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IEC/TS 62073, Ed.1.0 (2003)

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Australian Standard™

Guidance on the measurement of wettability of insulator surfaces

STANDARDS AUSTRALIA

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Australasian Railway Association
Australian Chamber of Commerce and Industry
Australian Electrical and Electronic Manufacturers Association
Australian Porcelain Insulators Association
Electricity Engineers Association (New Zealand)
Energy Networks Association

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Guidance on the measurement of wettability of insulator surfaces

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PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/ Standards New Zealand Committee EL-010, Overhead Lines. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian, rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide users and manufacturers of insulators with guidance on the measuring of wettability of insulator surfaces.

This Standard is identical with, and has been reproduced from IEC/TS 62073, Ed. 1.0 (2003), *Guidance on the measurement of wettability of insulator surfaces*.

As this Standard is reproduced from an International Standard, the following applies:

(a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.

(b) In the source text 'this international standard' should read 'this Australian Standard'.

(c) A full point should be substituted for a comma when referring to a decimal marker.

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The terms 'normative' and 'informative' are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

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INTRODUCTION

The wetting properties of a surface by water are commonly described by the terms hydrophobic (or hydrophobicity) and hydrophilic (or hydrophilicity). A hydrophobic surface is water-repellent, while a surface that is easily wetted by water is hydrophilic.

The wetting phenomenon of a surface is complex and many different parameters can influence its apparent wettability. Some important parameters include: type of insulator material, surface roughness, heterogeneities of the surface, chemical composition (e.g. due to ageing) and presence of pollution. For some of the insulator materials in common use, the wetting properties can change over time, due to the influence of the ambient conditions. This change can be either reversible or irreversible. Thus, the result of the measurement of the wettability may be influenced by the ambient conditions and the HV corona or dry-band ageing to which the insulator has been previously exposed. This dynamic wetting behaviour is more or less specific to different insulator materials.

The dynamic wetting behaviour exhibited by insulator materials is due to their chemical composition. Different processes such as oxidation, hydrolysis, migration of low molecular weight compounds, formation of complex compounds between e.g. siloxanes and water, rotation of flexible polymer chains, inter- and intra-molecular rearrangements, microbial growth, deposition of contaminants, adhesion and encapsulation of contaminant particles, may take place at different rates, depending on material and ambient conditions. Thus, wettability along and around an insulator can vary, due to differences in the exposure to solar radiation, rain, corona discharges, deposited pollution, etc. Therefore, wettability measurement of insulators should be performed on several separate areas of the insulator.

Measurement of the wettability of a surface is readily performed in the laboratory on well defined, homogeneous, smooth and planar surfaces of prepared specimens. In the case of insulators, for which non-destructive measurements are usually required (and where cut-out of material samples is usually not desired), these conditions do not exist and measurement with high precision is a difficult task. This is especially true when the measurement has to be performed on an insulator installed in an overhead line, substation or even in a high voltage test set-up in the laboratory.

NOTES

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Australian Standard

Guidance on the measurement of wettability of insulator surfaces

1 Scope and object

The methods described in this technical specification can be used for the measurement of the wettability of the shed and housing material of composite insulators for overhead lines, substations and equipment or ceramic insulators covered or not covered by a coating. The obtained value represents the wettability at the time of the measurement.

The object of this standard is to describe three methods that can be used to determine the wettability of insulators. The determination of the ability of water to wet the surface of insulators may be useful to evaluate the condition of the surface of insulators in service, or as part of the insulator testing in the laboratory.

2 Terms and definitions

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

2.1
wettability
ability of a surface to be wetted by a liquid (e.g. water)

2.2
hydrophobicity and hydrophilicity

2.2.1
hydrophobicity
low level of wettability by water of a surface. A hydrophobic surface has a low surface tension and thus is water-repellent

2.2.2
hydrophilicity
high level of wettability by water of a surface. A hydrophilic surface has a high surface tension and thus is wetted by water (in the form of a film)

2.3
surface tension
interfacial tension
region of finite thickness (usually less than 0,1 μm) in which the composition and energy vary continuously from one bulk phase to the other. The pressure (force field) in the interfacial zone has a gradient perpendicular to the interfacial boundary. A net energy is required to create an interface (surface) by transporting the matter from the bulk phase to the interfacial (surface) zone. The reversible work required to create a unit interfacial (surface) area is the surface tension and is defined thermodynamically as follows:

$$\gamma = \left(\frac{\partial G}{\partial A} \right)_{T,P,n}$$