IEC/TR 62662

Edition 1.0 2010-08

TECHNICAL REPORT

colour inside

Guidance for production, testing and diagnostics of polymer insulators with respect to brittle fracture of core materials

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE Q

ICS 29.080.10

ISBN 978-2-88912-172-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

GUIDANCE FOR PRODUCTION, TESTING AND DIAGNOSTICS OF POLYMER INSULATORS WITH RESPECT TO BRITTLE FRACTURE OF CORE MATERIALS

FOREWORD

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IEC 62662, which is a technical report, has been prepared by IEC technical committee 36: Insulators.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
36/294/DTR	36/297/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
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A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

There is an urgent need within utilities and industry for material standards, which define the physical properties of the polymers applied for outdoor insulation. As a first step, a state-of-the-art report was issued by CIGRE which led to the publication of IEC 62039. This IEC technical report presents – as a conclusion of the CIGRE-report – the important material properties for polymeric materials used in outdoor insulation and, where applicable, lists the standardized test methods including the minimum requirements. The acid (brittle fracture) resistance of FRP core materials (see 3.7) was recognized as an important property for suspension/tension composite insulators. This technical report presents more detailed guidance on this subject taking into account different insulator designs and production techniques. The risk of occurrence and the influencing parameters were evaluated by failure mode effect analysis (FMEA). Brittle fracture is not the only failure mechanism for insulators in service and is generally less frequently observed than other modes, such as failure due to tracking and erosion. However, this subject is not yet covered by any IEC test procedures specifically designed to detect or prevent brittle fracture.

GUIDANCE FOR PRODUCTION, TESTING AND DIAGNOSTICS OF POLYMER INSULATORS WITH RESPECT TO BRITTLE FRACTURE OF CORE MATERIALS

1 Scope

This technical report presents an analysis of the risk of influencing factors for brittle fracture of composite insulators that are mostly loaded in the tensile mode (suspension and tension insulators). Guidance is given to reduce the risk of in-service brittle fractures.

This phenomenon is limited to tension and suspension insulators. However, the general information given concerning the importance of various parameters can be used as a guideline for the design and production of any kind of composite insulator.

2 Normative references

The following referenced documents are indispensable for the application 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 61109, *Insulators for overhead lines – Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V – Definitions, test methods and acceptance criteria.*

IEC/TR 62039, *Selection guide for polymeric materials for outdoor use under HV stress*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
fibre reinforced plastic material
FRP
composite material consisting of reinforcing components e.g. glass or synthetic fibres that are embedded in a polymer matrix e.g. epoxy or polyester. The FRP core is the integral load-carrying part of a composite insulator

3.2
stress corrosion cracking
SCC
failure of material subjected to a constant tensile stress in a corrosive environment

3.3
brittle fracture
abnormal and sudden breakage of FRP core materials with well-defined characteristic fracture patterns

NOTE Before brittle fracture, no apparent plastic deformation takes place. In the case of FRP core materials, brittle fracture is caused by SCC.

3.4
failure mechanism
principal and fundamental process that leads to a characteristic failure, e.g. brittle fracture