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BSI Standards Publication

UHV AC transmission systems

Part 101: Voltage regulation and insulation design

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Part 101: Voltage regulation and insulation design

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 63042-101, which is a Technical Specification, has been prepared by IEC technical committee 122: UHV AC transmission systems.

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

Enquiry draft	Report on voting
122/60/DTS	122/70A/RVDTS

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

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

A list of all parts in the IEC 63042 series, published under the general title *UHV AC transmission systems*, 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 "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Large-scale power sources including renewable energy have recently been developed. To meet the requirements for large power transmission capacity, some countries have introduced, or are considering introducing, ultra high voltage (UHV) transmission systems, overlaying these on the existing transmission systems at lower voltages such as 420 kV and 550 kV.

However, the introduction of UHV AC also presents many challenges to planners and operators. One of the major challenges is the management and control of system voltage and reactive power control. Reactive power control is normally used to address power frequency voltage requirements and maintain the voltage under transient conditions. Suitable insulation designs and coordination procedures are adopted in order to control transient overvoltages and prevent damage to equipment.

The objective of UHV AC power system design is to achieve both economic efficiency and high reliability, considering its impact on systems at lower voltages such as 420 kV and 550 kV. Long-distance transmission lines in particular generate a large amount of charging reactive power (Mvar) that could cause the system voltage to rise significantly. For example, when energizing a transmission line, the terminal voltage at the remote end could reach an unacceptable level. Reactive power compensation is implemented to ensure that the UHV AC system operates within an adequate voltage range under normal conditions and any contingency conditions that the system is designed to withstand.

Moreover, effective insulation design that limits internal electric field stress is important for minimizing and optimizing the size and structure of UHV AC transmission lines and substation apparatus. This document provides technical specifications on insulation design and coordination, reactive power compensation design and voltage regulation that are essential for maintaining UHV AC transmission systems so that they operate safely and efficiently.

UHV AC TRANSMISSION SYSTEMS –

Part 101: Voltage regulation and insulation design

1 Scope

This part of IEC 63042 specifies reactive power compensation design, voltage regulation and control, and insulation design for the coordination of UHV AC transmission systems.

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 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

3 Terms and definitions

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

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

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

3.1
voltage deviation
difference between the actual voltage and nominal system voltage under continuous operating conditions

3.2
network node
<in power networks> any point where two or more transmission lines meet

3.3
controllable shunt reactor
CSR
high voltage shunt reactor whose capacity can be adjusted

3.4
continuous controllable shunt reactor
CCSR
high voltage shunt reactor whose capacity can be adjusted continuously

3.5
multi-stage controllable shunt reactor
MCSR
type of controllable shunt reactor, based on the principle of high impedance transformers whose reactive power output usually varies in discrete stages and is achieved by controlling transistors, circuit-breakers and other devices