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Australian Standard 2236—1979

ELECTRICAL EQUIPMENT FOR EXPLOSIVE ATMOSPHERES DUST-EXCLUDING IGNITION-PROOF ENCLOSURE

STANDARDS ASSOCIATION OF AUSTRALIA

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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 Manufacturers Association

Confederation of Australian Industry

Department of Productivity

Department of Public Works, N.S.W.

Departments of Explosives

Departments of Labour and Industry

Departments of Mines

Electrical Contractors Association of Australia

Insurance Council of Australia

Oil Companies

Statutory Electricity Authorities

Sydney County Countil (Testing Interest)

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To keep abreast of progress in industry, Australian standards are regularly reviewed. Suggestions for improvements to published standards, addressed to the head office of the Association, are welcomed.

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AUSTRALIAN STANDARD

DUST-EXCLUDING IGNITION-PROOF ENCLOSURE OF ELECTRICAL EQUIPMENT

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PREFACE

This standard was prepared by the Association's Committee on Electrical Equipment in Hazardous Locations for use in association with the SAA Wiring Rules and for the guidance of users, manufacturers and statutory authorities concerned with the operation of electrical equipment in dust laden atmospheres. It is a revision of AS C358—1965, Dust-excluding Ignition-proof Enclosure of Electrical Equipment, which it accordingly supersedes.

The degree of hazard associated with any particular installation depends on the nature of the dust-laden atmosphere and the potential source of ignition. Such features as types of dust with differing characteristics, dust particle size, dust concentration, and uniformity of dust cloud can have a bearing in this regard and influence the effectiveness of an enclosure for a particular situation.

Section 9, Hazardous Locations, of the SAA Wiring Rules deals with this matter in some detail and provides a basis for a better understanding of this standard. Consequently this standard prescribes an enclosure for industrial application in which the following aspects are considered:

(a) Dust aspects:

(i) Hazardous dust is totally excluded from the interior of the enclosure at all times.

(ii) The electrical equipment will function without impairing the dust-excluding ignition-proof properties of the enclosure.

(iii) The external surface of the enclosure are benign to the dust-laden atmosphere and to the dust.

(iv) The rigours of operation will not impair the dust-excluding ignition-proof properties of the enclosure or the failure of the enclosed electrical equipment.

(b) Temperature aspects:

(i) The limitation of exterior surface temperatures to 120° C so as to avoid spontaneous ignition of dusts which may collect on the enclosure.

(ii) The limitation of external surface temperatures to a defined or set temperature so that the external surfaces of the enclosure are benign to the dust laden atmosphere and the dust. (See Clause 2.14.1(e)).

The standard has wide application in industry but must not be regarded as prescribing the only means of safe operation of electrical equipment in dust-laden atmospheres. There are other means available whereby an explosion hazard may be controlled, e.g. good housekeeping, the use of point source extraction ventilation of the hazardous area, the use of enclosure under positive pressure to prevent the entry of dust, and other approved

methods. The SAA Wiring Rules set out many of these methods and makes reference to applicable standards. Installations in hazardous areas require expert and special attention.

NOTE: At present there are no IEC published standards for testing intrinsically safe apparatus for use in explosive dust atmospheres.

During the preparation of this standard reference was made to the following publications, and acknowledgement is made of the assistance received therefrom:

Defence Production Specification No FB479	Electrical Wiring Installations for Lighting, Heating and Power at Government Explosives and Filling Factories, Appendix A
NFPA Code No 63	Prevention of Dust Explosions in Industrial Plants
VDE 0165/9.7	Regulations for the Installation of Electrical Plant and Workshops, Where Explosive Dangers Present (Germany)

This standard requires reference to the following standards:

AS 1152	Test Sieves
AS 1939	Classification and Degrees of Protection Provided by Enclosures for Electrical Equipment
AS 3000, Part 1	SAA Wiring Rules
AS C98	Flameproof Enclosure of Electrical Equipment for Explosive Atmospheres
AS C100	Approval and Test Specification for Definitions and General Requirements for Electric Materials and Equipment
BS 2050	Electrical Resistances of Conductive and Antistatic Products Made from Flexible Polymeric Material

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Australian Standard
for
DUST-EXCLUDING IGNITION-PROOF ENCLOSURE OF ELECTRICAL EQUIPMENT

FOREWORD

The purpose of this standard is to establish requirements for a form of enclosure of electrical equipment for use in flammable dust atmospheres without the risk of fire or explosion, i.e. for dust excluding ignition-proof (DIP) enclosure or electrical equipment as required by the SAA Wiring Rules for Class II locations.

