

**Exemption No. 10180**

**UNITED STATES OF AMERICA  
DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION  
RENTON, WASHINGTON 98057-3356**

In the matter of the petition of

**Embraer**

for an exemption from § 25.981(a)(3) of Title  
14, Code of Federal Regulations

Regulatory Docket No. FAA-2010-1265

**GRANT OF EXEMPTION**

By letters dated December 13, 2010 and February 11, 2011, Mr. Sergio Augusto Viana de Carvalho, Airworthiness Manager, Empresa Brasileira de Aeronautica, S.A. (Embraer), Av. Brigadeiro Faria Lima, 2.1709, 12227-901 – S. J. dos Campos – SP, Brazil, petitioned the FAA, for an exemption from the requirements of § 25.981(a)(3) of Title 14, Code of Federal Regulations (14 CFR). This exemption, if granted, would permit relief from the fuel tank ignition prevention requirements for its EMB-135BJ airplanes modified in accordance with Design Change Approval (DCA) 0145-000-00020 (most recent FAA approved revision) (Legacy 650).

**The petitioner requests relief from the following regulation:**

**Section 25.981(a)(3) as amended by Amendment 25-102:**

(a) No ignition source may be present at each point in the fuel tank or fuel tank system where catastrophic failure could occur due to ignition of fuel or vapors. This must be shown by:

(3) Demonstrating that an ignition source could not result from each single failure, from each single failure in combination with each latent failure condition not shown to be extremely remote, and from all combinations of failures not shown to be extremely improbable. The effects of manufacturing variability, aging, wear, corrosion, and likely damage must be considered.

**The petitioner supports its request with the following information:**

This section quotes, in part, the relevant information from the petitioner’s documentation. The complete documentation is available at the Department of Transportation’s Federal Docket Management System, on the Internet at <http://regulations.gov>, in Docket No. FAA-2010-1265.

Embraer respectfully submits the enclosed petition for a time-limited exemption from the provisions of 14 CFR 25.981(a)(3) as they apply to the fuel pump and wiring installations of EMB-135BJ (Legacy 650) aircraft.

**Text of the Requirement for which exemption is sought**

14 CFR 25.981(a)(3) “Fuel tank ignition prevention.”

Demonstrating that, an ignition source could not result from each single failure, from each single failure in combination with each latent failure condition not shown to be extremely remote, and from all combinations of failures not shown to be extremely improbable. The effects of manufacturing variability, aging, wear, corrosion, and likely damage must be considered.

**Background**

It has proven impractical to demonstrate compliance with § 25.981(a)(3) at amendment 25-102 in a timely manner due to certain EMB-135/145 family fuel system design concepts and practices initially proposed to be retained for the EMB-135BJ (Legacy 650). Embraer requests that this time limited exemption be granted until practicable design solutions are identified, validated, and safely integrated into the fuel system of the EMB-135BJ (Legacy 650).

Some of design aspects that must be addressed by subsequent modifications include, but may not be limited to:

- Each fuel pump wiring harness within a fuel tank needs an additional independent and robust layer of protection against ignition source producing faults. Consideration is being given to placing the harness completely within a robust conduit which protects the harness from foreseeable damage while protecting the tank vapor space from any foreseeable harness faults (i.e. conduit provides vapor/explosion proof barrier that won’t be lost due to damage from any foreseeable harness fault);
- Fuel pump explosion proof features need to be made adequately fail-safe. Failures that are not extremely improbable have been identified which can cause loss of the pumps explosion containment capability. Fixes have been identified and are currently being validated;
- The wiring installations outside the fuel tanks must be made adequately fail-safe. Foreseeable wiring support failures have been identified that could cause non intrinsically

safe wiring to come into contact with the external skins of fuel tanks. Shorting of the conductors within these wires and the conductive skin of the tank could result in prohibited hot spots or burn through of the tank. To date sufficient information is not available to rule out such a short. Some specific fixes have been identified and are currently being validated, and the analysis to assure other foreseeable failures do not exist is still in process.

Embraer offers the following justification in support of this exemption, as well as, substantiation as to why the current type design provides an adequate level of safety for the interim period of this exemption and why granting the time limited exemption is in the public interest, as required by 14 CFR 11.81.

