

AS/NZS 3832:1998

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Australian/New Zealand Standard™

**Electrical installations—
Cold-cathode illumination systems**

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Cold-cathode illumination systems**

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL/1, Wiring Rules.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

The objective of this Standard is to provide regulatory authorities, manufacturers and installers involved with the installation of illumination signs with requirements for construction, testing and methods of installation to ensure safety from fire and electric shock.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Electrical installations—Cold-cathode illumination systems**

SECTION 1 GENERAL

1.1 SCOPE AND APPLICATION

1.1.1 Scope This Standard specifies requirements for the construction, installation and testing of cold-cathode illumination systems. It applies to systems operating at no-load rated voltages greater than 1000 V and not greater than 15 000 V and having tube currents of not more than 750 mA.

It includes requirements for electrical components and wiring, and provides recommendations for maintenance and repair.

This Standard applies to fluorescent lamps operating as cold-cathode tubes.

1.1.2 Application This Standard shall be used, in Australia, in conjunction with AS 3000, and in New Zealand with the New Zealand Electricity Regulations.

1.2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

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|--------|---|
| 1104 | Informative symbols for use on electrical and electronic equipment |
| 1319 | Safety signs for the occupational environment |
| 1939 | Degrees of protection provided by enclosures for electrical equipment (IP Code) |
| 2053 | Conduits and fittings for electrical installations |
| 2053.1 | Part 1: General requirements |
| 2420 | Fire test methods for solid insulating materials and non-metallic enclosures used in electrical equipment |
| 3000 | Electrical installations—Buildings, structures and premises (known as the SAA Wiring Rules) |
| 3017 | Electrical installations—Testing guidelines |
| 3100 | Approval and test specification—General requirements for electrical equipment |
| 3147 | Approval and test specification—Electric cables—Thermoplastic insulated—For working voltages up to and including 0.6/1 kV |

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| 3116 | Approval and test specification—Electric cables—Elastomer insulated—For working voltages up to and including 0.6/1 kV |
| 3166 | Approval and test specification—Cables for high voltage luminous discharge tube installations |
| 4296 | Cable trunking systems |
| 61050 | Transformers for tubular discharge lamps having a no-load output voltage exceeding 1000 V (generally called neon-transformers)—General and safety requirements |

NZ

The Electricity Regulations

1.3 DEFINITIONS For the purposes of this Standard the definitions below apply.

1.3.1 Arm's reach—a zone extending from any point on a surface where persons usually stand or move about to the limits which persons can reach with the hand (2.5 m upwards and 1.25 m sideways and downwards) in any direction without assistance.

NOTE: For illustration of the definition of arm's reach, see Appendix A.

1.3.2 Authorized person—the person in charge of the premises, or the licensed electrical contractor or electrician or other person appointed or selected by the person in charge of the premises, to perform certain duties associated with the electrical installation on the premises.

1.3.3 Ballast—a unit inserted between the supply and a cold-cathode tube which by means of inductance, capacitance or a combination of both, serves the purposes of establishing an electric arc through the cold-cathode tube and limiting the current through the tube to its safe working value.

1.3.4 Bounding surface—the inner surface of an enclosure, considered as though metal foil were pressed into contact with all internal surfaces of insulating material.

1.3.5 Clearance—the shortest distance between two conductive parts or between a conductive part and the bounding surface of its enclosure measured through the air.

1.3.6 Cold-cathode illumination system (referred to as 'system')—a system consisting of ballasts, transformers, inverters, convertors, cold-cathode tubes, high and low voltage cables and all ancillary equipment.

1.3.7 Cold-cathode tube (commonly called a 'neon' tube)—a tube or other vessel or device which is constructed of translucent material, is hermetically sealed, and is designed to emit light when an electric current passes through a gas or vapour contained within it. The tube may be with or without a fluorescent coating.

1.3.8 Competent person—a person having acquired through training, qualification or experience or a combination of these, the knowledge and skills enabling that person to perform the task required.

1.3.9 Convertor—a unit for electronic conversion of an a.c. supply at one frequency to an a.c. supply at another frequency. The voltage may or may not be altered during the conversion.

1.3.10 Creepage distance—the shortest path between two conductive parts, or between a conductive part and the bounding surface of the equipment, measured along the surface of the insulation.

1.3.11 Electrode insulator—a protective cover of suitable insulating material placed over tube electrodes and high-voltage connections.

