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Responsible committee: EXL/31 Equipment for explosive atmospheres

Interested committees:

Title: Draft BS EN 60079-2 Explosive atmospheres. Part 2: Equipment protection by pressurized enclosure "p".

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- iii) requires additional national guidance or information

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## Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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## Template for comments and secretariat observations

|                  |                        |
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| 1  | 2                                          | (3)                          | 4               | 5                                                                                                                                  | (6)                                                                      | 7                                                  |
|----|--------------------------------------------|------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| MB | Clause No./ Subclause No./Annex (e.g. 3.1) | Paragraph/Figure/ Table/Note | Type of comment | Commend (justification for change) by the MB                                                                                       | Proposed change by the MB                                                | Secretariat observations on each comment submitted |
|    | 3.1                                        | Definition 1                 | ed              | Definition is ambiguous and needs clarifying.                                                                                      | Amend to read '...so that the mains connector to which no connection...' |                                                    |
|    | 6.4                                        | Paragraph 2                  | te              | The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK. | Delete reference to UV photometer.                                       |                                                    |



# 31/1401/CD

COMMITTEE DRAFT (CD)

|                                            |                                                 |
|--------------------------------------------|-------------------------------------------------|
| PROJECT NUMBER:<br><b>IEC 60079-2 ED7</b>  |                                                 |
| DATE OF CIRCULATION:<br><b>2018-07-13</b>  | CLOSING DATE FOR COMMENTS:<br><b>2018-10-05</b> |
| SUPERSEDES DOCUMENTS:<br><b>31/1400/RR</b> |                                                 |

|                                                                                                                                                                      |                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEC TC 31 : EQUIPMENT FOR EXPLOSIVE ATMOSPHERES                                                                                                                      |                                                                                                                                                          |
| SECRETARIAT:<br>United Kingdom                                                                                                                                       | SECRETARY:<br>Mr Mick Maghar                                                                                                                             |
| OF INTEREST TO THE FOLLOWING COMMITTEES:                                                                                                                             | PROPOSED HORIZONTAL STANDARD:<br><input type="checkbox"/><br>Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary. |
| FUNCTIONS CONCERNED:<br><input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY |                                                                                                                                                          |

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

**Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure "p"**

NOTE FROM TC/SC OFFICERS:

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## EXPLOSIVE ATMOSPHERES –

## Part 2: Equipment protection by pressurized enclosure "p"

## FOREWORD

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International Standard IEC 60079-2 has been prepared by technical committee 31: Explosive atmospheres.

This sixth edition cancels and replaces the fifth edition published in 2007. This sixth edition cancels and replaces the first edition of IEC 61241-4 published in 2001. This sixth edition constitutes a technical revision.

The significance of changes between IEC 60079-2, Edition 7.0, 20xx and IEC 60079-2, Edition 6.0, 2014 are as listed below:



## Explanations:

### A) Definitions

**Minor and editorial changes** clarification decrease of technical requirements minor technical change editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

**Extension** addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous standard. Therefore, these will not have to be considered for products in conformity with the preceding edition. 5.

**Major technical changes** addition of technical requirements increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that a product in conformity with the preceding edition will not always be able to fulfill the requirements given in the later edition. These changes have to be considered for products in conformity with the preceding edition. For these changes additional information is provided in clause B) below

### B) Information about the background of 'Major Technical Changes'

C1 – the pressurization control systems sold as associated equipment do not fully handle all concerns for pressurized equipment when installed . It is essential that when a pressurized control system is used, that the final pressurized equipment is fully assessed to the requirements of this standard.

C2 – When a flowmeter is used at the inlet of the pressurized enclosure of the pressurized equipment, special provisions will need to be made to assure that the flow being measured is able to properly pressurize the equipment to the required pressurization overpressure. There could be conditions such as open doors or open apertures that would prevent the required pressurization overpressure from being reached based only the flowmeter at the inlet without additional measures to confirm the defined area to be pressurized and a defined maximum leakage rate are in place.

C3 – For pressurization control systems sold as associated equipment, clarification was needed as to how the components that comprise the pressurization control system shall be marked to identify what is covered as part of the pressurization control system

C4 –

C5 –

C6 –

C7 –

C8 – .

