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NEW ZEALAND ELECTRICAL CODE OF PRACTICE

for

ELECTRICAL INSTALLATIONS

COLD CATHODE DISCHARGE LIGHTING

Issued by the Office of
The Chief Electrical Inspector,
Energy and Resources Division, Ministry of Commerce

THE ELECTRICITY ACT 1992

APPROVAL OF ELECTRICAL CODE OF PRACTICE

FOR

ELECTRICAL INSTALLATIONS
COLD CATHODE DISCHARGE LIGHTING

Pursuant to Section 36 of the Electricity Act 1992 ("the Act")

On the 1st day of February 1993, the Secretary of Commerce issued
Electrical Code of Practise for electrical Installations, Cold Cathode Discharge Lighting ("the Code")

On the 4th day of February 1993, pursuant to Section 38 of the Act the Secretary published in the Gazette a notice of intention to apply to me for approval of the code, and there has been consultations with such persons (or their representatives) as will be affected by the Code and they have had the opportunity to consider possible effects and comment on those effects.
I have considered the comments concerning those effects and where necessary amendments were made to the Code.

Therefore Pursuant to Section 38 of the Act, I, John Luxton, Minister of Energy, have this day approved the Code as attached to this approval, which Code shall come into force on the 1st day of April 1993.

Dated this 18th day of March 1993.

John Luxton
Minister of Energy.

COMMITTEE REPRESENTATION

This Code of Practice was prepared by the Ministry of Commerce, Chief Electrical Inspector's Office with reference to the following organisations:

Electrical Inspectors' Association
New Zealand Electrical Institute
Sound Logic Research
Claude Neon

ACKNOWLEDGEMENT

It should be noted that the source material for this Code was derived from the following documentation, New Zealand Standard NZS 2150, Australian Standard AS 3000.

REVIEW

This Code of Practice will be revised as occasions arise. Suggestions for improvement of this Code will be welcomed. They should be sent to the Chief Electrical Inspector's Office, Energy and Resources Division, Ministry of Commerce, PO Box 1473, WELLINGTON.

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INTRODUCTION

The construction and installation of cold-cathode discharge lighting systems (neon signs) spans the disciplines associated both with fixed installation wiring and appliances.

Often these systems, which are essentially appliances, are only completed during final installation due to their size.

These systems differ significantly however from a normal consumer's installation in respect of the voltages used.

The purpose of this Code is to set those criteria with are specific to high and extra high voltage cold cathode discharge lighting, and to update the technical requirements previously applied to these installations.

ELECTRICAL INSTALLATIONS OF COLD CATHODE DISCHARGE LIGHTING

SECTION 1

SCOPE, APPLICATION, REFERENCED DOCUMENTS, INTERPRETATIONS, GLOSSARY AND NUMBERING

1.1 SCOPE

1.1.1 This Code of Practice specifies requirements related to electric discharge cold cathode lighting operating at high voltage.

1.2 APPLICATION

1.2.1 This Code applies to the installation of electric discharge lighting systems, luminous discharge tube signs, luminous discharge tube outline lighting systems and their associated fittings.

1.3 REFERENCED DOCUMENTS

The following documents and standards are referred to in this Code.

EWRs	Electrical Wiring Regulations
AS 1939	Classification of degrees of protection provided by enclosures for electrical equipment.
AS 2420	Fire test methods for solid insulating materials and non-metallic enclosures used in electrical equipment.

1.4 INTERPRETATIONS

For the purposes of this Code, the definitions given below shall apply.

1.4.1 Arms reach - means 2.5 metres upward and 1.25 metres sideways and downwards from the floor or platform.

1.4.2 Backing - means the material immediately behind the illumination source. It may form an integral part of the sign construction, or may be removable in the form of loose panels attached to the main frame of the sign. It may form a structural part of a building.

1.4.3 Electric discharge sign - means a word, letter, model, emblem, border, outline, box, device, representation, announcement or direction, including the framework and backing, and the means of attachment to the building or supporting structure, illuminated by means of luminous-discharge-tubes, the means of illumination forming an integral part thereof.

1.4.4 Luminous discharge tube - means any cold cathode tube (commonly referred to as a "NEON" tube), or other vessel or device, which is constructed of translucent material, is hermetically sealed, and is designed for the emission of light arising from the passage of an electric current through a gas or vapour contained within it. The tube may be with or without a fluorescent coating.

1.4.5 Protective bonding - means electrical connection of exposed conductive parts and/or of protective shielding to provide electrical continuity to the means for connection of an electrical protective conductor.

