

Australian Standard[®]

Insulation co-ordination

**Part 1: Definitions, principles
and rules**

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Australian Electrical and Electronic Manufacturers Association
Electricity Supply Association of Australia
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Insulation co-ordination

Part 1: Definitions, principles and rules

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL/7 on Power Switchgear to supersede AS 1824, Insulation co-ordination (phase-to-earth and phase-to-phase, above 1 kV), Part 1: *Basic principles, standard insulation levels and test procedures*.

This Standard is the result of a consensus among representatives on the Joint Committee to produce it as an Australian Standard.

With the exception of Appendix ZZ, this Standard is equivalent in technical content but does not correspond in full presentation with IEC 71-1 (1993), *Insulation co-ordination, Part 1: Definitions, principles and rules*.

Appendix ZZ lists the Australian variations between this Standard and IEC 71-1. For the purposes of this Standard, the IEC text is amended, supplemented or replaced as set out in Appendix ZZ. These changes are indicated by a marginal bar against each clause, table, figure or part thereof affected.

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<i>Reference to International Standard</i>		<i>Australian Standard</i>	
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60	High-voltage test techniques	1931	High voltage testing techniques
60-1	Part 1: General definitions and test requirements	1931.1	Part 1: General definitions, test requirements, test procedures and measuring devices

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CONTENTS

Clause	Page
1 Scope	1
2 Normative references	1
3 Definitions	2
3.1 Insulation co-ordination	2
3.2 External insulation	2
3.3 Internal insulation	2
3.4 Self-restoring insulation	2
3.5 Non-self-restoring insulation	2
3.6 Insulation configuration terminal	2
3.7 Insulation configuration	2
3.8 Nominal voltage of a system	3
3.9 Highest voltage of a system	3
3.10 Highest voltage for equipment (U_m)	3
3.11 Isolated neutral system	3
3.12 Solidly earthed neutral system	3
3.13 Impedance earthed (neutral) system	3
3.14 Resonant earthed (neutral) system	3
3.15 Earth fault factor	3
3.16 Overvoltage	3
3.17 Classification of voltages and overvoltages	4
3.18 Standard voltage shapes	4
3.19 Representative overvoltages (U_{rp})	5
3.20 Overvoltage limiting device	5
3.21 Lightning (or switching) impulse protective level	5
3.22 Performance criterion	5
3.23 Withstand voltage	5
3.24 Co-ordination withstand voltage (U_{cw})	5
3.25 Co-ordination factor (K_c)	6
3.26 Standard reference atmospheric conditions	6
3.27 Required withstand voltage (U_{rw})	6
3.28 Atmospheric correction factor (K_a)	6
3.29 Safety factor (K_s)	6
3.30 Standard withstand voltage (U_w)	6
3.31 Test conversion factor (K_t)	6
3.32 Rated insulation level	6
3.33 Standard insulation level	6
3.34 Standard withstand voltage tests	6

Clause	Page
4 Procedure for insulation co-ordination	7
4.1 General outline of the procedure	7
4.2 Determination of the representative overvoltages (U_{rp})	7
4.3 Determination of the co-ordination withstand voltages (U_{cw})	8
4.4 Determination of the required withstand voltages (U_{rw})	8
4.5 Selection of the rated insulation level	9
4.6 List of standard short-duration power frequency withstand voltages	9
4.7 List of standard impulse withstand voltages	10
4.8 Ranges for highest voltage for equipment	10
4.9 Selection of the standard insulation levels	10
5 Requirements for standard withstand voltage tests	11
5.1 General requirements	11
5.2 Standard short-duration power-frequency withstand voltage tests	12
5.3 Standard impulse withstand voltage tests	12
5.4 Alternative test situation	13
5.5 Phase-to-phase and longitudinal insulation standard withstand voltage tests for equipment in range I	13
5.6 Phase-to-phase and longitudinal insulation standard withstand voltage tests for equipment in range II	14
Figure	16
Tables	17
Annex A	20
APPENDIX ZZ List of variations between this Standard and IEC 71-1	21

AUSTRALIAN STANDARD

INSULATION CO-ORDINATION

Part 1: Definitions, principles and rules

1 Scope

This part of International Standard IEC 71 applies to three-phase a.c. systems having a highest voltage for equipment above 1 kV. It specifies the procedure for the selection of the standard withstand voltages for the phase-to-earth, phase-to-phase and longitudinal insulation of the equipment and the installations of these systems. It also gives the lists of the standardized values from which the standard withstand voltages shall be selected.

This part recommends that the selected withstand voltages should be associated with the highest voltage for equipment. This association is for insulation co-ordination purposes only. The requirements for human safety are not covered by this Standard.

Although the principles of this part also apply to transmission line insulation, the values of the withstand voltages may be different from the standard withstand voltages.

The apparatus committees are responsible for specifying the withstand voltages and the test procedures suitable for the relevant equipment taking into consideration the recommendations of this Standard.