C9 –

The text of this standard is based on the following documents:

|      |                  |
|------|------------------|
| FDIS | Report on voting |
|      |                  |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This standard is to be read in conjunction with IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 60079 series, under the general title Explosive atmospheres can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the new edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

## INTRODUCTION

This part of IEC 60079 gives requirements for the design, construction, testing and marking of electrical equipment for use in explosive atmospheres in which

- a) a protective gas maintained at a pressure above that of the external atmosphere is used to guard against the formation of an explosive gas atmosphere within enclosures which do not contain an internal source of release of flammable gas or vapour;
- b) a protective gas maintained at a pressure above that of the external atmosphere is used to guard against the formation of an explosive gas atmosphere within enclosures and is supplied to an enclosure containing one or more internal sources of release in order to guard against the formation of an explosive gas atmosphere; or
- c) a protective gas maintained at a pressure above that of the external atmosphere, is used to prevent the entry of combustible dust which might otherwise lead to the formation of an explosive dust atmosphere within enclosures, but only where there is no internal source of release of combustible dust.

This standard includes requirements for the equipment and its associated equipment including the inlet and exhaust ducts, and also for the auxiliary control equipment necessary to ensure that pressurization and/or dilution is established and maintained.

## EXPLOSIVE ATMOSPHERES –

### Part 2: Equipment protection by pressurized enclosure "p"

#### 1 Scope

This part of IEC 60079 contains the specific requirements for the construction and testing of electrical pressurized equipment, of type of protection "p", intended for use in explosive gas atmospheres or explosive dust atmospheres. It also includes the requirements for pressurized equipment containing a limited release of a flammable substance within the pressurized equipment.

This standard supplements and modifies the general requirements of IEC 60079-0. Where a requirement of this standard conflicts with a requirement of IEC 60079-0, the requirements of this standard take precedence.

This standard does not include the requirements for:

- pressurized equipment where the containment within the pressurized equipment may release
  - a) air with an oxygen content greater than normal, or
  - b) oxygen in combination with inert gas where the oxygen is in a proportion greater than 21 %.
- pressurized rooms or analyzer houses; see IEC 60079-13;
- pressurized equipment used where "explosives" or pyrotechnics are present;
- pressurized equipment used where hybrid mixtures of gas/vapour and combustible dust are present;
- pressurized equipment used where pyrophoric substances such as explosives or propellants containing their own oxidizers are present
- pressurized equipment with an internal source of release of combustible dust.
- pressurized equipment with use of gas detectors to eliminate the need for purging

NOTE When the user acts in the role of the manufacturer, it is typically the user's responsibility to ensure that all relevant parts of this standard are applied to the manufacturing and testing of the equipment.

#### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034-5, *Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification*

IEC 60050 (all parts), *International Electrotechnical Vocabulary*

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"*

415 IEC 60079-15, *Explosive atmospheres – Part 15: Equipment protection by type of protection*  
416 *"n"*

417 IEC 60112, *Method for the determination of the proof and the comparative tracking indices of*  
418 *solid insulating materials*

419 IEC 60127, (All parts) *Miniature fuses*

420 IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

421 IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1:*  
422 *Principles, requirements and tests*

423 *ANSI/UL 248-1, Low-Voltage Fuses – Part 1: General Requirements*

### 424 **3 Terms and definitions**

425 For the purposes of this document, the terms and definitions given in IEC 60050-151,  
426 IEC 60050-426 and IEC 60079-0, as well as the following apply.

427 NOTE Unless otherwise specified, the terms "voltage" and "current" mean the r.m.s. values of an alternating,  
428 direct or composite voltage or current.

#### 429 **3.1**

##### 430 **alarm**

431 piece of equipment that generates a visual or audible signal that is intended to attract  
432 attention

#### 433 **3.2**

##### 434 **containment system**

435 part of the pressurized equipment containing the flammable substance that may constitute an  
436 internal source of release

#### 437 **3.3**

##### 438 **dilution**

439 continuous supply of a protective gas, after purging, at such a rate that the concentration of a  
440 flammable substance inside the pressurized enclosure is maintained at a value outside the  
441 explosive limits at any potential ignition source (that is to say, outside the dilution area)

442 Note 1 to entry: Dilution of a pressurized enclosure or in an area (that includes a source of release) with inert gas  
443 may result in a concentration of flammable gas or vapour that would be above the upper flammable limit (UFL) if it  
444 were gas in air, but without oxygen it cannot ignite. This is an acceptable protection method, but requires additional  
445 consideration in the exhaust of the protected system or when the pressurized enclosure is opened as oxygen will  
446 now be added to the gas mixture.