1.4.6 Protective separation - means separation between circuits, with a level of protection not lower than that provided by double insulation.

1.4.7 Tube voltage (or effective voltage in the case of an alternating current) - means the voltage between the electrodes of a discharge lamp during stable operating conditions.

1.5 GLOSSARY OF ABBREVIATIONS USED IN THIS CODE

AS	Australian Standard
IP	Ingress protection code
mm	Millimetres
mm^2	Square millimetres

1.6 NUMBERING SYSTEM OF THIS CODE

1.6.1 Sections are numbered from 1 to 6.

1.6.2 Subsections are numbered by one full stop between two numbers.(eg: 1.6)

1.6.3 Clauses are numbered by two full stops between three numbers.(eg: 4.18.3)

1.6.4 Subclauses are numbered by three full stops between four numbers.(eg: 3.2.1.1)

1.6.5 Paragraphs contain numbering punctuated by one or more full stops together with a parenthesised letter.

1.6.6 Subparagraphs are represented by lower case roman numerals enclosed in parenthesis following paragraphs.

SECTION 2

PROTECTION FOR SAFETY

2.1 PROTECTION AGAINST DIRECT AND INDIRECT CONTACT (ELECTRIC SHOCK)

2.1.1 Persons and property shall be protected against dangers that may arise from contact with live parts of an electric discharge lighting installation.

2.1.1.1 Luminous discharge tubing shall not be regarded as a live part.

2.1.2 Enclosures containing live parts shall be arranged such that a tool is required to gain access to those parts.

2.1.3 Where discharge lighting is located within arms reach:

(a) It shall not be possible to touch with a standard test finger any live parts or basic insulation covering live parts, with or without the luminous discharge tubing being present; and

(b) It shall be provided with an automatic open circuit monitoring device to disconnect the supply in the event of an open circuit occurring in the secondary circuit.

2.2 PROTECTION AGAINST THERMAL EFFECTS IN NORMAL SERVICE

2.2.1 The discharge lighting installation shall be so arranged that there is no risk of ignition of flammable materials due to high temperatures or electric arc. Also, during normal operation of the electrical equipment, there shall be no risk of persons suffering burns.

2.2.2 Fittings including transformers, capacitors, electrode connections, automatic switching apparatus and similar devices shall be totally enclosed in fire retardant material to effectively prevent the spread of fire. Such material used shall meet the requirements of the heat behaviour test and the 850 degrees Celsius glow wire test of AS 2420.

2.2.3 Fittings including transformers, capacitors, electrode connections, automatic switching apparatus and similar devices shall be located and installed by using materials which do not ignite readily or by the use of designs which minimise the possibility of ignition or propagation of fire in the event of ignition.

2.2.4 Terminal contacts and live parts shall be so arranged that short circuit or destructive arcing, either between live parts or between any live part and other conductive material, cannot take place.
This shall be achieved by ensuring that:

(a) Connections between conductors and lamp 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, or by means of soldered, brazed or welded joints, or spring type connections; and

(b) Adequately rated and mechanically secure insulating sleeves are fitted, which sleeves shall have an insulation value not less than the rated value of the high voltage cable; or

(c) A fire retardant shroud or earth screen of adequate mechanical strength is installed.

2.3 PROTECTION AGAINST OVER-VOLTAGE

2.3.1 No electric discharge sign shall have an open-circuit voltage exceeding 7,500 volts to earth, nor 15,000 volts between live conductors.

2.3.2 Adequate separation of high voltage fittings from low and extra low voltage fittings, shall be provided by either a 50 mm air gap or fire retardant insulating barrier rated at no less than the highest voltage present.

2.4 FLAMMABLE AND EXPLOSIVE CONDITIONS

High voltage electric discharge signs shall not be installed in a hazardous area.

SECTION 3

ISOLATING SWITCHES, CONTROL SWITCHES AND MARKINGS

3.1 ISOLATING AND CONTROL SWITCHES

3.1.1 The permanent wiring supplying the electric discharge sign shall terminate in an isolating switch mounted on the permanent structure installed as close as practicable to the sign, except that where there is no suitable position on the permanent structure, the switch may be mounted on the sign.

3.1.1.1 The isolation of a group of signs by a single switch is not precluded.

3.1.1.2 Where the isolating switch is not located within clear view of any person working on the electric discharge sign, the isolating switch shall be provided with a means of securing it in the open position.

3.1.1.3 Isolating switches need not be provided for portable type electric discharge signs that are connected to the fixed wiring by means of a socket-outlet and flexible cord or cable.

