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Australian Standard 2238—1982

ELECTRICAL EQUIPMENT FOR EXPLOSIVE ATMOSPHERES

NON-SPARKING APPARATUS TYPE OF PROTECTION n

STANDARDS ASSOCIATION OF AUSTRALIA
Incorporated by Royal Charter

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THE FOLLOWING SCIENTIFIC, INDUSTRIAL AND GOVERNMENTAL ORGANIZATIONS and departments were officially represented on the committee entrusted with the preparation of this standard:

Australian Coal Association

Australian Electrical and Electronics Manufacturers Association

Australian Institute of Petroleum

Confederation of Australian Industry

Department of Industrial Relations, N.S.W.

Department of Industry and Commerce

Department of Mineral Resources, N.S.W.

Department of Minerals and Energy, Vic.

Department of Mines, Qld

Electrical Contractors Associations of Australia

Electricity Supply Association of Australia

Independent testing interests

Insurance Council of Australia

State electricity regulatory authorities

This standard, prepared by Committee EL/14, Electrical Equipment in Hazardous Locations, was approved on behalf of the Council of the Standards Association of Australia on 24 September 1981, and was published on 25 January 1982.

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AUSTRALIAN STANDARD

ELECTRICAL EQUIPMENT FOR EXPLOSIVE ATMOSPHERES

NON-SPARKING APPARATUS TYPE OF PROTECTION n

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PREFACE

This standard was prepared by the Association's Committee on Electrical Equipment in Hazardous Locations. It supersedes AS 2238—1979 and is intended for the guidance of manufacturers, users, statutory authorities and associated interests, and for use with the SAA Wiring Rules (AS 3000) and relevant mining regulations.

In its terminology, definitions and general treatment of the subject this standard is similar to corresponding draft recommendations issued by the International Electrotechnical Commission (IEC) under document reference 31(Secretariat)109 and acknowledgement is made of the assistance received from that source.

The major changes in this edition are as follows:

(a) Reference is made to AS 2380, Part 1 for grouping of apparatus, temperature classification and marking.

(b) New requirements have been introduced for winding wires.

(c) Requirements for fluorescent lamp starter holders have been deleted.

(d) The voltage for the dielectric strength test has been reduced to 1000 V.

This standard requires reference to the following standards:

AS 1076 Code of Practice for Selection, Installation and Maintenance of Electrical Apparatus and Associated Equipment for Use in Explosive Atmospheres (Other Than Mining Applications)
Part 1—Basic Requirements
Part 7—Apparatus with Type of Protection n—Non-sparking Apparatus

AS 1194 Winding Wire

AS 1201 Tubular Fluorescent Lamps for General Lighting Service
Part 1—Test and Compliance Requirements

AS 1468 Ballasts for High Pressure Mercury Vapour and Low Pressure Sodium Vapour Discharge Lamps

AS 1593 Electrical Equipment for Explosive Atmospheres—Increased Safety Apparatus—Type of Protection e

AS 1829 Intrinsically Safe Electrical Apparatus for Explosive Atmospheres

AS 1896 Method of Test for Ignition Temperature of Gases and Vapours

AS 1939 Classification of Degrees of Protection Provided by Enclosures for Electrical Equipment

AS 2236 Dust-excluding Ignition-proof Enclosure of Electrical Equipment

AS 2380 Electrical Equipment for Explosive Gas Atmospheres—Explosion Protection Techniques
Part 1—General Requirements

AS 2430 Classification of Hazardous Areas
Part 1— Explosive Gas Atmospheres

AS 3000 SAA Wiring Rules

AS 3100 Approval and Test Specification for Definitions and General Requirements for Electrical Materials and Equipment

AS 3117 Approval and Test Specification for Bayonet Lampholders

AS 3140 Approval and Test Specification for Edison-type Screw Lampholders

IEC 61 Lamp Caps and Holders Together with Gauges for the Control of Interchangeability and Safety

