EASA European Union Aviation Safety Agency	**Means of Compliance with the Special Condition EHPS** **Calibration Assurance**	Doc. No. : **MOC-EHPS.440** Issue : 1 Date : 12 March 2025 Proposed ☒ Final ☐

The document at hand, Doc. No. MOC-EHPS.440, contains the 1st publication of the proposed Means of Compliance to the SC E-19 requirement EHPS.440 Calibration Assurance.

All MOC publications of the SC E-19 will be consolidated in a single document in the Easy Access Rules (EAR) format for general convenience.

In this sense, the Statement of Issue and the structure of the document is the same for all of them.

Deadline to submit comments: 15 April 2025

Statement of Issue

EASA has received several requests for the type certification of electric engines and EHPS propulsion systems. In the absence of suitable certification specifications for the type certification of this type of product, a complete set of dedicated technical specifications in the form of a Special Condition for Electric/Hybrid Propulsion System was developed.

Specifically, the EHPS.10 requirement establishes the scope of application of the special condition, in which elements such as certified turbines and reciprocating engines or APUs having an ETSO could be reused in an EHPS.

The SC-E 19 design and safety objectives has been initiated from the CS-E while extracting the prescriptive text and therefore some paragraphs of the SC E-19 cover known technologies and designs of today's combustion engines and APUs.

In addition, the requirements of SC E 19 follow the approach previously used for the development of CS-23 Amendment 5, avoiding limiting technical innovation by describing prescriptive design solutions as certification standards.

The proposed Means Of Compliance (MOC) contained within this document fill this gap addressing the applicant's requests for clarification of EASA's interpretation of these objectives and of possibilities how to demonstrate compliance with them.

In this sense, the MOC included in this document may be updated with any necessary complement or modification, while additional MOC with different objectives in the Special Condition may also be incorporated in this document as necessary. During these revisions, EASA may recognise available Industry Standards as accepted SC E 19 Method of Compliance.

EASA may also accept other means to demonstrate compliance with the objectives contained in the Special Condition during the certification of a particular design. In doing so, EASA will thoroughly evaluate all MOC proposals and analyse their merits and associated justification. Subsequently EASA will establish whether the proposed MOC will ensure that the relevant safety objective in the Special Condition can be demonstrated as being fully met by it. The goal being to provide flexibility in the design of the EHPS whilst ensuring that the objectives of the Special Condition are satisfied and demonstrated by the applicant.

Structure of the document

The document provides clarifications of the rationale and intent of the SC- E 19 requirements referenced in the Scope of the document, as well as the links to other relevant requirements associated to these requirements.

For each specific relevant EHPS configuration (electric, reciprocating or turbine), one or more Means Of Compliance are then proposed.

When necessary, the document refers to Methods of Compliance, also defined as Level 3 MOC documents. The Method of Compliance can be parts or extracts from regulatory texts such as CS-E, FAR 33, AC guidance material, Certification Memo, Special Conditions, or Industry Standards.

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1 List of Acronyms

Acronym/Term	Definition
AC	*Advisory Circular (FAA)*
A/C	*Aircraft*
AMC	*Acceptable Means of Compliance*
AMT	*Accelerated Mission Test*
APU	*Auxiliary Power Unit*
CONOPS	*Concept of operations*
CFR	*Code of Federal Regulations (FAA)*
CPA	*Critical Point Analysis*
CS	*Certification Specification*
EASA	*European Union Aviation Safety Agency*
ED	*EUROCAE Standard*
EHPS	*Electric Hybrid Propulsion System*
ESS	*Energy Storage System*
FAA	*Federal Aviation Administration*
FAR	*Federal Aviation Regulation*
ICA	*Instructions for Continued Airworthiness*
IMI	*Initial Maintenance Inspection*
MoC	*Means of Compliance*
SC	*Special Condition*
VTOL	*Vertical Take-Off and Landing*
WG	*Working Group*