3.1.2 When a control switch is provided to switch an electric discharge sign and is remote from the sign it shall be permanently marked as to its purpose.

3.1.3 All switches shall be rated for breaking the inductive load of the circuit(s).

3.2 DANGER NOTICES

3.2.1 A notice reading "DANGER, HIGH VOLTAGE" shall be placed and maintained in a visible position on every container or enclosure which is accessible to unauthorised persons, and otherwise where necessary to provide a warning to persons.

3.2.1.1 The word "DANGER" shall be in block letters not less than 25 mm high and the words "HIGH VOLTAGE" in letters not less than 10 mm high. The letters shall be black on a bright yellow background.

3.3 MARKING

3.3.1 Every electric discharge sign shall be marked in a legible, indelible and durable manner with:

(a) The maker's name and address; and

(b) The total loading in amperes (or kilovolt amperes) and the supply voltage; and

(c) The date of manufacture; and

(d) A product serial or identification number; and

(e) Verification that the open circuit monitor complies with the requirements of Subsection 4.2 of this Code (if fitted).

3.3.1.1 Where there is no part on the sign capable of being marked, a suitable marking plate shall be installed adjacent to the isolating switch or the connection terminals for the incoming supply conductors.

SECTION 4

TRANSFORMERS, INVERTERS, CONVERTORS AND CAPACITORS

4.1 ISOLATION

Inductive devices supplying high voltage shall have separate primary and secondary windings and there shall be no electrical interconnection between the supply and any secondary windings except through any earthing conductors required for earthing the secondary winding.

4.2 OPEN CIRCUIT MONITORING DEVICES

4.2.1 Open circuit monitoring devices shall to disconnect the mains supply where there occurs an open circuit in either the output circuit or tube load.

4.2.2 Open circuit monitoring devices shall operate in the phase conductor.

4.2.2.1 An open circuit monitoring device shall operate within 400 milliseconds of an open circuit occurring.

4.2.2.2 An open circuit monitoring device shall have a non-self resetting characteristic. Resetting may be effected by switching off the supply.

4.2.2.3 An open circuit monitoring device shall operate correctly over a temperature range of -5 to 65 degrees Celsius.

4.2.2.4 If any part of the open circuit monitoring device is mounted within the case of the transformer, invertor or convertor, that part shall operate correctly over the temperature range occurring within that case.

4.3 CAPACITORS

Every capacitor, unless incorporated for the sole purpose of radio frequency interference suppression, shall be provided with means, such as a high-resistance leak, for its prompt automatic discharge immediately the supply is disconnected. This requirement shall not apply to small capacitors where no risk of shock can arise.

4.4 PROTECTION AGAINST INGRESS OF MOISTURE

Transformers, inverters or convertors used outdoors and damp situations shall have an appropriate IP rating or be protected by an appropriately IP rated enclosure.

SECTION 5

CABLES

5.1 HIGH VOLTAGE CABLES

5.1.1 All conductors operating at high voltage shall be:

(a) Insulated cables installed in accordance with Clause 5.1.2.; or

(b) Bare or other insulated conductors installed in accordance with Subsection 6.6.

5.1.2 All high voltage cables shall:

(a) Comply with an Official Standard for high voltage discharge lighting cable; and

(b) Be as short as practicable but not exceed 15 metres; and

(c) Be installed in a non metallic wiring enclosure of a fire retardant type to an Official Standard so that ionisation is prevented from occurring between the external surface of the cable and any earthed metal; and

(d) Be of a continuous length; and

(e) Be installed in individual conduits (but in no case shall the lead and return conductors be grouped together); and

(f) Be installed in a separate conduit for the circuit originating from each transformer.

5.2 EARTHING

5.2.1 The following items of an electric lighting system shall be connected to the installation earthing system:

(a) The protective bonding of all exposed metal; and

(b) The mid-point of the secondary winding of the transformer, where the secondary open-circuit voltage exceeds 7500 volts.

5.2.2 Where high voltage cables are installed within 100 mm of any metallic or conductive surface, all such surfaces shall be earthed.

