

TECHNICAL SPECIFICATION

**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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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
3.14 Terms related to Annex C.....	9
4 General considerations	11
4.1 Approach to qualification of EIS for road transportation applications.....	11
4.2 Overview of test procedure.....	11
4.3 Thermal endurance considerations for electrical insulating materials	13
4.4 Chemical compatibility considerations for electrical insulating materials	13
5 Test objects.....	14
5.1 Test object selection	14
5.2 General purpose models	15
5.3 Prototype parts for design qualification	15
6 Initial diagnostic subcycle	17
6.1 Overview	17
6.2 Initial impulse partial discharge test.....	17
6.3 Mechanical stress exposure	17
6.4 Cold exposure.....	18
6.5 Moisture exposure.....	18
6.6 Initial dielectric diagnostic test.....	18
7 Thermal ageing	19
7.1 General.....	19
7.2 Ageing periods and temperatures	19
7.3 Methods of heating.....	20
7.4 Ageing procedure.....	20
7.5 Confidence in a projected thermal rating	21
8 Diagnostic subcycle.....	21
8.1 Overview	21
8.2 Impulse partial discharge test and alternative test procedures.....	21
8.3 Mechanical stress exposure and alternative test procedures	22
8.4 Cold exposure and alternative test procedures.....	22
8.5 Moisture exposure and alternative test procedures.....	22
8.6 Dielectric diagnostic test	22
8.7 Other diagnostic tests	23
9 Analysing, reporting and classification.....	23
9.1 End-point criterion.....	23
9.2 Method of determining life	24
9.2.1 End of life	24
9.2.2 Average life	24
9.3 Extrapolation of data	25
9.3.1 Projected life and confidence limits.....	25
9.3.2 Extrapolation of data - Example.....	25
9.4 Utilization of ageing data for different life requirements	27
9.5 Report of results	27

10	Evaluation of data from candidate EIS and reference EIS	28
10.1	General.....	28
10.2	Determining qualification	28
10.3	Qualification cases.....	28
10.3.1	Case A: Qualification for the same class temperature and same expected service life	28
10.3.2	Case B: Qualification for the same class temperature and a different expected service life	29
10.3.3	Case C: Qualification for a different class temperature and same expected service life	30
10.3.4	Case D: Qualification for a different class temperature and different expected service life	31
11	Evaluation of ageing factors in addition to thermal.....	32
11.1	General.....	32
11.2	Multifactor evaluation examples.....	33
11.2.1	Combined thermal and mechanical stress evaluation (EIS_{TM}).....	33
11.2.2	Combined thermal and electrical stress evaluation (EIS_{TE}).....	33
11.2.3	Thermal evaluation of an EIS when combined with a liquid (EIS_{TA}).....	34
11.3	Cases of multifactor candidate EIS qualification	34
11.4	Single or multiple temperature multifactor evaluation	34
11.5	Analysis of results from multifactor evaluation.....	35
Annex A (informative)	Chemical compatibility of electrical insulating materials with cooling fluids	38
Annex B (informative)	GPM construction: Hairpin formette	39
B.1	Arrangement of hairpin formette	39
B.2	Components of hairpin formette	39
B.3	Assembly of hairpin formette	41
B.4	Test positions in hairpin formette	41
Annex C (normative)	Derivation of peak-to-peak test voltages for a diagnostic impulse PD test.....	42
C.1	General.....	42
C.2	Derivation of maximum allowable peak-to-peak voltages in service	42
C.3	Example of calculation of maximum allowable voltages in operation	45
C.4	Enhancement factors.....	46
C.4.1	PD safety factor	46
C.4.2	Temperature enhancement factor	46
C.4.3	Ageing factor	46
C.5	Derivation of peak-to-peak test voltages	47
Annex D (informative)	Additional discussion on analysis of test data	48
Bibliography	50
Figure 1	– Test procedure flowchart	12
Figure 2	– Example for a segmented stator	15
Figure 3	– Example for a prototype stator	16
Figure 4	– Arrhenius plot – for example ageing.....	26
Figure 5	– Case A: Candidate EIS qualified for the same thermal class and the same expected service life	29

Figure 6 – Case B: Candidate EIS qualified for the same thermal class and different expected service life	30
Figure 7 – Case C: Candidate EIS qualified for a different class temperature and the same expected service life	31
Figure 8 – Case D: Candidate EIS qualified for a different service life and different thermal class from the reference	32
Figure 9 – Multifactor Case A : Multifactor candidate EIS EIS_{TX} qualified for the same class temperature and the same expected service life	36
Figure 10 – Multifactor Case C - Multifactor candidate EIS EIS_{TX} qualified for a different (lower) class temperature and the same expected service life	37
Figure B.1 – A three-dimensional view of a suitable hairpin formette made with steel frame and pairs of bolted L-shaped slot plates.....	39
Figure B.2 – Three-dimensional view of hairpin formette frame	40
Figure B.3 – Drawing of hairpin formette frame.....	40
Figure C.1 – Voltage impulse waveshape parameters	43
Figure C.2 – Jump voltage (U_j) associated with a converter drive.....	43
Figure C.3 – Comparison of phase-to-phase (left), phase-to-ground (centre), and turn-to-turn (right) voltages for a two-level converter.....	44
Figure C.4 – Worst-case voltage stressing the turn-to-turn insulation in a variety of random wound stators as a function of the impulse rise time.....	45
Figure D.1 – Arrhenius plot – using low average passing times	48
Figure D.2 – Arrhenius plot – using minimum passing times	49
Table 1 – Guidance for test object selection	14
Table 2 – Initial dielectric diagnostic test settings	18
Table 3 – Suggested ageing temperatures and ageing periods.....	20
Table 4 – Test voltages.....	23
Table 5 – Example of calculated failure times for a 24-h ageing cycle at 235 °C	24
Table 6 – Log average life of set of test objects – 24-h ageing cycle at 235 °C	24
Table 7 – Log average life of set of test objects – 96-h ageing cycle at 215 °C	25
Table 8 – Log average life of set of test objects – 288-h ageing cycle at 195 °C	25
Table 9 – Data for Arrhenius plot.....	26
Table 10 – Conditions for qualification of candidate EIS.....	28
Table 11 – Overview on IEC 62332 series [20]	34
Table C.1 – Summary of enhancement factors to be applied to the operating voltages	46

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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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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