

## **Supplementary requirement to CS 23.901(d)(2) to harmonise with FAR 23.901(d)(2)**

### **Explanation**

On August 18, 2015 EASA published on this web site a proposed Special Condition SC-E23.0901-01, Issue 1. During the public consultation phase no comments have been received. Consequently the proposed SC was adopted. Afterwards it has been shown that the intended wording proposed by EASA's engineering staff has not been addressed correctly.

Beside all technical issues one of the main goals for this SC was to reach a full harmonised rulemaking text between both FAR 23.901(d)(2) and CS 23.901(d)(2).

This is the reason to publish the proposed SC E23.0901-01, Issue 2. This proposed SC shall replace the adopted SC E23.0901-01, Issue 1.

### **Introductory Note**

The following Special Condition has been classified as a new Special Condition and as such shall be subject to public Consultation in accordance with EASA Management Board decision 02/04 dated 30 March 2004, 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 Certification Basis for operation under rain for turbine engine aircraft on CS-23 aircraft present a discrepancy between the turbine engine installation requirement (CS 23.901(d)(2) and the requirement to be demonstrated during turbine engine certification that is called by CS 23.903(a)(1).

CS 23.901(d)(2) states:

*(d) Each turbine engine installation must be constructed and arranged to –*

*...*

*(2) Provide continued safe operation without a hazardous loss of power or thrust while being operated in rain for at least 3 minutes with the rate of water ingestion being not less than 4% by weight, of the engine induction airflow rate at the maximum installed power or thrust approved for take-off and at flight idle.*

CS 23.903(a)(1)states:

*(a) Each turbine engine must either –*

*(1) Comply with CS E-790 and CS E-800, or*

*...*

CS E-790 covers Ingestion of Rain and Hail at engine level. For all engines per CS E-790 (a) per sub-paragraph (a)(2) cross refers to CS-E Appendix A that identifies the required Rain and Hail concentrations :

*... each Engine is capable of acceptable operation throughout its specified operating envelope when subjected to sudden encounters with the certification standard concentrations of rain and hail as defined in Appendix A to CS-E. Acceptable Engine operation precludes, during any 3-minute continuous period in rain ...*

CS-E Appendix A figure 1 identifies a 3% Water to air by weight concentration for Rain thus conflicting with the 4% water by weight of CS 23.901(d)(2).

Note : CS E-790(b) is imposing a 4% Water to air by weight concentration for rotorcraft engines only

## **Justification**

In the continuation of some Aerospace Industries Association (AIA) studies started in 1987 identifying the need for 14 CFR part 33 to address more appropriately the water and hail threats, FAA and JAA initiated efforts, around 1989, to harmonize engine requirements, which among the critical items identified, included the Rain and Hail ingestion standards.

In 1992, FAA requested the Aviation Rulemaking Advisory Committee (ARAC) to evaluate the need for new rain and hail ingestion standards. This task, in turn, was assigned to the Engine Harmonization Working Group (EHWG) of the Transport Airplane and Engine Issues Group (TAEIG) which resulted in 1995 for a recommendation to launch a rulemaking task.

As a result of Notice of Proposed Rulemaking. Notice No. 96-12; issued on 02 FEB 96, FAR 33 and FAR 23 evolved (Final Rule Docket No. 28652) on 20 MAR 98. Prior to that rulemaking task, FAR 23.901(d)(2) was referring to the 4% water by weight for Rain:

*(2) Provide continued safe operation without a hazardous loss of power or thrust while being operated in rain for at least three minutes with the rate of water ingestion being not less than four percent, by weight, of the engine induction airflow rate at the maximum installed power or thrust approved for takeoff and at flight idle.*

It shall be noted that the FAR 23 wording until 1998 is the exact same wording as still existing today on CS-23 (since initial issue).

With the 1998 amendment, the FAR 23.901(d)(2) rule evolved to :

*(2) Ensure that the capability of the installed engine to withstand the ingestion of rain, hail, ice, and birds into the engine inlet is not less than the capability established for the engine itself under Sec. 23.903(a)(2).*

And did not change since then.

Interestingly, around the same period of time, JAR-E change 10 – 15 Aug 1999 included the outcome of NPA-E-27 which introduced the Rain and Hail engine rule (JAR E-790) as it still exists today in CS-E. The JAR E evolution for Rain and Hail came slightly after the FAR 33.78 evolution (Notice of Proposed Rulemaking. Notice No. 96-12; Issued on 02 FEB 96 and Final Rule Docket No. 28652; Issued on 20 MAR 98) that was revised along the FAR 23 rules still for same issue of Rain / Hail threats. As a result, JAR E.790 and FAR 33.78 were harmonised.

However during implementation of the Rain and Hail requirement for JAR-E, FAR 33 and FAR 23, the installation paragraph JAA 23.901(d)(2) did not evolve. No further evolution took

place with CS introduction at initial issue and its further amendments. As a consequence, its 4% water by weight of CS 23.901(d)(2) conflicts with CS 23.903(a)(1) which refers to CS E.790 / CS-E Appendix A and identify a 3% requirements.

Despite thorough research, the reasons for not amending JAR 23.901(d)(2) while updating CS E-790, FAR 33.78 and FAR 23.901(d)(2) are unclear.

There is no technical rationale for having the engine installation (i.e. air inlet) more capable to ingest rain than the engine certified capability.

It shall be noted that the CS-25/CS-27/CS-29, for the same Rain and Hail problematic, despite having different wording and rule layout, did not impose a greater capability for the installation than the engine itself.

It is proposed to issue a Special Condition, as per SC-E23.0901-01, Issue 2, that is inspired from the FAR 23 wording as follows:

## **Special Condition SC-E23.0901-01, Issue 2,**

### **Engine installation (rain conditions)**

Replace CS 23.901(d)(2) for CS-23 Amdt 1 to 4 with :

#### **GENERAL**

##### **CS 23.901 Installation**

\* \* \* \*

(d) Each turbine engine installation must be constructed and arranged to –

\* \* \* \*

(2) Ensure that the capability of the installed engine to withstand the ingestion of rain, hail, ice, and birds into the engine inlet is not less than the capability established for the engine itself under CS 23.903(a)(1).