

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

In the matter of the petition of

**The Boeing Company**

for exemption from § 25.863 of Title 14, Code of  
Federal Regulations

**Regulatory Docket No. FAA-2011-1042**

**DENIAL OF EXEMPTION**

By letters, RA-11-04847, dated September 21, 2011, from Mr. Timothy P. Dowling; and RA-12-01809, dated April 23, 2012, from Mr. Robert G. Filacchione; and RA-12-02182, dated May 21, 2012, from Mr. John Hamilton, The Boeing Company, P.O. Box 3707, Seattle, Washington, 98124-2207, petitioned for exemption from Title 14, Code of Federal Regulations (14 CFR) 25.863, as amended by Amendment 25-46. The proposed exemption, if granted, would permit relief from the requirement to provide flammable-fluid drainage from the engine tailpipe area of certain Boeing Model 737 airplanes, thereby allowing installation of older tailpipe assemblies that lack drainage provisions on recently approved engines that have drainage features in the tailpipe.

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

**Section 25.863, at Amendment 25-46**, requires that drainage be provided in flammable-fluid leakage zones.

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

This section quotes the relevant information from the petitioner's request dated May 21, 2012. The complete petition is available at the Department of Transportation's Federal Docket Management System, on the Internet at <http://regulations.gov>, in Docket No. FAA-2011-1042.

Boeing is seeking relief from the following regulation for the main engine exhaust plug installation on the 737-600/-700/-700C/-800/-900/-900ER models:

*14 CFR §25.863 Flammable fluid protection*

*(a) In each area where flammable fluids or vapors might escape by leakage of a fluid system, there must be means to minimize the probability of ignition of the fluids and vapors, and the resultant hazards if ignition does occur.*

*(b) Compliance with paragraph (a) of this section must be shown by analysis or tests, and the following factors must be considered:*

*(1) Possible sources and paths of fluid leakage, and means of detecting leakage.*

...

*(3) Possible ignition sources, including electrical faults, overheating of equipment, and malfunctioning of protective devices.*

**Extent of Relief**

The CFM56-7B engine installation on the 737-600/-700/-700C/-800/-900/-900ER models uses a core exhaust nozzle and plug to control the flow of the exhaust gases from the engine. The CFM56-7B engine incorporates a center vent tube that exhausts air into the plug cavity. The plug has a 4.8 inch opening in the aft end to allow the engine vent air to exhaust overboard. The engine also incorporates a drain for the main bearing aft oil sump that discharges into the plug cavity. There are no designed drainage provisions for the plug cavity of the 314A2620-1 plug installation.

Boeing is seeking relief from § 25.863(a), (b)(1), (b)(3) as it applies to the internal cavity of the 314A2620-1 plug installation on certain 737-600/-700/-700C/-800/- 900/-900ER airplanes. Engine oil and/or fuel can be directed to the plug cavity by the aft sump drain and/or the center vent tube. There are no drainage provisions in the 314 A2620-1 plug installation. The plug surface temperatures can exceed the auto-ignition temperature of engine oil and fuel. Consequently direct compliance for the 314A2620-1 plug installation cannot now be shown to § 25.863 (a),(b)(1),(b)(3). The 314A2620-1 plug installation was previously found compliant with § 25.863(a),(b)(1),(b)(3) in error.

At Line No. 3762, Boeing introduced a new exhaust installation including a new plug that was compliant with § 25.863. However, the new type design could not be approved with the 314A2620-1 plug installation as an interchangeable spare for the new exhaust. Consequently, installation of the 314A2620-1 plug is not allowed on 737-600/-700/-700C/-800/-900/-900ER models from Line No. 3762 and on. Boeing is seeking relief from the regulation via exemption to allow the installation.

**Public Interest**

Exemption from § 25.863(a),(b)(1),(b)(3) for the 314A2620-1 plug installation on Line No. 3762 and on would be in the public interest. The inability to use the 314A2620-1 plug on a sub-group of airplanes within an airline operator's fleet creates a significant interchangeability issue. There are currently over 7,000 of the 314A2620-1 plugs in

service operation. Typically the exhaust is installed as part of the spare engine kit to minimize the engine change time on the flightline.

