AS IEC 61000.6.5:2017
IEC 61000-6-5:2015
IEC 61000-6-5:2015/COR1:2017
(Incorporating Amendment No. 1)

Australian STANDARD®

STANDARDS Australia

Electromagnetic compatibility (EMC)

Part 6.5: Generic standards — Immunity for equipment used in power station and substation environment

AVA Documents
Document Sharing Hub

AS IEC 61000.6.5:2017

This Australian Standard was prepared by the Standards Australia Committee TE-003, Electromagnetic Compatibility. It was approved on behalf of the Council of Standards Australia on 3 April 2017.

This Standard was published on 24 May 2017.

The following are represented on Committee TE-003:

Australian Communications and Media Authority
Australian Industry Group
Australian Information Industry Association
Consumer Electronics Suppliers Association
Curtin University of Technology
Department of Defence (Australian Government)
Electrical Compliance Testing Association
EMC Society of Australia
Energy Networks Australia
Engineers Australia
Free TV Australia
Lighting Council Australia
National Measurement Institute
Wireless Institute Australia

This Standard was issued in draft form for comment as DR AS IEC 61000.6.5:2017.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:
www.standards.org.au

ISBN 978 1 76035 773 3

Documents
Document Sharing Hub

Full document details: AS IEC 61000.6.5-2017 (2023)

AS IEC 61000.6.5:2017
IEC 61000-6-5:2015
IEC 61000-6-5:2015/COR1:2017
(Incorporating Amendment No. 1)

Electromagnetic compatibility (EMC)

Part 6.5: Generic standards — Immunity for equipment used in power station and substation environment

First published as AS IEC 61000.6.5:2017.
Reissued incorporating Amendment No 1 (June 2023).

© IEC 2023 — All rights reserved
© Standards Australia Limited 2023

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of either the IEC or the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth). If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please see the contact details on the back cover or the contact us page of the website for further information.

Documents
Document Sharing Hub

Full document details: AS IEC 61000.6.5-2017 (2023)

Preface

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee TE-003, Electromagnetic Compatibility.

〈A1〉Amendment No. 1 to this Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee TE-003, Electromagnetic Compatibility.〈A1〉

The objective of this Standard is to specify EMC immunity requirements which apply to electrical and electronic equipment intended for use in power stations and substations.

〈A1〉This Standard is identical with, and has been reproduced from IEC 61000-6-5:2015 (ED.1.0), *Electromagnetic compatibility (EMC), Part 6-5: Generic standards—Immunity for equipment used in power station and substation environment* and its Corrigendum 1 (2017), which has been added at the end of the source text.〈A1〉

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

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

(a) In the source text “this part of 61000” should read “this Australian Standard”.

(b) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific standards.

The term “informative” has been used in this Standard to define the application of the annex to which it applies. An “informative” annex is only for information and guidance.

© Standards Australia Limited 2023

Full document details: AS IEC 61000.6.5-2017 (2023)

NOTES

Documents
Document Sharing Hub

Full document details: AS IEC 61000.6.5-2017 (2023)

CONTENTS

FOREWORD 4
INTRODUCTION 6
1 Scope and object 7
2 Normative references 8
3 Terms, definitions and abbreviations 9
3.1 Terms and definitions 9
3.2 Abbreviations 12
4 Electromagnetic environment 12
5 Performance criteria 16
6 Conditions during testing 18
7 Product documentation 19
8 Applicability 19
9 Measurement uncertainty 20
10 Immunity requirements 20
10.1 General 20
10.2 Immunity test requirements for equipment in power stations 20
10.3 Immunity test requirements for equipment in substations 24
Annex A (informative) Information on electromagnetic phenomena, typical sources and causes 29
Annex B (informative) Overview of the effect of the electromagnetic phenomena on the functions of equipment and systems 30
Annex C (informative) Guidelines for protected zones – Mitigation of radiated and conducted disturbances 34
C.1 General 34
C.2 General approach 34
C.3 Classification of protection zones 35
C.3.1 General 35
C.3.2 Zone 1 – Building shield 36
C.3.3 Zone 2 – Room shield 36
C.3.4 Zone 3 – Equipment shield 37
C.3.5 Zone 4 – Additional protection 37
C.4 Design principles for shielding 37
C.5 Shielding effectiveness 37
Annex D (informative) Guidance for the user of this standard 39
Bibliography 40