IEC 155 Starters for Fluorescent Lamps

IEC 162 Luminaires for Tubular Fluorescent Lamps

IEC 238 Edison Screw Lampholders

IEC 262 Ballasts for High Pressure Mercury Vapour Lamps

IEC 400 Lampholders and Starterholders for Tubular Fluorescent Lamps

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

for

ELECTRICAL EQUIPMENT FOR EXPLOSIVE ATMOSPHERES—NON-SPARKING APPARATUS—TYPE OF PROTECTION n

FOREWORD

The purpose of this standard is to establish the essential constructional features, test requirements and marking requirements for non-sparking electrical apparatus which may be used in areas which are not normally hazardous, and in which an explosive concentration of flammable gas or vapour, if it occurs, will exist for only a short time. The risk of the presence simultaneously of an explosive atmosphere and a source of ignition is considered to be acceptably low.

The requirements which apply to inherently non-sparking electrical apparatus are specified in Section 4 of this standard. Measures are specified in Section 5 which may be applied to those parts of apparatus or circuits which arc or spark or generate hot surfaces in normal operation, and which must, therefore, be suitably protected so that the risk of ignition of an external explosive atmosphere is reduced to an acceptable level.

The classification of hazardous areas is dealt with in AS 2430, Parts 1 and 2. Part 1 applies to explosive gas atmospheres and recognizes the following zones:

Zone 0—an area in which an explosive gas atmosphere is present continuously, or is expected to be present for long periods, or for short periods which occur with high frequency.

Zone 1—an area in which an explosive gas atmosphere can be expected to occur periodically or occasionally during normal operation.

Zone 2—an area in which an explosive gas atmosphere is not expected to occur in normal operation and if it occurs is likely to be present only infrequently and for short duration.

Enclosures complying with this standard will be suitable for installation in a Zone 2 area.

It should be noted that this concept of area classification deals only with risks due to combustible gas and vapours and, by implication, mists.

This standard does not deal with risks due to the presence of combustible dusts.

General constructional requirements are specified in Section 2.

Examples of equipment which may be made to comply with this standard include electric motors, switches and luminaires.

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SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This standard specifies requirements for the construction, assessment and test of non-sparking electrical apparatus which, when operating normally within its rated duty, will not ignite a surrounding explosive atmosphere.

It specifies the features of apparatus which are assessed to achieve a statistically satisfactory level of safety for apparatus in areas which are not normally hazardous.

1.2 APPLICATION. This standard prescribes the minimum requirements for the safety of apparatus in Zone 2*. It supplements the requirements for apparatus for non-hazardous areas as stated in other standards.

The requirements of this standard shall apply in so far as they are essential to the safety of the apparatus. Specific test requirements may be omitted if they are judged to be unnecessary for safety and if justification is given in the documentation.

NOTES:

1. If the electrical apparatus has to withstand particular adverse service conditions, e.g. rough handling, humidity effects, temperature variations of ambient air, gas or vapours, these should be agreed upon between purchaser and manufacturer.
2. When choosing electrical apparatus, the purchaser should take into account the influence and the smouldering temperature of any dusts which are likely to be deposited in a layer. (See Appendix A of AS 2236.)
3. The metal of current-carrying parts, including those in earth continuity paths, should be selected so as to take into account the possible effects of galvanic corrosion arising from dissimilar metals in direct contact.
4. Where necessary, adequate means of earthing shall be provided.

1.3 DEFINITIONS. For the purpose of this standard, the following definitions apply:

1.3.1 Clearance—the shortest distance through air between two conducting parts.

1.3.2 Creepage distance—the shortest distance between two conducting parts along the surface of the insulating parts.

1.3.3 Enclosed-break device—a device which incorporates electrical contacts that are made and broken, which has a net volume not greater than 20 cm^3, and which will withstand an internal explosion of the flammable gas or vapour which may enter it without suffering damage and without communicating the internal flammation to the external flammable gas or vapour.