### **Grounds Supporting Exemption**

Embraer will certify and incorporate into the production line of the EMB-135BJ (Legacy 650) the modifications required to demonstrate compliance with the requirements of § 25.981(a)(3) at amendment 25-102 by September 30, 2011.

Embraer will also retrofit the EMB-135BJ (Legacy 650) series airplanes delivered under the terms of this exemption by September 30, 2012.

These proposed dates are adequate considering that:

- The number of the airplanes that will be delivered within this period represents a negligible addition to the overall fleet risk.
- Some of the identified failure modes of concern require significant aircraft utilization and/or aging to develop into noncompliant failure conditions, and the timeframe proposed for this exemption is not sufficient for the affected airplanes to accumulate the flight hours or cycles required for the components to exhibit these aging effects.
- The fuel pump and wiring installations of the EMB-135BJ (Legacy 650) have the same characteristics as the rest of the EMB-145 family from which it is derived. That EMB-145 family has accumulated more than 17 million flight hours without notable adverse experience relevant to the objectives of the § 25.981(a)(3) requirement.
- There are five EMB-135BJ (Legacy 650) aircraft scheduled to be delivered to U.S. customers through the end of 2011. The additional number of flight hours that will be accumulated by these EMB-135BJ (Legacy 650) airplanes during the period of this exemption will be minimal due to that limited fleet size and the lower annual utilization typical of such business jets.
- The failure conditions of concern will be mitigated with the actions that are described below:

The proposed mitigation actions for pump manufacturing and assembly within this time-limited exemption application are the following:

1. Additional dielectric strength test on the pump harness before final assembly to guarantee the proper wiring insulation.
2. Torque verification of pump locking nuts at final inspection to guarantee the proper installation of the nut.
3. Addition of polysulfide sealant all over the pump locking nuts to guarantee the closure of the gap between stud and cover and, consequently, the explosion proof cavity.
4. Additional cleaning task to guarantee the adhesion of potting to connector counter bore.
5. In addition to the already existing inspections, a detailed visual inspection performed by qualified quality inspector to guarantee that
  - a. The wiring adjacent to all fuel tanks is installed in accordance with drawings;
  - b. The pump harness is installed according to the drawing to include
    - i. Clamp type (with yellow cushion)
    - ii. Clamp size
    - iii. Clamp alignment with the harness
    - iv. Correct number and location of clamps
    - v. Harness slack properly distributed along the length
    - vi. Harness clearance

The proposed limitation for pump maintenance within this time-limited exemption application is the following:

Any maintenance action accessing the wing tanks collector box or any auxiliary fuel tanks to perform any maintenance either on the fuel pump itself or other adjacent component or installation requires a detailed visual inspection and a functional check in accordance with the fuel system limitation task numbers 28-17-01-720-001-A01 and 28-50-01-220-001-A01 by a qualified inspector in order to guarantee that the installation of the pumps are in accordance with the Maintenance Manual instructions and illustrations.

The fuel system limitation task numbers 28-17-01-720-001-A01 and 28-50-01-220-001-A01 will include a GVI (General Visual Inspection) task number 28-41-00-200-801-A as part of the tank closure procedure after a maintenance activity is performed. These fuel limitation tasks will be added to the Embraer maintenance planning guide (MPG) temporary revision (TR) 7.2, before certificate of airworthiness or first delivery whichever occurs later.

Fuel System Limitation Task Numbers as follows:

28-17-01-720-001-A01	FNC	Functionally Check Ventral tank critical bonding integrity of Fuel Pump, FQGS connectors at tank wall by conductivity measurements <b>NOTE:</b> Applicable to aircraft Equipped with Ventral Fuel Tank and AE3007A2 Engines	193/1924/ 1972	30,000 FH or 144 MO	ALL
28-50-01-220-001-A01	DET	Inspect (Detailed Inspection) Fuel Pump Electrical Harness <b>NOTE:</b> Applicable to aircraft Equipped with Ventral Fuel Tank and AE3007A2 Engines	155/156 192	10,000 FH or 48 MO	ALL

The DET 20-00-00-220-001-A10 periodic maintenance task requires a periodic repetitive inspection of wire bundles to areas of concern adjacent to the fuel tank skins, at an interval of 18 months, to assure no wiring support failure persists.