Operators have informed Boeing that the interchangeability restriction will increase operational costs arising from the additional inventory control processes that will be needed, and potential delays if the correct exhaust part number is not immediately available. These costs will eventually be passed on to the public. Removing the restriction will allow greater flexibility and increased efficiency for the operator to better serve the public.

## **Safety**

Exemption from § 25.863(a), (b)(1), (b)(3) for the 314A2620-1 plug installation on Line No. 3762 and on would not adversely affect public safety based on the features summarized below. The FAA-SACO agreed with a similar assessment in 2009.

The airplane is protected from the effects of a potential fire within the exhaust plug by the following design and construction features:

- The plug is considered fireproof. There is a 4.8 inch diameter opening in the aft end of the plug to provide for ventilation flow. This opening is approximately 60 inches aft from the location where fluid would collect at the forward end of the plug.
- The plug is shielded from the airplane surfaces along most of its length by the exhaust nozzle, which is also considered fireproof.
- There is a heat shield directly above and aft of the exhaust that protects the aft strut fairing. The heat shield is considered fireproof.
- The lower surfaces of the wing within one nacelle diameter of the fire zone, including the control surfaces, are fire resistant.
- The vertical distance from the opening in the aft end of the plug to the aft fairing is 11 inches; to the undersurface of the wing is 36 inches. The horizontal distance to the wing rear spar is 48 inches.
- The area is surrounded by the engine primary gas path and turbine frame.
- In the event of a tailpipe fire, the Boeing Flight Crew Operations Manual (FCOM) directs fuel-flow shutoff and motoring of the engine to keep flames away from the airplane and cool the engine.

COSP 2008-1396 and other tailpipe fire events were reviewed by the Engineering Investigation Board (EIB) and received “not safety” determinations based on the supporting rationale documented above.

Failures of the engine that could result in evacuation of the oil system into the plug cavity will be indicated to the flight crew by a low oil pressure indication after a loss of 15-18 liters of oil out of a full engine oil tank capacity of 20.2 liters. The FCOM instructs the crew to perform an engine shutdown for low oil pressure indication. Risks associated with continued oil flow during windmilling after engine shutdown are mitigated by:

- Removal of hot surface ignition sources at the exhaust nozzle and plug as the engine cools
- Reduction of air flow through the center vent tube into the plug which will limit the intensity of any fire already burning
- Minimization of flame impingement and heat transfer to the surrounding structure due to cooling flow through the engine primary gas path while in flight

Cooling flow through the engine primary gas path is provided on ground by engine motoring. When engine motoring is not possible due to a particular mode of engine failure or inappropriate flight crew action, analysis shows ignition sources will not exist in the main fuel tank for a minimum of 5 minutes of exposure to an oil fed tailpipe fire.

During an oil fed tailpipe fire, temperatures within the main fuel tank of the affected wing will remain below the Jet A auto-ignition temperature of 440°F during a 5 minute exposure period. Thermal analysis shows a tailpipe fire will result in a maximum main tank lower inside skin temperature of 401°F within the first 5 minutes of exposure even if the engine is not motored to provide cooling flow. The minimum fuel quantity evaluated was 1400 lbs per tank. Attachment 1 contains a plot of maximum temperature with respect to time for this and other fuel quantities.

The center tank is sufficiently far away to minimize exposure to a tailpipe fire. The investigation of COSP 2008-1396 did not report damage indicating significant heating of the center tank.

While failure modes exist that would permit introduction of fuel inside the plug, there have been no reports of fuel leakage into the plug and all known tailpipe fires within the plug have been attributed to oil burning.

A number of tailpipe fires have occurred in service, however only a few have resulted in visible damage to the airplane.