1.3.4 Enclosure—the external casing protecting the electrical and mechanical parts of apparatus.

NOTE: The term excludes cables.

1.3.5 Energy limitation—the concept of restriction of energy at sparking contacts in normal operation to non-incendive levels, and limitation of surface temperatures to ensure safety.

1.3.6 Hermetically sealed device—a device which is so constructed that the external atmosphere cannot gain access to the interior and in which the seal is made by fusion, e.g. soldering, brazing, welding or the fusion of glass to metal.

1.3.7 Non-incendive component—a component with contacts for making and breaking a potentially incendive circuit where either the contacting mechanism or the enclosure in which the contacts are housed is so constructed that the component prevents ignition of the prescribed flammable gas or vapour under specified operating conditions.

NOTES

1. Non-incendive components are limited to a maximum rating of 250 V and 15 A, and a net volume of not greater than 20 cm^3.
2. A non-incendive component is limited in use to the particular circuit for which it has been shown to be non-ignition capable.

1.3.8 Sealed device—a device containing normally arcing parts or hot surfaces which is so constructed that it cannot be opened during normal service and has a free internal volume of less than 100 cm^3, and is sealed to effectively prevent entry of an external atmosphere.

1.3.9 Separation—the shortest distance between two conducting parts through solid insulating material.

1.3.10 Type of Protection n—a type of protection applied to electrical apparatus such that, in normal operation, it is not capable of igniting a surrounding explosive atmosphere and a fault capable of causing ignition is not likely to occur.

1.4 GROUPING OF APPARATUS. Non-sparking apparatus shall be grouped in accordance with Clause 1.5 of AS 2380, Part 1, except that non-sparking apparatus shall not be grouped as Group I.

1.5 TEMPERATURE CLASSIFICATION.

1.5.1 General. Apparatus shall be classified in accordance with Clause 1.6 of AS 2380, Part 1.

1.5.2 Permissible Excess Temperatures. Surface temperatures higher than indicated by the marked temperature classification can be permitted for small components, e.g. transistors or resistors, if it has been shown by test that there is no direct or indirect risk of ignition.

For other apparatus, surface temperatures higher than indicated by the marked temperature classification are permissible provided that it is shown by test that the maximum surface temperature is at least 50 K† below the lowest temperature at which ignition of the specified explosive gas/air mixture or mixtures will occur under the intended conditions of use. This is valid only for the flammable gases and vapours specified in the accompanying documentation, and the apparatus shall be marked with the restriction of application.

1.5.3 Unclassified Temperatures. Where apparatus is designed for a particular application or is designed for a maximum surface temperature greater than 450° C, the limiting temperature for accessible surfaces shall be marked on the apparatus in accordance with the requirements of Section 3.

1.5.4 Components of Luminaires. Auxiliary components of luminaires shall be classified in accordance with Clause 4.5.3.

1.5.5 Marking of Lamp Rating. Luminaires shall be marked with the lamp rating appropriate to the temperature class.

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*As classified in accordance with AS 2430, Part 1.

†K = kelvin. For temperature difference 1 K = 1°C.

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SECTION 2. DESIGN AND CONSTRUCTION

2.1 POTENTIAL IGNITION SOURCES. The apparatus shall not in normal operation—

(a) produce an arc or spark unless the operational arc or spark is prevented from causing ignition of an external explosive atmosphere by one of the methods described in Section 5; or

(b) develop a temperature of a surface or hot spot in excess of the maximum value appropriate to the temperature classification of the apparatus, unless the surface temperature or hot spot is prevented from causing ignition of an external explosive atmosphere by one of the methods described in Section 5 as appropriate, or is otherwise shown to be safe as specified in Clause 1.4.2.

NOTE: Sliding contacts are considered as sparking in normal operation.

2.2 ENCLOSURES.

2.2.1 General. The apparatus shall be provided with an enclosure.

NOTE: An enclosure may consist of a hermetically sealed enclosure, a restricted-breathing enclosure, an unrestricted-breathing enclosure, or a combination of these.