NOTE: Electrode insulators may be used to provide insulation at joints that are not at tube electrodes.

1.3.12 Exposed metal—all parts of a cold-cathode illumination system that can be touched with a standard test finger except the following:

- (a) Live parts (see Clause 1.3.19).
- (b) Parts separated from live parts by double insulation or reinforced insulation.
- (c) Metal nameplates, screw-heads, covers or plates—
 - (i) that are supported on or attached or connected to substantial non-conductive material so they cannot become live in case of failure of insulation of live parts; or

- (ii) whose means of fixing cannot contact any internal metal, other than earthed metal or parts referred to in Item (d), or be exposed to arcing contact with live parts.

NOTE: Failure of insulation in this context is taken to include accidental bridging of an insulation gap by metal or partially conducting material such as carbon dust or moisture, and electrical breakdown in the conventional sense.

- (d) Parts separated from live parts by other metal parts that are themselves earthed or have double insulation.
- (e) Parts within an enclosure, the cover of which requires the use of a key or tool for its removal.

Non-metal material that is conductive to a degree that may contribute to a hazardous condition arising is deemed to be exposed metal, subject to the above exceptions.

NOTE: Appendix B illustrates the metal parts listed in Items (a), (b), (c) and (e) which are not considered to be exposed metal.

1.3.13 Fire retardant material—solid insulating material meeting specified glow wire tests in accordance with AS 2420.

1.3.14 Flammable—a material is flammable if it does not pass the 850°C glow wire test in accordance with AS 2420.

1.3.15 Informative appendix—an appendix provided only for information and guidance.

1.3.16 Installer—the person who takes responsibility for the installation and its testing in accordance with this Standard.

NOTE: Appendix C outlines a typical syllabus for a training course for a person competent to install cold-cathode illumination systems.

1.3.17 Inverter—an electric energy transducer that converts direct current to alternating current.

1.3.18 IP rating—a coding system in accordance with AS 1939 that indicates the degrees of protection provided by an enclosure against access to hazardous parts, the ingress of solid foreign objects, and the ingress of water. It also gives additional information about such protection.

1.3.19 Live (alive)—a term applied to an object when a difference of potential exists or would exist between it and earth under normal conditions of operation. It includes all metal connected to the neutral conductor of the supply system, even if the neutral is earthed at the source of supply, except earthing conductors.

1.3.20 Mechanical damage—damage caused by mechanical means that may impair electrical safety.

1.3.21 Non-reusable OCPD—an OCPD that, after operating, requires the replacement of one or more of its parts before it can be reset.

1.3.22 Normative appendix—an appendix that is an integral part of this Standard.

1.3.23 Open-circuit protective device (OCPD)—a device that, if an interruption or failure occurs in the secondary circuit—

- (a) removes the power to a transformer, inverter or convertor; or
- (b) reduces the output voltage of a transformer, inverter or convertor to extra-low voltage; or
- (c) short-circuits the output of the transformer, inverter or convertor.

1.3.24 Operating current—the high-voltage circuit current measured by a suitable milliammeter when a transformer, inverter or convertor is supplying its connected lamp load.

1.3.25 Primary earthing system—the earthing system of the low voltage supply.

1.3.26 Reusable OCPD—an OCPD that, after operating, does not require the replacement of one or more of its parts before it can be reset.

1.3.27 Route length—the distance measured along the run of wiring from the origin of the circuit to the point of consideration, e.g. the distance so measured between a transformer and its cold-cathode connection.

1.3.28 Secondary earthing system—the earthing system of the high-voltage side of a transformer. This earthing system is separate from the primary earthing system.

1.3.29 Short-circuit current—the current measured by a suitable milliammeter when connected (shorted) across a transformer's high-voltage output terminals.

1.3.30 Standard test finger—a test finger in accordance with AS 3100.

1.3.31 Tracking—the progressive formation of conducting paths on the surface of a solid insulating material, due to the combined effects of electric stress and electrolytic contamination on that surface.

1.3.32 Transformer—a unit that converts an a.c. supply at one voltage and frequency to an a.c. supply at a different voltage and the same frequency.

NOTE: The high output impedance of transformers designed for cold-cathode tubes allows for the characteristics of transformer and ballast to be combined in one unit.

1.3.33 Tubulation—glass tubing used to provide insulation to bare conductors or cables not rated to their full working voltage.

