

Australian Standard[®]

**Electrical equipment for explosive
atmospheres—Explosion-protection
techniques**

**Part 4: Pressurized rooms or
pressurized enclosures**

This Australian Standard was prepared by Committee EL/14, Electrical Equipment in Hazardous Areas. It was approved on behalf of the Council of Standards Australia on 29 June 1994 and published on 19 September 1994.

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RECONFIRMATION
OF
AS 2380.4—1994
Electrical equipment for explosive atmospheres—Explosion-protection techniques
Part 4: Pressurized rooms or pressurized enclosures

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Electrical equipment for explosive atmospheres—Explosion-protection techniques

Part 4: Pressurized rooms or pressurized enclosures

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee on Electrical Equipment in Hazardous Areas, to supersede AS 1021—1980, *Protection by purging of electrical equipment for explosive atmospheres* and AS 1825—1982, *Electrical equipment for explosive atmospheres—Pressurized enclosures—Type of protection p*. Under the terms of the Active Cooperation Agreement, this Standard is the result of a consensus among Australian and New Zealand representatives on the Joint Committee to produce this document as an Australian Standard.

The scope of the Standard has also been expanded to include pressurized rooms, and pressurized rooms and enclosures for use in Class II (dust) areas.

This Standard is intended for the guidance of manufacturers, designers, installers, users, statutory authorities and associated interests. It is part of a series of Standards dealing with the explosion-protection of electrical equipment intended for use in potentially explosive atmospheres.

In its terminology, definitions and general treatment of the subject, this Standard is similar to IEC 79, *Electrical apparatus for explosive gas atmospheres*, Part 2: *Electrical apparatus—Type of protection “p”* and Part 13: *Construction and use of rooms or buildings protected by pressurization*.

Acknowledgment is made of the assistance received from these sources.

Some of the more significant changes to AS 1021 and AS 1825 included in this Standard are:

- (a) The inclusion of requirements for pressurized rooms and enclosures suitable for use in Class II combustible dust areas.
- (b) Definitions and terminology have been revised to align with other Australian and IEC Standards.
- (c) Reference to IEC 79-16 for analyser houses has been included.
- (d) Requirements for shutdown of electrical supply have been clarified.
- (e) The inclusion of a clause detailing the pressurization principle.

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CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	5
1.2 REFERENCED DOCUMENTS	5
1.3 DEFINITIONS	6
1.4 TEMPERATURE LIMITS	7
1.5 GROUPING OF EQUIPMENT	7
1.6 PRESSURIZATION PRINCIPLE	7
SECTION 2 GENERAL CONSTRUCTIONAL REQUIREMENTS	
2.1 SCOPE OF SECTION	9
2.2 ELECTRICAL PERFORMANCE OF EQUIPMENT	9
2.3 CONSTRUCTION MATERIALS	9
2.4 PROTECTION AGAINST ENVIRONMENT	9
2.5 PRESSURIZATION	9
2.6 INLET AND OUTLET APERTURES	9
2.7 ALTERNATIVE SOURCES OF PROTECTIVE GAS	9
2.8 INTAKE DUCTING	10
2.9 ELECTRICAL CONNECTIONS TO ENCLOSURES	10
2.10 ENTRY OF ELECTRICAL AND OTHER SERVICES TO ROOMS	10
2.11 DOORS AND COVERS	10
2.12 POSSIBLE SOURCES OF IGNITION	10
2.13 ENCLOSED COMPONENTS	10
2.14 PRESSURE OR FLOW ACTIVATED DEVICES	10
2.15 SUPPLY OF PROTECTIVE GAS	11
2.16 ROTATING MACHINES	11
2.17 PROTECTION REQUIREMENTS	11
2.18 INSPECTION DOORS	12
SECTION 3 ENCLOSURES HAVING NO INTERNAL SOURCE OF FLAMMABLE MATERIAL	
3.1 GENERAL	13
3.2 LEVEL OF OVERPRESSURE	13
3.3 PROTECTION REQUIREMENT	13
SECTION 4 ROOMS HAVING NO INTERNAL SOURCE OF FLAMMABLE MATERIAL	
4.1 GENERAL	14
4.2 LEVEL OF OVERPRESSURE	14
4.3 PROTECTIVE GAS FLOW	14
4.4 PROTECTION REQUIREMENT	14
SECTION 5 ENCLOSURES HAVING AN INTERNAL SOURCE OF FLAMMABLE GAS OR VAPOUR	
5.1 GENERAL	16
5.2 DESCRIPTION OF TECHNIQUES	16
5.3 LEVEL OF OVERPRESSURE	16
5.4 OUTLET APERTURES	16

