

**Exemption No. 9966**

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

In the matter of the petition of

**Airbus**

for an exemption from §§ 25.951(c) and 25.952(a) of Title 14, Code of Federal Regulations

**Regulatory Docket No. FAA-2009-0891**

**GRANT OF TIME-LIMITED EXEMPTION**

By letter dated September 19, 2009, Anne Jany, Head of Airworthiness Technical Directorate, Airbus S.A.S., 1 Rond-Point Maurice Bellonte, 31707 Blagnac Cedex, France, petitioned the Federal Aviation Administration (FAA) for a temporary exemption from the requirements of §§ 25.951(c) and 25.952(a) of Title 14, Code of Federal Regulations (14 CFR). This exemption, if granted, would permit installation of improved fuel oil heat exchangers (FOHE) on A330 and A340 airplanes powered by Rolls Royce Trent 700 and Trent 500 engines, respectively. The end date for the requested exemption is October 1, 2011.

**The petitioner requests relief from the following regulation(s):**

**Section 25.951(c) Fuel System General**, which requires that each fuel system for a turbine engine must be capable of sustained operation through its flow and pressure range with fuel initially saturated with water at 80 degrees F and having 0.75cc of free water per gallon added and cooled to the most critical condition for icing likely to be encountered in operation.

**Section 25.952(a) Fuel System Analysis and Test**, which requires that proper fuel system functioning under all probable operating conditions be shown by analysis and those tests found necessary by the Administrator. Tests, if required, must be made using the airplane fuel system or a test article that reproduces the operating characteristics of the portion of the fuel system to be tested.

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

This section quotes the relevant information from the petitioner's request. 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-2009-0891.

On 17th of January 2008 a British Airways Boeing Model 777-236 powered by two Rolls-Royce Model RB211 Trent 895-17 turbofan engines operating flight BA038 Beijing -- London crash landed short of London Heathrow runway.

The subsequent investigation led by the Air Accidents Investigation Branch (AAIB) of the United Kingdom established that an un-commanded reduction in thrust occurred on both engines as a result of reduced fuel flows. The investigation determined that under certain conditions, over a long period of low fuel temperatures, ice may accumulate in the main tanks and/or in the associated engine fuel feed systems. The release of the accumulated ice, as a result of increased fuel flow, of increased ambient temperature, of airframe deformation resulting from turbulent conditions during approach, could create a restriction within the engine fuel feed system, at the front end of the Fuel Oil Heat Exchanger (FOHE). A restriction in the engine fuel feed system, if not corrected, may result in failure to achieve a commanded thrust level, with subsequent forced landing of the aeroplane.

The AAIB determined that no abnormal water concentrations were identified in the fuel system, and subsequent analysis of fuel samples have shown that the fuel met all applicable standards, including for water content.

In November 2008 a second occurrence affected a Delta Airlines 777-200ER en route from Shanghai to Atlanta. The aircraft experienced un-commanded rollback of engine #2 during cruise; the problem was cleared after application of the relevant AFM procedure and descent to 31 000 feet. The root cause of the roll-back was not determined.

On 19th of May 2009, an Etihad A330-242 operating a flight from Abu Dhabi to Manchester performed a go-around at Manchester, the runway being obstructed by a vehicle. Both engines initially responded correctly; however, after the initial acceleration engine #1 stagnated and the corresponding engine stall warning was displayed in the cockpit. As per procedure the crew throttled back the engine, which recovered.

At this stage, the subsequent investigations conducted by Airbus and Rolls-Royce have established engine fuel flow restriction as the probable

cause of the rollback. With regards to the overall engine response there are significant differences from the confirmed Trent 800 ice restriction events. However fuel flow restriction due to icing cannot be ruled out. Therefore given the ongoing investigation into this phenomenon, Airbus has taken a precautionary approach by adding this event as such to the numerical risk analysis.

The Trent 500 (installed on Airbus A340-500/600), the Trent 700 (installed on A330) and the Trent 800 (installed on Boeing B777) FOHEs have a common design with a front face design that features protuberant tubes which allow fuel circulation. The protuberant tubes design was introduced to allow particles and debris coming from the aircraft fuel system to be collected without disturbing the correct functioning of the engine fuel system. The in-service experience and testing made in the frame of the London Heathrow event suggest that this design, while meeting all applicable JAR/CS E requirements, is vulnerable to clogging by ice which is liberated from the aircraft fuel system. Test results from Boeing rig tests suggest that some ice may accumulate in the aircraft fuel system piping and then may be released when engine is re-accelerated as fuel flow is increased at a sufficient level. Historically, at aircraft level the compliance to § 25.951(c) does not require to quantify the volume of ice accumulated in the pipes and lines.

Following the Boeing 777/Trent 800 accident at London-Heathrow, FAA mandated aircraft procedures mitigating the risk. On 13th of July 2009, the EASA issued an engine Airworthiness Directive (AD) rendering mandatory the replacement of the Trent 800 FOHE with a revised design having a flush front face. It is intended to issue a similar AD on Airbus aircraft applicable for the Trent 500 and the Trent 700 engines.

### ***Engineering assessment***

The flush front face FOHE is considered as a valuable precautionary measure for Trent 500 and Trent 700 engines. It will be certified at engine level using assumptions regarding the icing threat. It will be as well certified at aircraft level. As a result and in order to show full compliance with 25.951 (c) and 952 (a) Airbus needs to justify the benefit of the new FOHE vs blockage by ice scenario (new compliance criteria). The scope of this activity has yet to be fully established but it will certainly take months before the results are available.

Even if the scale of the threat has still to be defined, the enhanced FOHE has more capability to sustain ice release from the aircraft fuel system and its introduction is a good precautionary measure.

