must accommodate any environmental control system failure condition not shown to be extremely improbable, such that:

- (a) Flight deck and cabin environmental conditions shall not adversely affect the crew performance that results in a hazardous condition;
- (b) No occupant shall sustain permanent physiological harm.”

The FAA has determined that the ARAC MSHWG Final Report on FAR/JAR 25.831(g), dated July 24, 2003, provides an equivalent level of safety compared to direct compliance with §§ 25.831(g).

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

In order to demonstrate equivalent safety to the §§25.831 (g) criteria, Bombardier Inc. provided an analysis to demonstrate that using the guidance recommended by the National Institute for Occupational Safety and Health (NIOSH) for heat stress alert limits (RAL), the predicted deep body temperatures for the cabin occupants will remain within acceptable limits, and/or using the Core Body Temperature (transient heat stress analysis), the deep body temperature will not rise above 38°C (+ 100.4 °F). As per the FAA ARAC MSHWG final report, a body core temperature of 38.0°C steady-state conditions is acceptable, and a body core temperature transient to 38.5°C is acceptable where the 38.5°C body core temperature shall not be exceeded or sustained for any amount of time. The Bombardier analysis confirmed these body core temperature limits are not exceeded for the environmental and operational conditions per §25.831 (g) at Amendment 25-89 for the BD-700-2A12 and -2A13 airplane models.

Bombardier Inc. also considered operational provisions, which provide for, or mitigate the resulting environmental effects to airplane occupants. As such, the analysis recommends procedures to alleviate the cockpit and cabin temperature during hot day diversion under *RAM AIR (unpressurized flight) and AUX PRESS (pressurized flight)*.

**FAA approval and documentation of the ELOS finding**

The FAA has approved the aforementioned ELOS finding in project Issue Paper GA-ES-06 titled Acceptable High Temperature Physiological Environment During Failure Conditions - Equivalent Safety Finding (ESF) - §§ 25.831 (g). 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. This ELOS memorandum number should be listed in the type certificate data sheet under the Certification Basis section in accordance with the statement below:

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

§ 25.831(g) at Amendment 25-89 Ventilation

(documented in TAD ELOS Memorandum AT7180NY-T-GA-ES-06)

Original signed by Jone Regimbal

6/23/16

\_\_\_\_\_  
Transport Airplane Directorate,  
Aircraft Certification Service

\_\_\_\_\_  
Date

ELOS Originated by NYACO	ACO Manager Gaetano Sciortino	Routing Symbol ANE-170
-----------------------------	----------------------------------	---------------------------