5.5	ASSESSMENT OF THE INTERNAL RELEASE	16
5.6	PROTECTION REQUIREMENTS	17
5.7	SUPPLY OF PROTECTIVE GAS	18
SECTION 6 ASSESSMENT AND TESTS		
6.1	GENERAL	20
6.2	TYPE VERIFICATION AND TESTS	20
6.3	PRESSURIZATION TEST	20
6.4	MINIMUM OVERPRESSURE TEST	20
6.5	IMPACT TEST	20
SECTION 7 MARKING		21
APPENDICES		
A	DUCTS FOR PROTECTIVE GAS SUPPLY	22
B	GUIDELINES FOR ASSESSING THE TYPE OF RELEASE WITHIN ENCLOSURES	25
C	DISCUSSION OF PROTECTION REQUIREMENTS FOR CONTINUOUS DILUTION	27

STANDARDS AUSTRALIA

Australian Standard

**Electrical equipment for explosive atmospheres—
Explosion-protection techniques****Part 4: Pressurized rooms or pressurized enclosures**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard specifies requirements for the design, construction and testing of pressurized rooms or pressurized enclosures, type of protection ‘p’, intended for use in Class I, Zone 1 and Zone 2 or Class II explosive atmospheres. While this standard covers enclosures with an internal release of flammable gas or vapour, it does not cover rooms with such a release, e.g. analyser houses nor rooms or enclosures with an internal release of combustible dust.

The requirements contained in this Standard are supplementary to those in AS 2380.1.

NOTES:

- 1 The classification of explosive atmospheres, termed hazardous areas, is dealt with in AS 2430. Further guidance may be obtained from Handbook SAA HB13.
- 2 Equipment with large areas which are subjected to pressures in excess of 1 kPa (e.g. sheet metal switchboard enclosures) may require approval from the relevant authority responsible for pressure vessel legislation in the State or Territory in which the enclosure is to be installed.
- 3 Rooms in which there is an internal release of flammable gas or vapour e.g. analyser houses are covered by IEC 79-16.
- 4 Areas not covered by this standard may be treated by protection by ventilation in accordance with AS 1482.
- 5 To minimise the risk of failure of an enclosure due to rupturing arc faults safeguarding against potential fault currents of an installation, especially where levels exceed 6 KA, should be provided.

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

AS

- | | |
|--------|--|
| 1939 | Degrees of protection provided by enclosures for electrical equipment (IP Code) |
| 2380 | Electrical equipment for explosive atmospheres—Explosion-protection techniques |
| 2380.1 | Part 1: General requirements |
| 2381 | Electrical equipment for explosive atmospheres—Selection, installation and maintenance |
| 2381.1 | Part 1: General requirements |
| 2430 | Classification of hazardous areas |
| HB13 | Electrical equipment for hazardous areas |

IEC

- | | |
|-------|--|
| 79-16 | Electrical apparatus for explosive gas atmospheres, Part 16: Artificial ventilation for the protection of analyzer(s) houses |
|-------|--|

1.3 DEFINITIONS For the purpose of this Standard, the definitions given in AS 2380.1 and those below apply.

1.3.1 Air lock—an airtight entranceway designed to maintain the internal pressure of a room or enclosure in order to prevent the entry of a surrounding explosive atmosphere.

1.3.2 Continuous dilution—technique of supplying a protective gas flow continuously to an enclosure containing an internal source of flammable gas or vapour for the purpose of diluting any flammable gas or vapour which could be present.

1.3.3 Enclosure—all the walls which surround the live parts of electrical equipment including doors, covers, cable entries, rods, spindles and shafts and which ensure the protection of the electrical equipment.

1.3.4 Explosive atmosphere—mixture with air, under atmospheric conditions, of flammable materials in the form of gas, vapour, mist, dust or fibres in which, after ignition, combustion spreads throughout the unconsumed mixture.