<u>20-00-00-220-001-A10</u>	<u>DET</u>	Inspect (Detailed Inspection) all EWIS components of the aircraft.  NOTE: EWIS.  NOTE: Applicable to aircraft equipped with ventral fuel tank and AE3007A2 engines under FAA certification.	18 mo.	ALL
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**Issue of Public Interest**

Denial of this petition for exemption would result in the delay in certification and delivery of the EMB-135BJ (Legacy 650) to the United States (U.S.). While these airplanes are not manufactured in the U. S., a significant portion of the airplane, including the engines, avionics, and interiors are manufactured by U.S. suppliers. Denial of this exemption request would result in the loss of revenue for the U.S. suppliers and have an adverse impact on the U.S. balance of trade, both of which are counter to the public interest.

In addition, our U.S. customers have made fleet schedule plans based on the agreed-upon delivery schedule of these airplanes. To require Embraer to modify these airplanes prior to service entry will unavoidably delay delivery and have an adverse financial effect on these operators. This action would be counter to the public interest.

**Request to Forego Publication in the Federal Register**

Because this exemption petition is similar in both the technical and regulatory aspects addressed and the temporary relief sought to an exemption that has been issued in the past (Exemption 8761C) and has received no public comments, granting of this proposed exemption would not raise new issues or set any legal precedent. In comparison to this previous exemption, this petition requests only 21 months (measured from January 1, 2011) to complete the identified modifications and retrofitting the delivered airplanes. In

addition, the previous exemption was applicable to the entire fuel system, where in the case of the EMB-135BJ (Legacy 650), the majority of the affected system has already been shown compliant with 14 CFR 25.981(a)(3) and the necessary modifications identified. Accordingly Embraer requests that the FAA not delay granting of this exemption for publication of the petition summary in the Federal Register as allowed by 14 CFR 11.87.

Embraer has a contract with an U.S. operator to deliver the first EMB-135BJ (Legacy 650) by February 25, 2011. As described above in the Public Interest section, a delay in delivery will adversely affect this operator, forcing him to seek alternatives to his planned use of the airplane, e.g., cancel scheduled flights, charter alternative lift.

Embraer also notes that this petition was filed immediately after the identification of the non-compliance.

In summary, there exists the necessary justification for forgoing publication of a petition summary in the Federal Register, and Embraer respectfully requests that [the FAA] grant this petition without delay.

#### **Effect of the Exemption on Safety**

The entire EMB-145 family of aircraft have similar design features that could not be shown to comply with § 25.981(a)(3) amendment 25-102. There are 689 such aircraft currently operating safely within the U.S. fleet. Such aircraft have been operating safely in the U.S. for over 14 years and are expected to continue to do so for many years to come. Adding 5 additional aircraft expected to be delivered until September 30<sup>th</sup> 2011, with a similar level of risk to that fleet for less than two years will clearly have a negligible impact on safety.

#### **Operations Outside the United States**

As a manufacturer and not an operator, Embraer does not intend to operate outside the United States under the terms of the exemption which we are requesting, but our operators will certainly fly the EMB-135BJ (Legacy 650) internationally. The granting of this petition will not conflict with any of the terms of ICAO Annex 8, so the FAA will not need to file a difference with ICAO, as described in 51 1.83.

#### ***Federal Register Publication***

The FAA has determined that good cause exists for waiving the requirement for *Federal Register* publication because the exemption, if granted, would not set a precedent, and any delay in acting on this petition would be detrimental to Embraer.

## **The FAA's analysis**

### FAA Analysis - Introduction

To obtain this exemption, the petitioner must show, as required by § 11.81(d), that granting the request is in the public interest, and, as required by § 11.81(e), that the exemption will not adversely affect safety, or that a level of safety will be provided that is equal to that provided by the rules from which the exemption is sought.

### FAA Analysis - Public Interest

The FAA agrees with the petitioner that the adverse impacts on U.S. interests, including component manufacturers and operators of delaying approval of this type design amendment for approximately one year is not warranted as this granting would not materially impact the level of safety given the limited exposure being allowed, and the unusually vigilant maintenance being required by the conditions of this exemption.

