

Proposed Special Condition Applicable to Self-Ignition Piston Engines (Diesel Engines)

Introductory note:

The hereby proposed Special Condition is subject to public consultation in accordance with [EASA Management Board 02/04, MB Decision n° 7-2004 products certification procedure, 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:

In service experience of self-ignition diesel piston engines has shown that unintended flame-out events could occur after prolonged descent at idle power setting and low outside air temperature conditions. The occurrence may not be immediately detectable by the pilot because the engine is still rotating due to the wind milling effect of the propeller in single engine installations. Once the flame-out has occurred, the engine is not responding anymore when the pilot commands a power increase. In-flight re-start of the engine may be difficult to achieve under certain environmental conditions.

Deleted: In-flight restart of the engine may be difficult to achieve if a proper in-flight restart procedure has not been provided.¶

Discussion:

EASA has considered that these events constitute a potential unsafe condition and Airworthiness Directives were issued when necessary to address this problem with already certified diesel piston engines.

The CS-E 240 »Ignition« paragraph ensures that the ignition system has a very high reliability. In combination with CS-E 50 »Engine Control System«, this gives confidence that a piston engine will not stop functioning in the declared flight envelope as long as the engine operating procedures are

followed. The ignition system also provides the ignition source for in-flight restart. But this paragraph is applicable to spark-ignition engines only. There is no specific requirement for self-ignition diesel engines. In difference to spark ignition engines which have an inherent in-flight relight capability (due to the spark ignition system) diesel engines do not have.

The properties of the fuel, especially the ignition delay time (quantified via cetane number) may have an impact on this problem. A low cetane fuel is considered to have a worse effect compared to a high cetane fuel. The cetane number of the fuel used for engine certification testing shall be recorded Engine Type Certificate Data Sheet but does not constitute an operating limitation.

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To maintain a level of safety which is equivalent between spark-ignition piston engines and self-ignition piston engines, EASA proposes to introduce a Special Condition in accordance with Part 21A.16B(a)(1) and 21A.16B(a)(3).

Proposed Special Condition:

All self-ignition piston Engines shall comply with the following:

The engine design and operating procedure must provide continued ignition capability under the intended operating conditions established in compliance with CS-E 40(d). This must be substantiated considering the fuel with the lowest cetane number by appropriate tests or other evidences. The cetane number of the fuel considered for the demonstration will be recorded in the Engine Type Certificate Data Sheet

The engine constructor must recommend an envelope of conditions for relighting in flight and must substantiate it by appropriate tests or other evidence. The recommendation must state all of the conditions applicable e.g. altitude, air speed, windmilling rotational speed, whether starter assistance is required, the recommended drill. Possible effects of low ambient temperature on re-light capability must be included in the development of the recommendation.

Deleted: All self-ignition piston Engines shall comply with CS-E 910 »Relighting in Flight«.

References:

EASA AD 2005-0029

EASA AD D-2005-145 (now superseded by AD 2010-0137)