1.3.34 Type I system—a cold-cathode illumination system the electrical circuits of which are fully assembled and tested in a workshop.

NOTE: Appendix C outlines a typical syllabus for a training course for a person competent to install cold-cathode illumination systems.

1.3.35 Type II system—a cold-cathode illumination system which is constructed by assembling any combination of ballasts, transformers, inverters, convertors, cold-cathode tubes and high and low voltage cables at the intended site.

NOTE: Appendix C outlines a typical syllabus for a training course for a person competent to install cold-cathode illumination systems.

1.3.36 Voltage—a difference of potential normally existing between conductors and between conductors and earth as follows:

- (a) *Extra-low voltage*—not exceeding 32 V a.c. or 115 V d.c.
- (b) *Low voltage*—exceeding extra-low voltage, but not exceeding 1000 V a.c. or 1500 V d.c.
- (c) *High voltage*—exceeding low voltage.

1.4 FUNDAMENTAL PRINCIPLES Cold-cathode illumination systems shall be designed, constructed, installed, used and maintained so as to be electrically safe.

For the purposes of this Standard, 'electrically safe' means that there is no significant risk of injury or death to any person, or damage to property as a result of the application or use of electricity.

1.5 MARKING

1.5.1 Manufacturing details The following shall be marked durably, permanently and legibly on a suitable plate or label attached to the system or positioned in a clearly visible place close to the system:

- (a) The name and address of the system manufacturer or installation company responsible for the installation.
- (b) The year of manufacture.
- (c) The number of this Standard.
- (d) For a Type I system, an indication of conformity with this Standard.
- (e) The total loading in amperes (or kilovolt amperes) and the supply voltage.

1.5.2 Statement of conformity For a Type II system, the system installer shall provide to the system operator a statement of conformity with this Standard. The system installer shall retain a copy of the statement for at least three years.

NOTE: Appendix D provides an example of a typical statement of conformity.

1.5.3 Diagrams The system installer shall supply a simplified diagram, data sheet or other means that gives transformer locations, and that shows the system operator which transformers, inverters or convertors are operating which tubes. The system installer shall retain a copy of the diagram for at least three years.

1.5.4 Warning signs A sign reading 'WARNING—HIGH VOLTAGE' and having a dangerous voltage symbol 417-IEC-5036-50, coloured black on a yellow background, in accordance with AS 1104, shall be placed and maintained in a visible position on every container or enclosure of the system that is accessible to unauthorized persons, otherwise where necessary to provide a warning to persons.

The word 'WARNING' shall be in block letters not less than 25 mm high. Letters and their background shall be in bold contrasting colours.

Each notice shall state that if an open-circuit protective device is fitted it shall not be removed or disconnected.

If the warning sign cannot be attached to the system, it shall be installed near the isolating switch or the connection terminals for the incoming supply conductors.

NOTES:

- 1 Appendix E illustrates the dangerous voltage symbol in accordance with AS 1104.
- 2 AS 1319 provides recommendations for safety signs.

1.5.5 Isolating switches A conspicuous, legible and indelible danger notice shall be located near every isolating switch provided in accordance with Clause 3.6.

The danger notice shall show—

- (a) the intended purpose of the switch;
- (b) the system operating voltage; and
- (c) that no part of the system is to be touched unless the switch is in the open or off position.

1.6 MAINTENANCE A system should be maintained so that it provides safe performance throughout its life.

NOTE: Appendix F provides recommendations for maintenance.

SECTION 2 SAFETY

2.1 PROTECTION AGAINST ELECTRIC SHOCK

2.1.1 General Persons and property shall be protected against the risk of electric shock that results from direct or indirect contact with live parts of a system.

2.1.2 Access to live parts Equipment in enclosures containing exposed live parts shall be installed either—

- (a) in an area that is accessible only to authorized persons and all means of entry to such areas are provided with facilities for locking; or
- (b) so that a tool or key is required to enter the enclosure.

2.1.3 Insulation of high-voltage parts It shall not be possible to touch, using a standard test finger, bare live parts or live parts not covered with insulation meeting the requirements of AS/NZS 3166. The test with the standard test finger shall be done with the high-voltage circuit operating.

NOTES:

- 1 Cold-cathode tubes are not regarded as live parts for the purposes of this Clause.
- 2 An arc to the test finger indicates a failure.