1.3.5 Flammable material—gas, vapour, liquid, dust or solid which can react continuously under appropriate concentration conditions with atmospheric oxygen and which may therefore sustain fire or explosion when such reaction is initiated by a suitable spark, flame or hot surface.

NOTE: Many liquids and solids, though regarded as flammable, nevertheless do not normally burn. The application of heat to such materials serves to release vapour which may burn with atmospheric oxygen. The heat of the subsequent reaction serves to release further vapour for combustion. Flame may propagate throughout suspensions of dusts by this mechanism.

1.3.6 Fresh air—air drawn from an atmosphere which is free from flammable material.

1.3.7 Hazard—presence, or the risk of the presence, of an explosive mixture of a flammable material with air.

1.3.8 Ignition-capable equipment—equipment which in normal operation produces sparks, hot surfaces, or a flame which can ignite an explosive atmosphere.

1.3.9 Internal source of flammable gas or vapour—device(s) in the electrical equipment from which flammable gases or vapours are released during normal operation, or may be released in abnormal circumstances, e.g. due to a failure of the gas containment system.

1.3.10 Lower explosive limit (LEL)—concentration of flammable gas, vapour or mist in air, below which an explosive gas atmosphere will not be formed.

1.3.11 Opening—any aperture, door, window or non-airtight fixed panel.

1.3.12 Pressurization—technique of guarding against the ingress of the external atmosphere, which may be explosive, into a room or enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere.

1.3.13 Pressurization by circulation of protective gas—method of maintaining pressurization within an enclosure in which, after purging, the protective gas is passed continuously through the enclosure.

1.3.14 Pressurization with leakage compensation—method of maintaining pressurization within an enclosure in which, when the exit apertures are closed after purging, the supply of protective gas is sufficient to compensate for the inevitable leakages from the enclosure and its ducts.

1.3.15 Pressurized enclosure—enclosure in which pressurization is used to guard against ingress of the external atmosphere.

1.3.16 Protective device—any device provided to protect a system against conditions which could result in a fire or explosion.

1.3.17 Protective gas—gas used to maintain pressurization or to dilute flammable gases or vapours to a level well below the lower explosive limit. The protective gas may be air, nitrogen or any other non-flammable gas or a mixture of such gases.

1.3.18 Purging—operation of passing a quantity of protective gas through a room or enclosure prior to the equipment being energized such that the original atmosphere is exchanged and that the remaining atmosphere is well below the lower explosive limit.

1.3.19 Room—room or rooms provided with doors, cable ducts, conduits and similar, containing electrical equipment and of sufficient size to permit the entry of a person.

1.3.20 Self-revealing fault—a fault which would cause a malfunction of the apparatus necessitating correction before proceeding with further operation and which may be indicated, for example, by an audible or visible signal.

1.3.21 Type of protection ‘p’—concept of achieving safety by means of—

- (a) maintaining the internal pressure of an enclosure for electrical equipment above that of the external atmosphere; or
- (b) maintaining a sufficient flow of fresh air or inert gas through a room or enclosure in order to reduce to a safe level any concentration of flammable material within.

1.4 TEMPERATURE LIMITS The equipment shall be classified in accordance with AS 2380.1. The classification shall be determined by the higher of the following temperatures:

- (a) The maximum external surface temperature of the enclosure.
- (b) The maximum surface temperatures of internal parts which are protected by a type of protection recognized in AS 2381.1 and which remain energized when the supply of protective gas for pressurization or for continuous dilution is removed or fails, such as heaters.

If, during normal service, the temperatures of internal surfaces which may be exposed to an explosive atmosphere exceed the maximum values permitted in AS 2380.1 for the temperature class of the equipment, appropriate measures shall be taken to ensure that, if pressurization fails, the explosive atmosphere cannot reach the heated surfaces before they have cooled below the permitted maximum value, e.g. by bringing auxiliary ventilation systems into operation.

Similarly, if the source of protective gas for continuous dilution should fail, appropriate measures shall be taken to ensure that internal exposed surfaces which exceed the maximum temperature values permitted will not contact the explosive atmosphere before such surfaces have cooled below the maximum value permitted.