The risk analysis performed for the Airbus fleet, although the unsafe condition has not been demonstrated, indicates that a rapid introduction of the modified FOHE within the Airbus A330 and A340 fleets is a valid precaution.

***Level of safety***

The overall balance lies with granting a temporary deviation to 25.951(c) and 25.952(a) and allowing a rapid introduction within the LR [Long Range] fleet fitted with RR propulsion systems of the modified FOHE.

Airbus will complete its compliance demonstration with 25.951(c) and 952(a) within 24 months after the modification approval by FAA.

***Public interest***

Airbus presents the argument that the granting of this exemption will be in the public interest as allowing the installation of the enhanced FOHE is considered as a valuable precautionary measure for Airbus aircraft powered by Trent 500 and Trent 700 engines, as it has more capability to sustain ice release from the aircraft fuel system.

***Request for waiver of publication***

The petitioner requests that this petition for temporary exemption not be delayed by the public process, which includes publication of the subject petition, due to the impending delivery schedules.

Any delay in accepting this petition will not allow the potential safety benefit of the enhanced FOHE.

This temporary exemption will not set a precedent since it is not a complete exemption from the regulations, and will only allow sufficient time for Airbus to proceed to a full compliant certification process with the FAA for this improvement to the FOHE.

Airbus believes that good cause exists to waive the publication and comment requirements of §§ 11.85, 11.87, and 11.89 and hope that FAA find our request to be valid and grant a temporary exemption.

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**Federal Register publication**

On Monday, October 19, 2009, a summary of this petition was published in the *Federal Register* with a request for comments. The comment period closed on November 3, 2009. No comments have been received.

## **The FAA's analysis**

### ***Background***

As noted earlier by the petitioner, the flush front face FOHE is considered a valuable precautionary measure for Trent 500 and Trent 700 engines. It will be certified at the engine level using assumptions regarding the icing threat. It must also be certified at aircraft level. However, in order to show full compliance with §§ 25.951(c) and 25.952(a), Airbus needs to justify the actual benefit of the new FOHE based on its capability to function properly (not clog) in a critical aircraft fuel system icing scenario (new compliance criteria). The scope of this activity, which requires extensive rig build-up, testing, and analysis to define the critical icing condition, has yet to be fully established, but it will take many months before testing begins and subsequent results could be available.

Although the appropriate threat has yet to be defined, eliminating the protuberant tubes in the front face of the FOHE and replacing the front face with a flush face design has resulted in more capability for the FOHE to tolerate ice release from the aircraft fuel system.

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.

### ***Effect on safety***

In support of its petition, Airbus has noted three occurrences of engine un-commanded thrust reduction or rollback. The subsequent investigations conducted by Airbus and Rolls-Royce have established engine fuel flow restriction as the probable cause of the rollback. The in-service experience and testing conducted following the London Heathrow event suggest that the protuberant tube design in the front face of the FOHE is vulnerable to clogging by ice that is liberated from the aircraft fuel system. Also, the Trent 500 (installed on Airbus A340-500/600), the Trent 700 (installed on the A330), and the Trent 800 (installed on the Boeing 777) FOHEs all have a common design with a front face that features the protuberant tubes. Recently, the European Aviation Safety Agency (EASA) issued an engine AD mandating replacement of the Trent 800 FOHE with a revised design having a flush front face.

This grant of time-limited exemption inherently implies a somewhat greater uncertainty, and hence risk, than would exist with a demonstration of full compliance with

§§ 25.951(c) and 25.952(a). We do not consider the flush front face FOHE to be non-compliant, however, because we think Airbus will be able to demonstrate compliance with §§ 25.951(c) and 25.952(a) once it has completed the testing and analysis for the new fuel system icing scenario criteria relevant to the A340-500/600 and A330 aircraft fuel systems. Furthermore, the flush front face FOHE has demonstrated an enhanced capability to not clog from upstream ice releases and it has been mandated as the replacement for the current Trent 800 FOHE by the EASA.

In consideration of the above, the FAA concludes that granting this exemption will not adversely affect safety.

### ***Public interest***

For the reasons stated earlier by the petitioner, the FAA has determined that granting this time-limited exemption would be in the public interest and would not have an adverse effect on public safety.

Airbus will be required by the conditions for granting this time-limited exemption to report any information it acquires which might invalidate the justifications given for granting this exemption. In consideration of this condition, the FAA concludes that granting this petition is in the public interest.

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

In consideration of the foregoing, I find that a time-limited 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, Airbus is hereby granted a time-limited grant of exemption from 14 CFR 25.951(c) and 25.952(a) to the extent necessary to permit installation of improved fuel oil heat exchangers (FOHE) on A330 and A340 airplanes powered by Rolls Royce Trent 700 and Trent 500 engines, respectively, until Airbus can demonstrate full compliance with the regulations. These requirements relate to sustained fuel system operation with water/ice in the fuel and proper fuel system functioning under all probable operating conditions. This time-limited grant of exemption is subject to the following conditions and limitations:

1. Airbus must report to the FAA any information it acquires that might invalidate the justifications given for granting this exemption.
2. The granting of this exemption does not relieve any regulatory obligation to identify and correct unsafe conditions related to installation of the improved FOHE design.

This exemption terminates on October 1, 2011, unless sooner superseded or rescinded. Upon termination of this exemption, any certification approval issued by the FAA in

consideration of this exemption shall be void unless the Administrator has found compliance with the regulations from which this exemption was granted.

Issued in Renton, Washington, on November 23, 2009.

/s/Ali Bahrami  
Ali Bahrami  
Manager, Transport Airplane Directorate  
Aircraft Certification Service