

# **Proposed Temporary Deviation on No Re-opening in flight of hydraulic fire shut-off valves**

## **Applicable to A400M**

### **Introductory note:**

The hereby presented Temporary Deviation has been classified as important and as such 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."

### **Statement of issue**

The CS 25.1189(f) requirement states "*There must be means to guard against inadvertent operation of the shut-off means and to make it possible for the crew to reopen the shut-off means in flight after it has been closed.*"

An issue with Airbus A400M intended compliance with this CS 25.1189(f) requirement has been identified consisting on the inability to re-open the Hydraulic Fire Shut-Off Valves numbers 3 and 4 during flight phases:

- Flight Phase 5: 3<sup>rd</sup> step of Take-Off, aircraft speed is above V1, aircraft still on ground) and
- Flight Phase 6: 1<sup>st</sup> step of climb, aircraft takes-off and starts climb phase until 400 ft, and
- Flight Phase 7: 2<sup>nd</sup> step of climb, aircraft climb phase from 400 ft to 1500 ft.

Instead of the possibility to re-open these valves, they will remain latched in the closed position until flight phase 7 has been completed, due to a flaw in the UERF (Uncontained Engine Rotor Failure) protection logic in ATA 290 Hydraulics' Control Unit.

It has to be highlighted this issue does not affect or impend the re-opening of the fuel shut-off valves, just the hydraulic valves.

The origin of this different behaviour of systems and logics associated to Engines 3 and 4 when compared with those of Engines 1 and 2 is the implementation of a logic aiming at safeguarding Yellow hydraulic circuit in case of Uncontained Engine Rotor Failure. This function is mandatory for UERF compliance.

This issue has only an effect if both following conditions are met:

- An Engine Fire in engine 3 or engine 4, AND
- While executing associated AFM procedure for the case of Engine Fire, the crew by mistake close the wrong Fire Shut-Off Valve associated with engine 3 or 4, i.e. to the engine that is not in fire.

Then the consequence will be that under these conditions it will not be possible for the flight crew to reopen the Fire Shut-Off Valves 3 or 4 (closed by mistake) during the remainder of flight phases 5 to 7.

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The applicant has identified the following mitigations with regards temporary loss of reopening capability of hydraulic shut-off means as required by CS 25.1189(f):

1. Engine Fire Warnings are inhibited in flight phases 5 and 6, which means that only flight phase 7 remains as potential flight phase to get a Fire Shut-Off Valve latched due to reopen command. An Engine fire warning in flight phases 1 to 4 requires the flight crew to perform a Rejected Take Off (RTO).
2. However, it is not realistic that the flight crew will close the wrong push button, because it is guarded and it is illuminated if a fire is detected in the associated engine.
3. The latching issue concerns only the Hydraulic Fire Shut-Off Valves associated with engines 3 and 4 (Yellow Hydraulic System) and not the corresponding Fuel Shut-Off Valves, therefore a relight of the engine shut-off by mistake will never be prevented.
4. The worst repercussion at hydraulic system level is the loss of one circuit (Yellow) due to this deviation, which is classified minor as a standalone failure.

However, from the aircraft performance / handling qualities point of view a scenario consisting in a fire in one engine in combination with by mistake shutting down a different engine by closing its associated Fire Shut-Off Valve must be considered equal than the loss of thrust from two engines, which is anyway classified at worst as catastrophic during flight phases 5-7 as per power plant system safety assessment.

Therefore, from the aircraft safety assessment point of view, the critical repercussion comes by the loss of power of two different engines, but not by the temporary unavailability on recovering reopening capability of the Hydraulic Fire Shut-Off Valve associated with Engines 3 or 4 during flight phases 5 to 7

Airbus SAS request EASA a Temporary Deviation for compliance with CS 25.1189(f).

As EASA conclusion, a Temporary Deviation with regards compliance with CS 25.1189(f) for the A400M can be granted by EASA associated to the following conditions:

- (1) A planning to be provided by Airbus SAS to EASA regarding the post TC design correction that will provide full compliance with CS 25.1189(f) and
- (2) This EASA temporary deviation will be valid since initial A400M certification until 31<sup>st</sup> December 2012 or first A400M aircraft entry into service, whichever occurs first.