Figure 1 – Equipment ports 10
Figure 2 – Example of the situation of a power station 14
Figure 3 – Example of the situation of an air-insulated substation (AIS) 15
Figure 4 – Example of the situation of a gas-insulated substation (GIS) 16
Figure C.1 – Equipment ports 34
Figure C.2 – Zones of protection of shielding and earthing systems 36

Documents
Document Sharing Hub

© Standards Australia Limited 2023

Full document details: AS IEC 61000.6.5-2017 (2023)

Table 1 – Characterization of the electromagnetic phenomena 13
Table 2 – Suggested performance criteria for some representative functions 18
Table 3 – Immunity requirements – Power station – Enclosure port 21
Table 4 – Immunity specifications – Power station – Signal/control ports 22
Table 5 – Immunity specifications – Power station – Low voltage a.c. input and output power ports 23
Table 6 – Immunity specifications – Power station – Low voltage d.c. input and output power ports 24
Table 7 – Immunity specifications – Substation – Enclosure port 25
Table 8 – Immunity specifications – Substation – Signal/control ports 26
Table 9 – Immunity specifications – Substation – Low voltage a.c. input and output power ports 27
Table 10 – Immunity specifications – Substation – Low voltage d.c. input and output power ports 28
Table A.1 – Electromagnetic phenomena – Sources and causes 29
Table D.1 – Immunity tests and test levels to be considered in the future or for particular product families 39

Documents
Document Sharing Hub
© Standards Australia Limited 2023
Full document details: AS IEC 61000.6.5-2017 (2023)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 6-5: Generic standards – Immunity for equipment used in power station and substation environment

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61000-6-5 has been prepared by committee 77: Electromagnetic compatibility (EMC).

This first edition cancels and replaces the first edition of IEC TS 61000-6-5 published in 2001. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) the scope is extended in order to cover also power generating systems in industrial facilities;
b) the locations under consideration, i.e. power stations and substations are described in more detail;
c) performance criteria and the EUT functions they apply to are reviewed;

Documents
Document Sharing Hub

© Standards Australia Limited 2023

Full document details: AS IEC 61000.6.5-2017 (2023)

d) immunity requirements are reviewed and more specifically related to the relevant locations;

e) informative annexes for guidance and on protected zones are added.

The text of this standard is based on the following documents:

FDIS	Report on voting
77/484/FDIS	77/500/RVD

Full information on the voting for the approval of this standard 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.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

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.

The contents of the corrigendum of December 2017 have been included in this copy.

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.

Documents
Document Sharing Hub
© Standards Australia Limited 2023

Full document details: AS IEC 61000.6.5-2017 (2023)

INTRODUCTION

IEC 61000 series is published in separate parts, according to the following structure:

Part 1: General
General considerations (introduction, fundamental principles)
Definitions, terminology
Part 2: Environment
Description of the environment
Classification of the environment
Compatibility levels
Part 3: Limits
Emission limits
Immunity limits (in so far as they do not fall under the responsibility of the product committees)
Part 4: Testing and measurement techniques
Measurement techniques
Testing techniques
Part 5: Installation and mitigation guidelines
Installation guidelines
Mitigation methods and devices
Part 6: Generic standards
Part 9: Miscellaneous

Each part is further subdivided into sections which are to be published either as International Standards or as technical specifications or technical reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

This International Standard deals with the electromagnetic compatibility (EMC) of equipment used in the generation, transmission and distribution of electricity and related telecommunication systems.