2.1.4 Open-circuit protection

2.1.4.1 General An open-circuit protective device shall be installed to protect a system if—

- (a) a system is exposed to mechanical damage and is not constructed to prevent electrodes arcing to flammable material when a cold-cathode tube is broken; or
- (b) a system is exposed to mechanical damage and a tube electrode is within arm's reach and an IP rating of 2X is not maintained when a cold-cathode tube is broken.

NOTES:

- 1 It is recommended that an OCPD be installed, though it is not required by Item (a) or (b) above, if there is a danger of persons damaging a cold-cathode system while carrying out maintenance and construction of other building services.
- 2 An OCPD should not be relied upon to provide protection from electrocution when maintenance and construction of other building services are performed in the vicinity of a cold-cathode system. The system should be isolated from its low-voltage supply.

2.1.4.2 Non-reusable OCPDs Non-reusable OCPDs shall—

- (a) only be used with transformers, inverters and convertors certified by their manufacturers as suitable for operating continuously with their output terminals short-circuited;
- (b) be of a suitable size to protect the cold-cathode system circuit; and
- (c) be compatible for operation with the device protecting the low-voltage circuit that supplies the transformer, inverter or convertor.

2.1.4.3 Prohibited circuits Circuits for which an OCPD does not see an interruption if a fault develops in one site of the secondary circuit (because the tubes on the other side will continue to operate) shall not be used with an OCPD unless they are supplied by a transformer, inverter or convertor capable of operating in this condition.

NOTE: See Figures G3 and G4, Appendix G.

2.2 PROTECTION AGAINST THERMAL EFFECTS IN NORMAL SERVICE

2.2.1 General During normal operation of a system there shall be no risk of fire or of persons suffering burns.

2.2.2 Fire retardance

2.2.2.1 High-voltage connections Insulating materials, high-voltage connections, automatic switching apparatus and similar devices shall be constructed using fire retardant material meeting the requirements of AS 2420, the test being made at 850°C, or by designs that reduce the possibility of ignition or propagation of fire in case of ignition.

2.2.2.2 Enclosures Enclosures of transformers, inverters and convertors shall be constructed of a material able to pass a glow-wire test in accordance with AS 2420, the test being made at 850°C.

2.2.3 Connections Connections shall be so arranged that short-circuits or destructive arcing cannot take place. This shall be achieved as follows:

- (a) Connections between conductors and tube electrodes, transformers, inverters and convertors are mechanically and electrically sound. Such connections shall be made at the terminals of accessories, or by means of mechanical connectors, spring-type connections or twisted connections. Twisted connections shall be made in accordance with Appendix H.
- (b) At least one of the following shall apply:
 - (i) Adequately rated and mechanically secure electrode insulators shall be fitted. Insulators shall have an insulation value not less than the rating required by AS/NZS 3166.
 - (ii) A fire retardant shroud or earth screen of adequate mechanical strength shall be installed.
 - (iii) Clearance and creepage distances in accordance with Table 2.1 shall be maintained between conductive material and high-voltage connections. The clearance and creepage distances of Table 2.1 need not apply to inverters and convertors if they comply with Clause 3.3.

NOTES:

- 1 Clause 2.1.3 requires that it shall not be possible to touch bare live parts or parts not covered with insulation meeting the requirements of AS 3166 with the standard test finger.
- 2 Appendix I provides examples of cold-cathode tube connections.

2.2.4 Ballasts Ballasts shall be mounted on a surface that readily allows for the dissipation of heat.

2.3 FLAMMABLE AND EXPLOSIVE CONDITIONS Cold-cathode illumination systems shall not be installed in a hazardous area.

TABLE 2.1
CLEARANCE AND CREEPAGE DISTANCES

Open-circuit voltage	Dry rooms and similar protected situations		Outdoors or in damp or wet rooms		Systems operating at frequencies greater than 1 kHz	
V	Creepage distance mm	Clearance distance mm	Creepage distance mm	Clearance distance mm	Creepage distance mm	Clearance distance mm
>1 000 ≤6 000	32	24	40	30	48	36
>6 000 ≤9 000	44	33	55	41	66	49
>9 000 ≤15 000	68	51	85	63	102	76

NOTES:

- 1 The requirements for maintaining clearances and creepage distances apply to cables run in trunking and conduit.
- 2 The clearances and creepage distances given in Table 2.1 have been determined for open-circuit conditions.
- 3 The clearances and creepage distances given for systems operating at frequencies greater than 1kHz apply to systems in all locations.