2 References

(1) CS-E, amendment 7
(2) CS-APU, amendment 1
(3) SC E-19: Electric / Hybrid Propulsion System, issue 1
(4) ED-321 Guidance Material for Endurance Substantiation of Electric/Hybrid Propulsion Systems
(5) [reserved]*

* to be updated when EUROCAE P-004 Guidance Material for Durability substantiation of Electric/Hybrid Propulsion Systems (EHPS) is published

3 Scope

This document proposes MOC for EHPS.440 Calibration Assurance intended for endurance and durability certification tests performed on electric hybrid propulsion systems. It explains the strategy how to use existing AMC material and published standards to show Compliance to EHPS.440. It also clarifies the relation with other paragraphs of SC E-19.

Other elements of the EHPS propulsion system, such as the propulsion batteries and the distribution system, as well as their interaction with other regulations where necessary, are not included in the scope of this document.

Finally, the scope of this document includes the proposed Means of Compliance for those EHPS systems that include turbines or piston engines in hybrid-electric architectures.

The sections of the SC E-19 where no appropriate means to demonstrate compliance (ie. Industry Standard) has been published yet and, consequently, there is no Method of Compliance associated, are tagged as “Reserved”.

4 Requirements

4.1 SC E-19

4.1.1 Requirements

The requirements to be considered within this MOC are provided in Reference (3)(3).

- EHPS.440 Calibration Assurance

Additional requirements are related to this MOC:

- EHPS.40 Ratings and operating limitations
- EHPS.50 Materials
- EHPS.410 General conduct of tests
- EHPS.420 Endurance Demonstration
- EHPS.430 Durability Demonstration
- EHPS.450 Teardown Inspection

4.1.2 EHPS.440 General information

EHPS.440 requires calibration tests that are necessary to establish its power characteristics and the conditions both before and after the required endurance and durability demonstrations.

4.1.3 EHPS – Hybrid systems

When the EHPS includes already certified turbines, reciprocating engines or APU's, credit may be taken from the performances, limitations and installation procedures established in the certificate.

4.1.4 Associated Interpretative Material / Means of Compliance of SC E-19

EUROCAE ED-321	Guidance Material for Endurance Substantiation of Electric Hybrid Propulsion
CS-E 350	Calibration test and related AMC E 350 (Piston engine)
CS-E 730	Engine Calibration Test (Turbine engine)

5 Means of compliance for *electric engines*

The objective of performing calibration tests is to establish the power characteristics of the engine, under all normal operating conditions within the declared flight envelope.
Apart from this, it's also a mean to detect degradation of the engine and assess its functional and safety impacts.

In order to identify the engine power changes that may occur during the endurance and durability tests of EHPS.420 and EHPS.430, sea level power calibration curves of the test engine need to be established at the beginning and the end of the endurance and durability test.

5.1 Methodology for endurance

Compliance Strategy for the endurance test by ED-321

ED-321, Chapter 8 provides detailed Guidance on calibration sequences and pass-fail criteria for the initial and final calibration tests to be performed. It also highlights the test data that needs to be recorded and analysed. The resulting calibration curves should be established up to the highest rating to be declared.

ED-321 also points to the engine electric engine vibration signature to be established during both initial and final calibrations, and guidance on how to perform these tests by covering the range from minimum to maximum permissible rotor speeds.

5.1 Methodology for durability

Compliance Strategy for the durability test by ED P004.

[reserved]

The compliance strategy follows a similar approach as defined by the substantiation in ED-321.

However, the durability calibration may pursue different objectives which may include aspect such as susceptibility to partial discharge, insulation degradation, etc. (ref. to IEC 60034-18-41).

Section to be updated once (5) is publish.

6 Means of compliance to EHPS.430 for *turbine engines*

For turbine engines used in an EHPS the CS-E 730 and it associated AMC 730 can be used.

7 Means of compliance to EHPS.430 for *piston engines*

For piston engines used in an EHPS the CS-E 350 and it associated AMC 350 can be used.

8 Means of compliance to EHPS.430 for *generator(s)*

[Reserved]

9 Means of compliance to EHPS.430 for emergency electric engines.

[Reserved]