Several EMC product standards have been published by technical committees dealing with different application areas in the generation, transmission and distribution of electricity and related telecommunication systems, for example:

- fixed power supply installations and apparatus for railway applications (TC 9),
- switchgear and controlgear (TC 17),
- instrument transformers (TC 38),
- nuclear instrumentation (TC 45),
- power systems management and associated information exchange (TC 57),
- industrial-process measurement and control – system aspects (SC 65A),
- measuring relays and protection equipment (TC 95), etc.

The requirements specified in these product standards consider product-specific aspects only. It is the task of this generic standard IEC 61000-6-5 to specify a set of essential requirements, test procedures and generalized performance criteria applicable to such products or systems operating in this electromagnetic environment.

Documents
Document Sharing Hub

© Standards Australia Limited 2023

Full document details: AS IEC 61000.6.5-2017 (2023)

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 6-5: Generic standards – Immunity for equipment used in power station and substation environment

1 Scope and object

This part of IEC 61000 specifies EMC immunity requirements which apply to electrical and electronic equipment intended for use in power stations and substations, as described below. Immunity requirements for electromagnetic phenomena with spectral contributions in the frequency range 0 Hz to 400 GHz are covered. No tests need to be performed at frequencies or for phenomena where no requirements are specified.

This international standard sets immunity test requirements for equipment intended for use in the generation, transmission and distribution of electricity and related telecommunication systems. The electromagnetic environments encompassed by this standard are those which exist at locations

- in power stations, and
- in high and medium voltage substations.

Installations to generate or convert into electrical power inside industrial facilities are also covered by this standard as long as they, at their primary electrical connection, cannot be directly connected to the LV power network, e.g. where the generator output voltage is medium voltage or higher. Power installations that directly provide power into the low voltage network (such as photovoltaic cells or combined heat power systems in private houses) are not covered by this standard.

NOTE 1 In general, power stations comprise installations which are mainly built to convert some kind of primary energy into electrical energy. Moreover, these power stations are connected to the medium or high voltage power system directly or via a step-up transformer.

The object of this standard is to define immunity test requirements for equipment defined in the scope in relation to continuous and transient, conducted and radiated disturbances, including electrostatic discharges.

The immunity test requirements are given on a port-by-port basis, and selected according to the location, with differentiated levels for equipment to be installed in power stations or substations. In special cases, situations will arise where the level of electromagnetic disturbances may exceed the levels specified in this standard; in these instances, special mitigation measures should be adopted.

The immunity requirements are suitable for satisfying the particular needs related to the functions and tasks of equipment and systems, for which reliable operation is required under realistic electromagnetic conditions; in this respect, this standard establishes performance criteria for different functional requirements.

This generic EMC immunity standard is applicable if no relevant dedicated product or product-family EMC immunity standard exists. According to IEC Guide 107, this generic standard should be considered for the preparation or revision of any EMC standard referring to specific products used in power stations and substations.

NOTE 2 Product standards covering EMC aspects for equipment to be used in power stations or substations are for example IEC 62271-1 (switchgear and controlgear), IEC 60255-26 (measuring relays and protection equipment) or IEC 62236-5 (fixed power supply installations and apparatus for railway applications).

Documents
Document Sharing Hub
© Standards Australia Limited 2023

Full document details: AS IEC 61000.6.5-2017 (2023)

Non-electronic high voltage and power equipment (primary system) are excluded from the scope of this standard.

Emission requirements are not within the scope of this standard and are covered by relevant product or product-family standards.

NOTE 3 Where no dedicated product or product family standard covering emission requirements exists, the generic standard IEC 61000-6-4 applies.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-16, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*

IEC 61000-4-17, *Electromagnetic compatibility (EMC) – Part 4-17: Testing and measurement techniques – Ripple on d.c. input power port immunity test*

IEC 61000-4-18, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-4-29, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

IEC 61000-4-34, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current more than 16 A per phase*

Documents
Document Sharing Hub

© Standards Australia Limited 2023

Full document details: AS IEC 61000.6.5-2017 (2023)

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

NOTE The definitions related to EMC and to relevant electromagnetic phenomena can be found in IEC 60050-161 and in other IEC publications.