2.2.2 Degree of Protection. Enclosures of bare live parts and enclosures for insulated parts shall provide degrees of protection not less than IP 40 and IP 20 of AS 1939, respectively.

NOTE: Enclosures for outdoor use will require a degree of protection to AS 1939 that is superior to the above requirements.

2.2.3 Mechanical Strength. Enclosures shall be capable of complying with the impact test requirements specified in the normal industry standard. Where no standard for the particular equipment exists, or where impact test requirements are not specified, the requirements specified in Clause 6.4 shall apply.

2.2.4 Protective Guards. Every guard provided for the protection of a light-transmitting part or window shall have a mesh where the opening is not greater than 5000 mm^2 and the distance between bars is not more than 120 mm.

Where plastics are employed for enclosures or guards, they shall be suitable for the particular temperature conditions.

2.3 CONNECTION FACILITIES.

2.3.1 General. Connection facilities shall comply with Clause 2.3.2 or Clause 2.3.3, as appropriate, unless failure to comply would not result in an unsafe condition. (For plugs and sockets, see Clause 4.4).

2.3.2 Connections for External Conductors.

2.3.2.1 *General.* Terminals provided for external connections shall be designed so that the conductors can be connected readily to the terminals and can be clamped without reducing their cross-sectional area and in such a manner that they are permanently gripped and secured against loosening and twisting, and that the contact pressure will be maintained permanently. This requirement is not intended to exclude the use of terminals which rely for their integrity against loosening on friction alone.

Alternatively, the terminals may be suitable for cable lugs provided that the lugs can be secured against loosening and that the arrangement is such that the contact pressure will be maintained permanently. Where this type of termination is used, means shall be provided for preventing accidental reduction of clearances. This may be achieved by the use of insulating barriers at least as high as the terminals.

2.3.2.2 *Size of conductors.* Terminals for external connection shall accommodate at least the size of conductor appropriate to the rated current of the equipment.

NOTE: System conditions (voltage drop, fault level, etc) may make it necessary to provide terminals suitable for larger conductors than are required by thermal considerations.

2.3.2.3 *Apparatus containing internal sources of heat.* Where the apparatus contains internal sources of heat which may cause the temperature of the incoming supply wiring to exceed the recommended limiting temperature for general purpose PVC-insulating wiring (V 75), the apparatus of the terminal enclosure shall be provided with a warning such as—

'WARNING: WIRING ENTRY TEMPERATURE . . . °C. USE ONLY CABLE WITH APPROPRIATE RATING'.

NOTE: If internal sources of heat within the apparatus or the terminal enclosure could cause the temperature of the incoming supply wiring to exceed the recommended limiting temperature for general purpose PVC-insulated wiring, special installation instructions may be required, e.g. heat-resistant sleeving may be necessary.

2.3.3 Internal Connections. Internal connections shall not be subject to undue mechanical stress. They shall be such that contact pressure is adequately maintained. Examples of suitable methods are as follows:

(a) Screwed or bolted connections.

(b) Crimped connections.

(c) Soldering.

(d) Brazing.

(e) Welding.

(f) Pinching screws, provided that the pinching screws do not damage the conductors.

(g) Machine-wrapped solderless joints (for currents not greater than 1 A).

(h) Pressure-type wire connectors.

2.4 PROTECTION OF WIRING. Internal wiring which might come in contact with a sharp metallic part shall be either mechanically protected or clamped to avoid chafing.

2.5 CLEARANCES, SEPARATIONS AND CREEPAGE DISTANCES.

2.5.1 General. Where electrical breakdown would be potentially incendive, clearances, separations and creepage distances for the separation of live parts shall comply with the requirements given in Table 2.1, unless the apparatus is subjected to routine high voltage tests conducted at the voltages specified in Clause 6.5 plus 500 V.

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