

Proposed Deviation on CS 25.979(b)(2) at Amdt 17
Right Main Fuel Tank Indication of Refuel System Failure at Full Fuel Tank Level

Applicable to Boeing 737/-7/-8200/-9

Introductory Note:

The hereby presented Deviation shall be subject to public consultation, in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) of which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

Consultation time for this Deviation is proposed for 3 weeks.

Statement of Issue:

For the 737/-7/-8200/-9, the individual tank fuelling indicators will flash when the automatic shutoff volume is exceeded, before fuel spills into the surge tank. This is an indication to the refueller that a fuel spill is imminent, therefore, refuelling should be stopped.

The flashing volume threshold for the Right Main Tank was designed too high.

At certain airplane attitudes and with variability from Fuel Quantity Indicating System (FQIS) measurement tolerances, some airplanes, if the Volumetric Top Off (VTO) system fails to stop refuelling when the right main tank is full, fuel could transfer to the right wing surge tank, drain out of the surge tank through the fuel tank vent and spill before flashing occurs on the right tank (tank 2) indicator.

This fuel spill could be hazardous if there were an ignition source in the area of the right fuel tank vent.

This system behaviour deviates from CS 25.979(b)(2) at Amdt 17 intent:

- (b) An automatic shutoff means must be provided to prevent the quantity of fuel in each tank from exceeding the maximum quantity approved for that tank. This means must –*
- (2) Provide indication at each fuelling station of failure of the shutoff means to stop the fuel flow at the maximum quantity approved for that tank.*

Deviation E-36

Boeing 737/-7/-8200/-9

Boeing is petitioning for a line number limited deviation to CS 25.979(b)(2) at Amdt 17 for the right fuel tank of 737-9, 737-7 and 737-8200 airplane refuel system autoshutoff failure indication during refueling operations.

This line number limited deviation is for 737-9, 737-7 and 737-8200 airplanes delivered to EASA customers before line number 7650. Line number 7650 estimated delivery is late June or early July 2019. Eleven (11) 737-9, 737-7 and 737-8200 airplanes of the 737 MAX model series for delivery to EASA operators are being covered by this Deviation (six (6) 737-9, no 737-7, and five (5) 737-8200 airplanes).

Design details

The refuel system normally shuts off refueling when the tank is full. If there is a failure of the right tank refuel system, fuel could spill from the right fuel tank into the surge tank and later out of the right fuel tank vent when the surge tank is full.

The fuel tank vents are sized to accommodate maximum refueling flow rate through the vents without over pressuring the fuel tanks. The vents include flame arrestors to protect the fuel tanks from possible ground fires. The refuel system failure is extremely remote. A leak in combination with an external ignition source being present resulting in a hazardous condition to the airplane is an event that can be qualitatively determined to be less than extremely improbable.

If fuel does spill, it goes to an area beneath the right vent where there is no airplane ignition sources and normally no ground equipment ignition sources per the refueling procedures. The potential fuel spill area for the right tank vent is adjacent to the refueling station such that the person refueling the airplane can stop the fueling process soon after the spill begins. This limits the quantity of fuel that leaks from the right tank.

A Boeing service bulletin will be created to recommend replacement of the Fuel Quantity Processor Unit (FQPU) with an FQPU that has new software with improved fueling shutoff failure indication at the next convenient maintenance opportunity once hardware is available.

Statement of No Adverse Effect on Safety

A leak in combination with an external ignition source being present resulting in a hazardous condition to the airplane is an event that can be qualitatively determined to be less than extremely improbable according to Boeing. In the event of a leak, the designated drain paths are designed and demonstrated to accommodate max refuel rates without over pressuring the fuel tank structure, the spill quantity is limited because of the line of sight from the fuelling station to the right main tank vent and there is no ignition source in the area of the fuel tank vent by design and per the refueling procedures. In the unlikely event of a ground fire, the flame arrestor in the vent channel prevents spreading of the fire to the fuel tank. In addition, aircraft fueling standard procedures requires fire protection, caution and procedures in the event that a fire were to occur.

Note that all 737-100/-200/-300/-400/-500 airplanes that were certified to earlier amendment levels, were not required to have indication of an automatic fueling shutoff failure and have demonstrated an excellent service record without having this feature. Having 11 additional 737s that do not have a fully functional indication of automatic fueling shutoff failure will not affect safety of the fleet.

EASA position

EASA agrees with the analysis conducted by Boeing and determines that the deviation from CS 25.979(b)(2) at Amdt 17 under the above described circumstances still meets the essential requirements for airworthiness, and in particular 1.c. of Annex I to Regulation (EC) No 216/2008.

In line of the above and considering some uncertainty in the qualitative risk assessment (human error, probability of ignition source linked to procedure, random effect of environmental conditions (i.e wind), probability of failure of VTO float switch (1E-06 order), it is EASA opinion that the Deviation shall be limited over time for the 11 EASA affected aircraft to reduce threat exposure.

Understanding that a design solution with a revised Fuel Quantity Processor Unit (FQPU) software will be available by mid 2019 for showing direct compliance for the aircraft line number 7650 and onwards and knowing that the solution retrofit is not technically complex, the deviation is limited to 4 years from the Entry Into Service.