3.1.1
connections to HV equipment
connections from control equipment to HV equipment such as circuit breakers, current transformers, voltage transformers, power line carrier systems

3.1.2
DC distribution network
local DC electricity supply network in the infrastructure of a certain site or building intended for flexible use by one or more different types of equipment and guaranteeing continuous power supply independently from the conditions of the public mains network

Note 1 to entry: Connection to a remote local battery is not regarded as a DC distribution network, if such a link comprises only power supply for a single piece of equipment.

3.1.3
enclosure port
physical boundary of the equipment through which electromagnetic fields may radiate or impinge on

3.1.4
equipment
single apparatus or set of devices or apparatuses, or the set of main devices of an installation, or all devices necessary to perform a specific task

Note 1 to entry: Examples of equipment are a power transformer, the equipment of a substation, measuring equipment.

[SOURCE: IEC 60050-151:2001, 151-11-25]

3.1.5
field connections
cables which are intended to be connected to process equipment of the plant, within the same earth network

EXAMPLE

Examples of this category are:

– connections from control room or equipment room to the field of power stations and HV substations;
– connections to low voltage power equipment;
– connections within the relay house or telecommunication house of HV substations, where no special mitigation measures are adopted (e.g. shielding);
– field bus.

Note 1 to entry: Those cable ports of process instrumentation which are self-powered through the signal conductors (e.g. 4 mA to 20 mA) are considered as signal ports.

Documents
Document Sharing Hub
© Standards Australia Limited 2023
Full document details: AS IEC 61000.6.5-2017 (2023)

3.1.6
high voltage
HV
set of voltage levels in excess of medium voltage

Note 1 to entry: In the context of this standard the following terms for system voltage are used (see also 3.1.9):

– low voltage (LV) refers to $U_n \leq 1$ kV;

– medium voltage (MV) refers to 1 kV $< U_n \leq 36$ kV;

– high voltage (HV) refers to voltage above 36 kV and includes EHV and UHV.

3.1.7
installation
several combined items of equipment (including cables) put together at a given place to fulfil a specific task

3.1.8
low voltage
set of voltage levels used for the distribution of electricity and whose upper limit is generally accepted to be 1 000 V a.c.

[SOURCE: IEC 60050-601:1985, 601-01-26]

3.1.9
medium voltage
MV
any set of voltage levels lying between low and high voltage

Note 1 to entry: The boundaries between medium and high voltage levels overlap and depend on local circumstances and history or common usage. Nevertheless the band 30 kV to 100 kV frequently contains the accepted boundary.

Note 2 to entry: In the context of this standard, medium voltage is defined as the voltage range of 1 Kv $< U_n \leq 36$ kV.

[SOURCE: IEC 60050-601:1985, 601-01-28, modified – a note to entry 2 has been added.]

3.1.10
port
particular interface of the equipment which couples this equipment with, or is influenced by, the external electromagnetic environment

Note 1 to entry: Examples of ports of interest are shown in Figure 1. The enclosure port is the physical boundary of the equipment (e.g. enclosure). The enclosure port provides for radiated and electrostatic discharge (ESD) energy transfer, whereas the other ports provide for conducted energy transfer.