### FAA Analysis - Effect on Safety

The petitioner estimates that at most 5 airplanes of the noncompliant type design airplanes will be delivered to U.S. operators, and these will be operated for at most two years before being brought into compliance with the subject rule. Based on the good service history demonstrated by the existing fleet with similar designs, and the limited time in which the new airplanes will be operating, the risk to safety within the U.S. fleet of granting this exemption is very low. Embraer's proposal for additional assembly steps and maintenance actions will further mitigate the risk. The FAA plans to evaluate the risk within the existing Embraer fleet to determine whether the design changes that Embraer will develop should be incorporated into these other airplanes.

## **The FAA's Decision**

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator, Embraer is hereby granted an exemption from the requirements of 14 CFR 25.981(a)(3) as they relate to the Model EMB-135BJ (Legacy 650) airplane, fuel pump and wiring installations, with the following conditions and limitations:

1. For Model EMB-135BJ (Legacy 650) airplanes granted a certificate of airworthiness before September 20, 2011. The following compensating features identified by the petitioner in their petition shall be mandatory:

- a. Additional dielectric strength test on the pump harness before final assembly to assure the proper wiring insulation.

- b. Torque verification of pump locking nuts at final inspection to assure the proper installation of the nut.
- c. Addition of polysulfide sealant all over the pump locking nuts to assure the closure of the gap between stud and cover and, consequently, the explosion proof cavity.
- d. Additional cleaning task to assure the adhesion of potting to connector counter bore.
- e. In addition to the already existing inspections, a detailed visual inspection performed by a qualified inspector to assure that:
  - (1) the wiring adjacent to all fuel tanks is installed according to the drawings; and
  - (2) the pump harness is installed according to the drawing to include:
    - i. Clamp type (with yellow cushion),
    - ii. Clamp size.
    - iii. Clamp alignment with the harness,
    - iv. Correct number and location of clamps,
    - v. Harness slack properly distributed along the length, and
    - vi. Harness clearance.
- f. The proposed limitation for pump maintenance within this time-limited exemption application is the following:
  - (1) Any maintenance action for accessing the wing tanks collector box or any auxiliary fuel tanks for performing any maintenance, either on the fuel pump itself or other adjacent components or installations, requires a detailed visual inspection and a functional check in accordance with the fuel system limitation task numbers 28-17-01-720-001-A01 and 28-50-01-220-001-A01, by a qualified inspector, in order to assure that the installation of the pumps are in accordance with the maintenance manual instructions and illustrations.
  - (2) The fuel system limitation task numbers 28-17-01-720-001-A01 and 28-50-01-220-001-A01 will include a GVI (General Visual Inspection)

task number 28-41-00-200-801-A, as part of the tank closure procedure after a maintenance activity is performed. These fuel limitation tasks will be added to the Embraer maintenance planning guide (MPG) temporary revision (TR) 7.2, before certificate of airworthiness or first delivery whichever occurs later.

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20-00-00-220-001-A10	DET	Inspect (Detailed Inspection) all EWIS components of the aircraft.  <b>NOTE:</b> EWIS.  <b>NOTE:</b> Applicable to aircraft equipped with ventral fuel tank and AE3007A2 engines under FAA certification.	18 mo.	ALL
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2. The “Airworthiness Limitation” section of the “Instructions for Continued Airworthiness” will state that these airplanes cannot be operated after September 30, 2012, unless the design changes submitted in accordance with limitation 3 (below) are incorporated by the owner or operator.

3. On or before September 30, 2011, Embraer shall obtain FAA type certification approval of an amendment to the EMB-135BJ (Legacy 650) type design which fully complies with the provisions of § 25.981(a)(3) at Amendment 25-102 or later.

4. On or before March 30, 2012, Embraer will develop and submit for FAA approval, service information to incorporate any design changes and/or operating and maintenance limitations developed to meet the provision of § 25.981(a)(3), as identified in limitation 2 (above).

5. Airplanes for which application for airworthiness certificate is made after September 30, 2011, must incorporate any design changes and/or operating and maintenance limitations developed to meet the provisions of § 25.981(a)(3), as identified in limitation 2 (above).

6. The FAA will not issue original airworthiness approvals for Model EMB-135BJ (Legacy 650) airplanes after September 30, 2012, unless Embraer has shown full compliance with the provisions of this exemption by that date.

Issued in Renton, Washington, on February 16, 2011.

*/s/ Ali Bahrami*

Ali Bahrami  
Manager, Transport Airplane Directorate  
Aircraft Certification Service