5.3 RETURN CONDUCTORS OPERATING AT EARTH POTENTIAL

Any return conductor shall be deemed to be operating at earth potential only where it is installed in accordance with the following requirements:

(a) One terminal of the secondary winding of the transformer is connected to earth; and

(b) One terminal of the electric discharge sign circuit is connected to earth independent of that required for (a) above; and

(c) The earth connection for both the secondary winding of the transformer and the electric discharge sign is achieved by a brass stud fitted with two washers, a nut, and a lock nut provided on the sign and transformer enclosure for the purposes of earthing the return conductor and frame only; and

(d) Legible and indelible notices are fixed adjacent to the connections between the return conductor and the frame at the electric discharge sign and at the earthed transformer secondary terminal. Such notices shall contain the words, "DO NOT DISCONNECT BONDING OF RETURN CONDUCTOR TO FRAME" in bold letters; and

(e) The earth return conductor is not used as an earthing medium for any portion of the installation; and

(f) The return conductor between the earthed point of the secondary winding of a transformer and the earthed point of the luminous discharge tube is made by the means of a conductor that:

(i) is not less than seven strands; and

(ii) has a cross-sectional area of not less than 2.5 mm^2; and

(iii) is adequately protected against mechanical damage; and

(iv) is securely fixed in position; and

(v) is insulated in accordance with the requirements for medium voltage (where installed externally to the enclosure of a electric discharge sign); and

(vi) does not have an identification colour of green, yellow, or green and yellow combination; and

(vii) is suitable for exposure to direct sunlight where installed out of doors.

NOTE: A circuit diagram for an earthed return conductor system is given in Figure 1.

5.4 CABLE TERMINATIONS

5.4.1 High and extra high voltage connections shall be made in accordance with Clause 2.2.4.

5.4.2 All cable terminations shall be of adequate mechanical strength to withstand the conditions of normal service.

5.4.3 All points of entry of cables to enclosures shall maintain the required degree of protection and shall be bushed or so finished as to prevent abrasion of the cable.

SECTION 6

LUMINARIES

6.1 LUMINOUS DISCHARGE TUBING

Luminous discharge tubing connections shall be:

(a) Free from contact with flammable material; and

(b) Located or protected so that they are not exposed to accidental damage; and

(c) Installed to maintain the clearances according with the requirements of Table 1, Page 13 of this Code; and

(d) Mechanically and electrically sound (connections shall be made by means of mechanical connectors, or by means of soldered, brazed or welded joints, or spring type connections); and

(e) Insulated with adequately rated and mechanically secure insulating sleeves or protected by a fire retardant shroud or earth screen installed in accordance with Clause 2.2.4.

6.2 TUBING SUPPORTS

Electric discharge tubing shall be adequately supported and secured on insulated supports which:

(a) Permit any necessary adjustment; and

(b) Are not located within 100 mm of an electrode; and

(c) Are mechanically sound.

6.3 GLASS TUBULATION

6.3.1 Glass tubulation used to protect bare or lightly insulated conductors shall be continuous in length, and have a wall thickness not less than 1 mm.

6.3.2 Cables protected by glass tubulation shall:

(a) Have a minimum size of 1 mm^2; and

(b) Not be more than 1.2 m in length; and

(c) Be resistant to the effects of ozone corrosion (e.g. nichrome type wire).

6.4 CABLE TERMINATIONS

6.4.1 High voltage connections shall be made in accordance with Clause 2.2.4.

6.4.2 Cable terminations shall be of adequate mechanical strength to withstand the conditions of normal service.

6.4.3 Points of entry of cables to enclosures shall maintain the required degree of protection and be bushed or so finished as to prevent abrasion of the cable.

6.5 EARTHING NOT REQUIRED

Earthing of an electric discharge sign is not required where the sign:

(a) Is constructed of all-insulated material which meets the requirements of Clause 2.2.2; and

(b) Has no exposed metal liable to become alive; and

(c) Meets the requirements for reinforced insulation (Test voltage = 2 x operating voltage to earth + 1000 volts.); and

(d) Is protected by an open circuit monitoring device.

6.6 BARE CONDUCTORS OR OTHER INSULATED CONDUCTORS

6.6.1 Where bare conductors or conductors not insulated to full working voltage, are used for high voltage wiring, they shall be adequately supported on suitable insulators so that the spacing between conductors of opposite polarity, and between conductors and all materials other than insulators, is not less than that specified in Table 1, for the appropriate voltage. Such conductors shall be enclosed and protected so that accidental personal contact is not possible.

TABLE 1

ELECTRIC DISCHARGE LIGHTING SYSTEMS MINIMUM CLEARANCES FOR BARE CONDUCTORS

Open-circuit Voltage Volts	Minimum clearance between bare conductors* or between bare conductors and material other than an insulator mm
> 250 < 1000	12
> 1000 < 6000	25
> 6000 < 15000	50

* Or cables not in compliance with an Official Standard for high voltage cables.

Figure 1

GUIDE TO THE RETURN CONDUCTOR SYSTEM FOR HIGH VOLTAGE ELECTRIC DISCHARGE LIGHTING SYSTEMS