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BSI Standards Publication

Electromagnetic performance of high voltage direct current (HVDC) overhead transmission lines

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee PEL/22, Power electronics.

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROMAGNETIC PERFORMANCE OF HIGH VOLTAGE DIRECT CURRENT (HVDC) OVERHEAD TRANSMISSION LINES

FOREWORD

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IEC TR 62681, which is a technical report, has been prepared by IEC technical committee 115: High Voltage Direct Current (HVDC) transmission for d.c. voltages above 100 kV.

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

Enquiry draft	Report on voting
115/71/DTR	115/84/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,
- withdrawn,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 publication using a colour printer.

INTRODUCTION

Electric fields and magnetic fields are produced in the vicinity of an HVDC transmission line. When the electric field at the conductor surface exceeds a critical value, known as the corona onset gradient, positive or negative free charges leave the conductor and interact with the surrounding air and ionization takes place in the layer of surrounding air, leading to the formation of corona discharges. The corona discharge will not only bring out corona loss but also produce electromagnetic environment problems.

The parameters used to describe the electromagnetic environment of an HVDC transmission line mainly include the:

1) electric field,
2) ion current,
3) magnetic field,
4) radio interference,
5) audible noise.

To control these parameters in a reasonable and acceptable range, for years, a great deal of theoretical and experimental research was conducted in many countries and relevant national standards or enterprise standards were developed. This Technical Report collects and records the status of study and progress of electric fields, ion current, magnetic fields, radio interference, and audible noise of HVDC transmission lines.

ELECTROMAGNETIC PERFORMANCE OF HIGH VOLTAGE DIRECT CURRENT (HVDC) OVERHEAD TRANSMISSION LINES

1 Scope

This Technical Report provides general guidance on the electromagnetic environment issues of HVDC transmission lines. It concerns the major parameters adopted to describe the electromagnetic environment of a High-Voltage Direct Current (HVDC) transmission line, including electric fields, ion current, magnetic fields radio interference, and audible noise generated as a consequence of such effects. Engineers in different countries can refer to this Technical Report to:

– ensure the safe operation of HVDC transmission lines,

– limit the influence on the environment within acceptable ranges, and

– optimize engineering costs.

2 Terms and definitions

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

2.1
corona
set of partial discharges in a gas, immediately adjacent to an uninsulated or lightly insulated conductor which creates a highly divergent field remote from other conductors

[SOURCE: IEC 60050-212:2010, 212-11-44, modified – Note 1 has been deleted.]

2.2
electric field
constituent of an electromagnetic field which is characterized by the electric field strength E together with the electric flux density D

Note 1 to entry: In the context of HVDC transmission lines, the electric field is affected not only by the geometry of the line and the potential of the conductor, but also by the space charge generated as a result of corona; consequently, electric field distribution may vary non-linearly with the line potential.

[SOURCE: IEC 60050-121:1998, 121-11-67, modified – Note 1 to entry has been added.]

2.3
space-charge-free electric field
electric field due to a system of energized electrodes, excluding the effect of space charge present in the inter-electrode space

2.4
ion current
flow of electric charge resulting from the motion of ions

2.5
magnetic field
constituent of an electromagnetic field which is characterized by the magnetic field strength H together with the magnetic flux density B

[SOURCE: IEC 60050-121:1998, 121-11-69, modified – Note 1 has been deleted.]