NOTE – In IEC 71-2 Application Guide, (under revision), all rules for insulation co-ordination given in this Standard are justified in detail, in particular the association of the standard withstand voltages with the highest voltage for equipment. When more than one set of standard withstand voltages is associated with the same highest voltage for equipment, guidance is provided for the selection of the most suitable set.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 71-1. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 71-1 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 38:1983, *IEC standard voltages*

IEC 60-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 insulation co-ordination: The selection of the dielectric strength of equipment in relation to the voltages which can appear on the system for which the equipment is intended and taking into account the service environment and the characteristics of the available protective devices. [IEV 604-03-08, modified]

NOTE – By “dielectric strength” of the equipment, is meant here its rated or its standard insulation level as defined in 3.32 and 3.33 respectively.

3.2 external insulation: The distances in atmospheric air, and the surfaces in contact with atmospheric air of solid insulation of the equipment which are subject to dielectric stresses and to the effects of atmospheric and other external conditions, such as pollution, humidity, vermin, etc. [IEV 604-03-02, modified]

NOTE – External insulation is either *weather-protected* or *non-weather-protected*, designed to operate inside or outside closed shelters respectively.

3.3 internal insulation: The internal solid, liquid, or gaseous parts of the insulation of equipment which are protected from the effects of atmospheric and other external conditions. [IEV 604-03-03]

3.4 self-restoring insulation: Insulation which completely recovers its insulating properties after a disruptive discharge. [IEV 604-03-04]

3.5 non-self-restoring insulation: Insulation which loses its insulating properties, or does not recover them completely, after a disruptive discharge. [IEV 604-03-05]

NOTE – The definitions of 3.4 and 3.5 apply only when the discharge is caused by the application of a test voltage during a dielectric test. However, discharges occurring in service may cause a self-restoring insulation to lose partially or completely its original insulating properties.

3.6 insulation configuration terminal: Any of the electrodes between any two of which a voltage that stresses the insulation can be applied. The types of terminal are:

- a) **phase terminal**, between which and the neutral is applied in service the phase-to-neutral voltage of the system;
- b) **neutral terminal**, representing, or connected to, the neutral point of the system (neutral terminal of transformers, etc.);
- c) **earth terminal**, always solidly connected to earth in service (tank of transformers, base of disconnectors, structures of towers, ground plane, etc.);

3.7 insulation configuration: The complete geometric configuration of the insulation in service, consisting of the insulation and of all terminals. It includes all elements (insulating and conducting) which influence its dielectric behaviour. The following insulation configurations are identified:

- **three-phase:** having three phase terminals, one neutral terminal and one earth terminal.
- **phase-to-earth:** a three-phase insulation configuration where two phase terminals are disregarded and, except in particular cases, the neutral terminal is earthed.

- **phase-to-phase:** a three-phase insulation configuration where one phase terminal is disregarded. In particular cases, the neutral and the earth terminals are also disregarded.
- **longitudinal,** having two phase terminals and one earth terminal. The phase terminals belong to the same phase of a three-phase system temporarily separated into two independently energized parts (open switching devices). The four terminals belonging to the other two phases are disregarded or earthed. In particular cases one of the two phase terminals considered is earthed.

3.8 nominal voltage of a system: A suitable approximate value of voltage used to designate or identify a system. [IEV 601-01-21]

3.9 highest voltage of a system: The highest value of operating voltage which occurs under normal operating conditions at any time and at any point in the system. [IEV 601-01-23]

3.10 highest voltage for equipment (U_m): The highest r.m.s. value of phase-to-phase voltage for which the equipment is designed in respect of its insulation as well as other characteristics which relate to this voltage in the relevant equipment Standards. [IEV 604-03-01]

3.11 isolated neutral system: A system where the neutral point is not intentionally connected to earth, except for high impedance connections for protection or measurement purposes. [IEV 601-02-24]

3.12 solidly earthed neutral system: A system whose neutral point(s) is(are) earthed directly. [IEV 601-02-25]

3.13 impedance earthed (neutral) system: A system whose neutral point(s) is (are) earthed through impedances to limit earth fault currents. [IEV 601-02-26]

3.14 resonant earthed (neutral) system: A system in which one or more neutral points are connected to earth through reactances which approximately compensate the capacitive component of a single-phase-to-earth fault current. [IEV 601-02-27]

NOTE – With resonant earthing of a system, the residual current in the fault is limited to such an extent that an arcing fault in air is usually self-extinguishing.

3.15 earth fault factor: At a given location of a three-phase system, and for a given system configuration, the ratio of the highest r.m.s. phase-to-earth power frequency voltage on a healthy phase during a fault to earth affecting one or more phases at any point on the system to the r.m.s. phase-to-earth power frequency voltage which would be obtained at the given location in the absence of any such fault. [IEV 604-03-06]

3.16 overvoltage: Any voltage between one phase conductor and earth or between phase conductors having a peak value exceeding the corresponding peak of the highest voltage for equipment. [IEV 604-03-09, modified]