Such measures may include bringing an auxiliary source of protective gas into operation. Alternatively, other means of protection may be used, such as containment within a hermetically sealed enclosure or encapsulation of the hot surfaces.

If it can be shown by test that surface temperatures exceeding the values permitted in AS 2380.1 are not ignition capable, auxiliary or alternative means of protection are not required.

1.5 GROUPING OF EQUIPMENT When used in Class I areas pressurized rooms and enclosures shall be grouped in accordance with AS 2380.1.

1.6 PRESSURIZATION PRINCIPLE Protection by pressurization is a form of explosion protection that is reliant upon the enclosure or room being subjected to a continuous pressure from a supply of uncontaminated air or other non-flammable gas while equipment within the enclosure is energized.

In designing a pressurization system the following basic principles apply:

- (a) There is a reliable and continuous flow of air or inert gas which maintains the pressure above a predetermined level.
- (b) Pressurization failure automatically initiates alarms or disconnects the system from the electricity supply.
- (c) The enclosure is purged for a definite time before the electrical supply to the system can be connected, in order to dissipate any accumulated flammable mixture left in the enclosure, either accidentally following failure of the pressurization system, or following normal shutdown.
- (d) Where the pressurization medium is discharged into the hazardous area, means are provided to prevent matter or hot particles from equipment fault conditions entering the hazardous area or the pressurization medium is discharged into a safe atmosphere.

SECTION 2 GENERAL CONSTRUCTIONAL REQUIREMENTS

2.1 SCOPE OF SECTION The requirements of this Section apply, unless otherwise stated, to all rooms or enclosures with type of protection 'p'.

2.2 ELECTRICAL PERFORMANCE OF EQUIPMENT The electrical performance of equipment contained within the room or enclosure shall be such that the equipment is capable of functioning up to its full rating and recognised overloads, if any, without detriment to the room or enclosure or rise in surface temperature in excess of the specified limits.

2.3 CONSTRUCTION MATERIALS The materials used for the room or enclosure, ducts and coupling components shall be as resistant, chemically and physically, as is necessary for the use intended; moreover, they shall be able to withstand the maximum surface temperature at which they are intended to be used without affecting the type of protection.

2.4 PROTECTION AGAINST ENVIRONMENT Consideration should be given to the nature of the environment in which the room or enclosure shall be installed, including mechanical, chemical, thermal, corrosive and solvent factors and ultraviolet exposure.

Where the room or enclosure is subject to hosing down, means shall be provided to ensure that safe and satisfactory operation of the equipment is not impaired. Rooms or enclosures which have a degree of protection of at least IPX6 to AS 1939 shall be deemed to comply with this requirement.

2.5 PRESSURIZATION

2.5.1 Overpressure requirements

2.5.1.1 Enclosures The enclosure, ducts and coupling components should be able to withstand an overpressure equal to 1.5 times the maximum overpressure specified in normal service or 200 Pa (2mbar), whichever is greater. Suitable protective devices should be fitted if an overpressure can occur in service that is capable of causing dangerous deformation of the enclosure, ducts or connections.

2.5.1.2 Rooms A minimum overpressure of 25 Pa (0.25 mbar) with respect to the outer atmosphere should be maintained at all points inside the room and its associated ducts at which leaks are liable to occur, all doors and windows being closed.

2.5.2 Dual pressurization Where dual pressurization or purging techniques are used, i.e. a room or enclosure is either purged or pressurized to make it non-hazardous and contains a device with a source of release which is also protected by pressurization, the two sources of air shall either be independent or automatic shutdown shall be provided.

2.6 INLET AND OUTLET APERTURES The location, size and number of inlet and outlet apertures shall be sufficient to ensure efficient purging. The number of apertures shall be chosen with regard to the design and disposition of the protected equipment, particular consideration being given to the needs of subcompartments into which the equipment might be divided.

2.7 ALTERNATIVE SOURCES OF PROTECTIVE GAS In certain circumstances, such as where it is necessary to maintain operation of the electrical equipment, it may be advisable to provide two sources of protective gas so that the alternative source may take over in the event of failure of the primary source. Each source shall be capable of maintaining, independently, the required level of pressure or rate of supply of protective gas.