EASA European Union Aviation Safety Agency	**Means of Compliance with the Special Condition EHPS** **Ratings and Operating Limitations**	Doc. No. : **MOC-EHPS.40** Issue : 1 Date : 19 December 2024 Proposed ☒ Final ☐

The document at hand, Doc. No. MOC-EHPS.40, contains the 1st publication of the proposed Means of Compliance to the SC E-19 requirement EHPS.40 - Ratings and operating limitations.

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: 01 March 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.

Table of contents

1 List of Acronyms

Acronym/Term	Definition
APU	Auxiliary Power Unit
AMC	Acceptable Means of Compliance
EHPS	Electric Hybrid Propulsion System
MOC	Means Of Compliance
LOP	Loss of Power
IOM	Installation Operating Manual

2 Reference Documents

1. SC E-19: Electric / Hybrid Propulsion System
2. CS-E amendment 7
3. CS-APU amendment 1
4. Eurocae ED 321 issue 1
5. IEC60034-1_ed13

3 Scope

This document proposes Means of Compliance to EHPS.40 - Ratings and operating limitations for electric engines, reciprocating engines or turbine engines being part of the Type Design under certification. It explains the strategy how to use existing AMC material and published standards to show Compliance to EHPS.40.

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.

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 under consideration.

4.1 SC E-19

The scope of the SC E-19 is defined in EHPS.10.

4.1.1 Requirements

The requirement to be considered under this MOC is provided in Reference [1].

- EHPS.40 Ratings and operating limitations

Additionally, the following requirements are related to this MOC:

- EHPS.420 Endurance Demonstration
- EHPS.430 Durability Demonstration
- EHPS.480 (c) Specific Operation.

4.1.2 EHPS.40 – general information

EHPS.40 paragraph has been derived from the CS-E 40.

The appearance of the EHPS system integrating electric engines has enable new propulsion architectures such as the distributed propulsion that may require the definition of new ratings. This MoC gives guidance on how to define these ratings.

4.1.2.1 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.

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

The following standards can be used when proposing the verification methods for the EHPS.40

EUROCAE ED-321: provides Guidance on the intend of EHPS.420 and the strategy to demonstrate compliance to the endurance substantiation. The document also provides some guidance to other requirements in the context of the endurance demonstration, including EHPS.40.

IEC60034-1_ed13: provides Guidance on the concept of duty Cycle.

EHPS.480 (c): The Means of Compliance should at least cover CS-E 920 (Over-temperature Test).

4.2 CS – E

4.2.1 Link of EHPS.40 with CS-E 920

CS-E 920 requires for declared powers of less than 2 minutes, that the motor maintains its integrity while operating at temperatures 19°C above the declared maximum operating temperature for that power rating. The same philosophy must be used for electric motors declaring power ratings of less than 2 minutes.

5 Means of Compliance for Electric Engine

5.1 Methodology

ED-321 main objective is to provide guidance on the intend of EHPS.420 and the strategy to demonstrate compliance to the endurance substantiation. However, this document also offers some guidance on EHPS.40.

Chapter 3 of ED-321 provides a methodology to define the EHPS rating structure and associated operating limitations. The process starts by identifying the aircraft operational phases (take-off, climb, cruise, landing, etc..) and the emergency situations that may occur during these phases. The second step is to determine the power/thrust demand for each phase of flight and its duration. Finally, the operating limitations are determined for each rating.

Engine to engine variation, performance deterioration mechanisms and control system accuracy should be considered to determine the operating conditions at which the lowest thrust or power of a rating is obtained to declare the operating limitations.

In this regard, a minimum efficiency of the electric engine shall be established and declared in the IOM.

- IEC60034-1_ed13

Chapter 4 of IEC60034-1_ed13 introduces the concept of duty cycle and defines the more common types.

Chapter 5 describes the assignment of ratings depending on the type of duty cycle.

For example, the rating maximum continuous power will be associate to S1 duty cycle for which thermal stabilization is expected.