A potential fire in the plug cavity will be identified and addressed by the flight and ground crews in the same manner as a traditional fuel-fed tailpipe fire occurring in the primary gas path. The risk of inappropriate crew or passenger response exists for any tailpipe fire and is not limited to a specific design of nozzle or plug. A tailpipe fire, regardless of cause, will not adversely affect egress through forward doors or rear over-wing door on opposite side of aircraft.

The Boeing Flight Attendant Manual (FAM) provides recommended egress procedures for a flight crew initiated evacuation. The FAM guidelines specify that the safety of

inside and outside conditions should be assessed before opening an exit. If an exit is unsafe, flight attendants are trained to redirect passengers to other exits.

The installation is currently operating on over 3,500 airplanes and has accumulated over 66 million hours and 35 million cycles as of April 2011. Operation and installation of the 314A2620-1 plug installation on post-Line No. 3762 airplanes is identical to the installations that have safely accumulated these hours/cycles.

### **Request to Waive Publication and Comment**

In some cases, the FAA may waive the requirement for publication and comment. One potential reason is that the relief requested is identical to previously granted exemptions. Given that the installation of the 314A2620-1 exhaust plug is currently operating on over 3,500 airplanes and has accumulated over 66 million hours and 35 million cycles as of April 2011, Boeing requests that the FAA waive the requirement for publication and comment.

### **Need to Exercise the Exemption Outside of the United States**

737-600/-700/-700C/-800/-900/-900ER model airplanes from Line No. 3762 and on are anticipated to be operated in many foreign countries. To provide for maximum efficiency and flexibility for foreign operators, Boeing requests that the FAA allow the use of the petitioned exemption outside of the United States.

### **Federal Register publication**

A summary of the petition was published in the Federal Register on November 23, 2011 (76 FR 72494). No comments were received.

### **The FAA's analysis**

The FAA has reviewed the information provided by Boeing, as well as continued operational safety data, and has concluded that Boeing has not shown that granting this exemption is in the public interest for the following reasons.

Ensuring that installation of only the later version of the tailpipe assemblies on line numbers after 3,762 will most likely involve operators maintaining separate spare parts and managing different configurations within their 737 airplane fleets. While not ideal, this effort is not uncommon within normal airline operations and does not represent a unique burden.

Furthermore, we have concluded that Boeing has not shown that granting the exemption would not adversely affect safety or shown how the exemption would provide a level of safety at least equal to that provided by the rule from which they sought the exemption.

Boeing has two versions of the 737 tailpipe assembly that are approved for use on the Model 737-600/-700/-700C/-800/-900/-900ER series airplanes. The earlier version approved for installation up through line number 3,762 has since been determined to not comply with airworthiness standards as it does not have drainage provisions in the tailpipe assembly. Because

of this lack of drainage capability, certain failures in the engine can result in accumulation of oil in the tailpipe, ignition of the oil by hot surfaces, and an engine fire in the vicinity of the main fuel tanks. The 737 airplane does not have fire detection or active fire extinguishing capability in the tailpipe assembly area. Boeing provided data showing fires of varying intensity and severity have occurred in service involving the earlier version of the tailpipe assembly. Although limited data was presented regarding these events, in at least one of these events, inspection of the engine revealed that the oil tank was empty, indicating that the oil may have leaked and accumulated in the tailpipe cavity where there were no provisions to drain these flammable fluids as required by § 25.863. The later version of the tailpipe assembly that allows the flammable fluids to drain should more effectively prevent such fires from occurring. Introducing a design with the demonstrated potential for such fires on more airplanes would have an adverse effect on the level of safety for those airplanes.

### **The FAA's decision**

In consideration of the foregoing, I find that a grant of exemption is not in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator, The Boeing Company is hereby denied an exemption from § 25.863, to permit installation of 737 tailpipe assemblies that lack drainage provisions on airplanes that have been approved with the provisions present.

Issued in Renton, Washington, on September 21, 2012.

*/s/ Ali Bahrami*

Ali Bahrami  
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