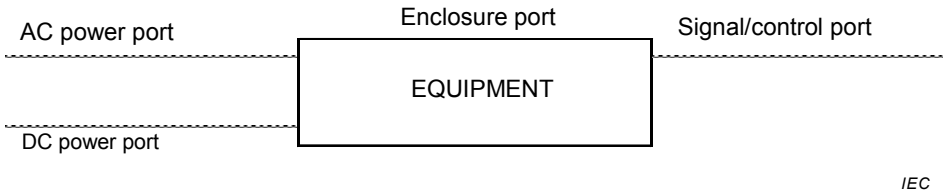

Figure 1 – Equipment ports

© Standards Australia Limited 2023

Full document details: AS IEC 61000.6.5-2017 (2023)

3.1.11
power port
port at which a conductor or cable carries the primary electrical power needed for the operation (functioning) of equipment

3.1.12
power station
installation whose purpose is to generate electricity and which includes civil engineering works, energy conversion equipment and all the necessary ancillary equipment

[SOURCE: IEC 60050-601:1985, 601-03-01]

3.1.13
protected area
area inside an installation in which electromagnetic phenomena appear in a mitigated extent compared to other areas of the same installation

Note 1 to entry: Mitigation can be provided for example by means of shielding or filtering.

3.1.14
signal/control port
port at which a conductor or cable intended to carry signals is connected to equipment

Note 1 to entry: Examples are analog inputs, outputs and control lines; data busses; communication lines, fibre-optic lines containing metallic conductors, etc.

3.1.15
substation (of a power system)
part of an electrical system, confined to a given area, mainly including ends of transmission or distribution lines, electrical switchgear and controlgear, buildings and transformers. A substation generally includes safety or control devices (for example protection)

Note 1 to entry: The substation can be qualified according to the designation of the system of which it forms a part. Examples: transmission, substation (transmission system), distribution substation, 400 kV or 20 kV substation.

[SOURCE: IEC 60050-601:1985, 601-03-02]

3.1.16
switchgear
general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for use in connection with generation, transmission, distribution and conversion of electric energy

[SOURCE: IEC 60050-441:2000, 441-11-02]

3.1.17
system
several items of equipment combined to fulfil a specific task as a single functional unit

3.1.18
telecommunication connections
communication cables which reach the border of the earth network of the plant for interfacing with a telecommunication network or with a remote equipment without any particular insulation barrier

Documents
Document Sharing Hub
© Standards Australia Limited 2023
Full document details: AS IEC 61000.6.5-2017 (2023)

3.2 Abbreviations

AIS Air insulated switchgear
CRT Cathode ray tube
CT Current transformer
EHV Extra high voltage
ESD Electrostatic discharge
EUT Equipment under test
GIS Gas insulated switchgear
HV High voltage
MTU Master terminal unit
MV Medium voltage
PLC Power line communication
PT Power transformer
RTU Remote terminal unit
UHV Ultra high voltage
UPS Uninterruptable power systems

4 Electromagnetic environment

The typical locations covered by this international standard are power stations (see Figure 2), medium voltage (MV) and high-voltage (HV) substations, comprising air insulated switchgear (AIS) (see Figure 3), and/or gas insulated switchgear (GIS) (see Figure 4). In Figure 2, the solid lines do not represent physical boundaries between the areas where the equipment is installed. They rather indicate boundaries between electromagnetic environments. It should be kept in mind that the electromagnetic environments can be different for items of equipment installed close to each other.

For the purpose of the specifications given in this international standard, the term "HV" is taken to mean extra high voltage and high voltage of 36 kV and above.

NOTE A different limit between MV and HV can be agreed upon between the parties involved and the manufacturer.

An overview of electromagnetic phenomena to be taken into account at the locations covered by this standard is given in Table 1. For the purpose of determining the need of the corresponding phenomenon as well as of the applicable performance criterion, the phenomena are grouped with respect to their nature and probability of occurrence. A survey of these electromagnetic phenomena is given in IEC TR 61000-2-5 and IEC 61000-4-1. Additional information on the typical sources and causes of electromagnetic disturbances is given in Annex A. Typical values of electromagnetic phenomena observed in high voltage substations and power stations can be found in the publications listed in the bibliography.

Documents
Document Sharing Hub

© Standards Australia Limited 2023

Full document details: AS IEC 61000.6.5-2017 (2023)