

M-TS-0000448**Equivalent Safety Finding****Engine Thrust Control****1. APPLICABILITY**

This ESF is applicable to CS-25 “large aeroplanes” with rear-mounted engines, fitted with a single lever controlling the thrust delivered by two engines in normal operating conditions and a back-up control means (rotary knob) used in case of engine failure condition requiring to set up different thrust levels on each individual engine.

1.1 AFFECTED CS

CS 25.777(b); CS 25.779 (b)(1) ; CS 25.1143 (a) and (b)(1)

Nota: CS 25.1302 is not part of this ESF because EASA expects the full design to be fully compliant with CS 25.1302.

2. EQUIVALENT SAFETY FINDING

In lieu of direct compliance with *CS 25.1143 (a) and (b)(1)*, and provided that the compensating factors of § 3 are complied with, it is acceptable that, in normal operating conditions, a single thrust lever controls both engines.

EASA considers that the design complies with the intent of CS 25.1143 (a) and (b)(1). Under normal operating conditions, there is no need to individually control the thrust delivered by each engine. However, in the event of an engine failure condition requiring adjustment of the thrust delivered by one engine, the faulty engine can be controlled independently. This is achieved through the backup control means, which allows the pilot to manage the faulty engine's commands while continuing to control the other engine with the thrust lever or the autothrust function, if engaged.

In lieu of direct compliance with CS 25.779 (b)(1), it is acceptable for the backup control knobs to not operate as specified by that requirement, provided that the compensating factors of § 3 are met.

EASA considers that the design meets the intent of CS 25.779 (b)(1) because the backup control knobs are only used to set the thrust of the faulty engine in case of failure condition, rather than for continuous thrust control. The pilot continues to manage the aeroplane's energy using the thrust lever, which complies with CS 25.779 (b)(1) and ensures intuitive control to prevent confusion.

In lieu of direct compliance with CS 25.777(b) and provided that the compensating factors of § 3 are complied with, it is acceptable that the backup control knobs do not provide an off position and do not operate through an increasing range, to the full on position.

EASA considers that the design meets the intent of CS 25.777(b) since there is a stable “idle” position which is equivalent to the minimum thrust level that can be commanded in flight if there is no need for a stable full thrust position as there is no operational need to quickly access the maximum thrust value.

The “+” and “-” momentary position meets the intent of CS25.777(b) for incrementally controlling the engine thrust.

3. COMPENSATING FACTORS

The compensating factors summarized below shall be demonstrated to show an ESF to CS 25.1143 (a) and (b)(1) for the proposed design.

An operational case analysis, supported by analysis, flight or simulator tests shall be performed demonstrating that:

- There is no need to act separately on each engine in normal operating condition and that the single thrust lever is used in a similar way as traditional thrust controls,
- The proposed design complies with CS 25.1143 (a) and (b)(1) in abnormal operating conditions (presence of an engine failure condition) using the backup knobs and by the fuel cut off switch,
- The Autothrust function can be used without limitation in case of thrust lever jamming or other scenario leading to the loss of thrust control.

The compensating factors summarised below shall be demonstrated to show an ESF to 25.779(b) for the proposed design.

- The movement shall contribute to the objective of CS 25.779(b) to avoid confusion, to be intuitive and consistent in its application,
- An analysis, supported by test and in-service experience review shall demonstrate that the knobs only need to be used in case of engine failure condition and are capable to:
 - Allow intuitive and prompt pilot response to the specific engine failure conditions,
 - Optimise engine thrust setting to cope with the relevant operational procedures,
 - Be in line with the flight deck philosophy.
- Operational studies shall support the statement that the control knob is not used to continuously control the faulty engine but only to adapt the thrust of the engine.
- The thrust lever, which complies with CS 25.779(b), shall still control the healthy engine as in normal operating conditions.

The compensating factors summarised below shall be demonstrated to show an ESF to CS25.777(b) for the proposed design.

It shall be demonstrated that:

- The presence of an “Idle” stable position is equivalent to the full off stable position in this specific use case,
- The “Idle” position is used in the majority of operational cases requiring the backup knob activation,

- The proposed design allows intuitive and rapid selection of the requested engine thrust levels, through default setting of the latest thrust command upon selection of the neutral position and the introduction of “+” and “-” momentary positions and “Idle” position,
- There is no need of full on position on the backup control knobs to quickly access the maximum thrust value through the backup control knobs,
- There is no need for a continuous increase of thrust from full off to full on position.