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Electrical insulation systems - Procedures for thermal evaluation - Part 42: Specific requirements for evaluation of an electrical insulation system (EIS) used for road transportation applications

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FOREWORD

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IEC TS 61857-42 was prepared by IEC technical committee 112: Evaluation and qualification of electrical insulating materials and systems.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
112/681/DTS	112/687/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 61857 series, published under the general title *Electrical insulation systems – Procedures for thermal evaluation*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

As per today all standards to evaluate the lifetime of electrical insulation system (EIS) are linked to the needs of industrial motors (e.g. IEC 60034-18-21 [1] developed in IEC TC 2 and IEC 61857-21 [2] developed in IEC TC 112). Drivetrain units for road transportation applications can have a similar technical concept to industrial motors but are different from them in terms of their operational demands. They mostly operate at variable loads and speeds, at increased mechanical stresses, at variable climatic conditions , and are powered from battery voltage levels such that they can pose a greater risk of partial discharges.

The aim of this document is to close this gap and to provide users with a suitable test procedure to evaluate the EIS in drivetrain units for road transportation.

As a key example, one parameter is the estimated lifetime of the unit. While industrial motor EIS is typically qualified based on a thermal evaluation of 20 000 h lifetime, drivetrain units for passenger cars are designed for a typical lifetime of 8 000 h. This document gives guidance on how to adjust the test procedure for the thermal evaluation to the particular and unique need of the individual application.

Other influences on the EIS, like compatibility with cooling fluids (oils), different mechanical load profiles are possible to screen by using a multifactor evaluation and an adjusted lifetime can be calculated.

In the IEC 61857 series, thermal ageing is the dominant ageing stress for the evaluation and qualification of EIS. The test is established for general purpose models (GPMs) or simple models (such as partial segments of a motor stator), all the way to full stator designs and takes into account specific winding configurations such as round wire (random windings) and rectangular wire (e.g. hairpin).

Due to the new content and a lack of test results based on the new test geometry, this document is published as a Technical Specification.

1 Scope

This document provides a procedure to evaluate the lifetime of an electrical insulation system (EIS) in a drivetrain unit within road transportation (automotive) applications. Typical applications include motors and generators in hybrid and full electric passenger vehicles, light-duty and heavy-duty commercial vehicles, as well as buses.

In general, the IEC 61857 series is applicable to EIS used in electrotechnical products with an input voltage of up to 1 000 V where the predominant ageing factor is thermal. In the context of this document the limit of 1 000 V is understood to be the application-specific battery DC voltage.

The EIS evaluated by this procedure will operate free from partial discharges over its whole lifetime.

Evaluation of EIS in the following applications is outside the scope:

– motors and generators within the scope of IEC TC 2, Rotating machinery;
– rail traction machines in the scope of IEC TC 9, Electrical equipment and systems for railways;
– motors and generators for road vehicles that are not intended for the traction of them.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60216-5, *Electrical insulating materials - Thermal endurance properties - Part 5: Determination of relative temperature index (RTI) of an insulating material*

IEC 61857-1, *Electrical insulation systems - Procedures for thermal evaluation - Part 1: General requirements - Low-voltage*

IEC TS 61934, *Electrical insulating materials and systems - Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61857-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
electrical insulation system
EIS
insulating structure containing one or more electrical insulating materials together with associated conducting parts employed in an electrotechnical device