The enclosure specified shall be designed in such a way that failure of the enclosed electrical equipment will no impair the dust-excluding properties of the enclosure. The standard requires that close attention be given to the treatment of joint surfaces in order to prevent ignitable dusts from entering the enclosure. Likewise arcs, sparks or heat otherwise generated or liberated inside the enclosure must not cause ignition of exterior accumulations or atmospheric suspensions of a dust.

The standard provides for two basic types of enclosure, viz—

Type A—an enclosure in which the air pressure remains substantially constant with change in temperature, i.e. pressure relief is provided to a dust-free atmosphere; and

Type B—an enclosure in which the air pressure changes with temperature, i.e. pressure relief is not provided.

Systems are classified as Type A where they have venting or pressure relief to an external dust-free atmosphere, and Type B where they are totally sealed by virtue of the method employed for connection to external circuit conductors.

In addition, the standard recognizes the use of enclosures having a degree of protection IP 6X as specified in AS 1939. Such enclosures are exempt from the pressure test specified in Clause 3.5, but are required to comply with all other relevant technical criteria specified herein.

It must be recognized that safe use of electrical equipment in flammable explosive dust atmospheres may depend on many factors besides the use of a DIP enclosure. Some of these factors are as follows:

(a) Proper appreciation of the hazards involved (see AS 3000, Part 1, Section 9—Hazardous Locations).

(b) Proper installation, operation and maintenance, strict observation of design ratings, and provision of adequate automatic protective devices are essential.

(c) Specially hazardous dusts, such as gunpowder, nitrocellulose, and the like, are so inherently explosive that the emphasis must be on minimizing the use of electrical equipment in atmospheres where these dusts occur. Where DIP enclosures are used with a specially hazardous dust, the surface temperature must be less than the ignition temperature by an adequate safety margin.

(d) There are means other than a DIP enclosure whereby an explosive hazard may be controlled, e.g. enclosure under positive pressure, intrinsically safe apparatus and circuits, and other approved specialized safeguards. Some of these safeguards are mentioned in Section 9 of SAA Wiring Rules.

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This standard specifies requirements for enclosures for electrical equipment which are so constructed as to prevent the ingress of dust and the spontaneous ignition of certain dusts which may gather on the enclosure.

The tests specified herein are intended as type tests.

NOTES:

1. Technical information on flammable and explosive dusts is tabulated in Appendix A
2. Typical operation diagrams are given in Appendix C.

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

1.2.1 Combustible hazardous dusts—dusts which when mixed with air in certain proportions or layered can be ignited by the application of a specific level of energy. Examples of such dusts are starch and coal dust.

NOTE: Layered dusts under certain conditions may glow without ignition.

1.2.2 Dust—particulate material which is or has been airborne and which passes a 75 μm mesh sieve complying with AS 1152.

NOTE: Particles smaller than 1 μm are defined as smoke.

1.2.3 Enclosure, dust-excluding ignition-proof (DIP enclosure)—an enclosure which excludes dust, and which will not permit arcs, sparks or heat otherwise generated or liberated inside the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure.

NOTE: A dust-excluding ignition proof enclosure, in accordance with the foregoing definition, will not be flameproof unless constructed in compliance with AS C98.

1.2.4 Fibre—a unit of matter characterized by flexibility, fineness and high ratio of length to thickness.

1.2.5 Flying—waste fibres which fly out into the atmosphere during carding, drawing, spinning and other processes.

1.2.6 Glow temperature (of dusts)—the lowest temperature of a heated exposed surface at which a dust layer 5 mm thick ignites.

NOTE: As the layer thickness increases the glow temperature is reduced.

1.2.7 Ignition temperature (of a substance , whether solid, liquid or gaseous)—the minimum temperature required to initiate or cause self-sustained combustion independently of the heating or heated element. The ignition temperature of a solid is influenced by its physical condition and the rate of heating. Ignition temperature varies with the size, shape and material of the testing container and other factors.