447

#### 448 **3.4**

##### 449 **dilution area**

450 area in the vicinity of an internal source of release where the concentration of a flammable  
451 substance is not diluted to a safe concentration

#### 452 **3.5**

##### 453 **enclosure volume**

454 volume of the empty pressurized enclosure without internal equipment. For rotating electrical  
455 machines, the free internal volume plus the volume displaced by the rotor

**3.6****flammable substance**

gases, vapours, liquids or mixtures thereof that are capable of being ignited

**3.7****hermetically sealed device**

device which is so constructed that the external atmosphere cannot gain access to the interior and in which any seal is made by fusion

Note 1 to entry: Examples of fusion include brazing, welding or the fusion of glass to metal.

**3.8****ignition-capable equipment****ICE**

equipment which in normal operation constitutes a source of ignition for a specified explosive atmosphere.

**3.9****indicator**

piece of equipment that shows whether flow or pressure is adequate and which is intended to be monitored periodically, consistent with the requirement of the application

**3.10****internal source of release**

point or location from which a flammable substance in the form of a flammable gas or vapour or liquid may be released into the pressurized enclosure such that in the presence of air an explosive gas atmosphere could be formed

**3.11****leakage compensation**

provision of a flow of protective gas sufficient to compensate for any leakage from the pressurized enclosure and its ducts

**3.12****overpressure**

pressure above ambient pressure within a pressurized enclosure

**3.12.1 pressurization overpressure**

the overpressure in the pressurized enclosure required to maintain pressurization

**3.12.2 maximum overpressure**

the maximum possible overpressure in the pressurized enclosure during purging or pressurization

**3.13****pressurization**

technique of guarding against the ingress of the external atmosphere into an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere

**3.14****pressurization control system**

grouping of safety devices and other components used to pressurize and monitor or control pressurized equipment

**3.15****pressurized enclosure**

enclosure in which a protective gas is maintained at a pressure greater than that of the external atmosphere

**3.16****pressurized equipment**

the assembly of a pressurization control system, the pressurized enclosure, and equipment contained in the pressurized enclosure that is protected by pressurization.

**3.17****protective gas**

air or inert gas used for maintaining an overpressure and, if required, dilution and purging

Note 1 to entry: For the purposes of this standard, inert gas means nitrogen, carbon dioxide, argon or any gas which, when mixed with oxygen in the ratio 4 parts inert to 1 part oxygen as found in air, does not make the ignition and flammability properties, such as explosive limits, more onerous.

**3.18****protective gas supply**

compressor, blower or compressed gas container that provides the protective gas at a positive pressure

Note 1 to entry: The protective gas supply includes inlet (suction) pipes or ducts, pressure regulators, outlet pipes, ducts, and supply valves.

Note 2 to entry: Components of the pressurization system other than the pressure regulator, are not included.

**3.19****purging**

in pressurized equipment, the operation of passing a quantity of protective gas through the enclosure and ducts, so that the concentration of the explosive gas atmosphere is brought to a safe level

**3.20****static pressurization**

maintenance of an overpressure within a pressurized enclosure without the addition of protective gas in a hazardous area

**3.21****Level of Protection “pxb”**

Pressurized equipment providing Equipment Protection Level Mb, Gb or Db

Note 1 to entry: This permits unprotected equipment to be installed within the pressurized enclosure except for safety devices, see 3.23.

**3.22****Level of Protection “pyb”**

pressurized equipment providing Equipment Protection Level Gb or Db with Equipment Protection Level Gc or Dc internal to the pressurized enclosure

Note 1 to entry: This permits Equipment Protection Level Gc or Dc equipment to be installed within the pressurized enclosure, except for safety devices, see 3.23

**3.23****Level of Protection “pzc”**

pressurized equipment providing Equipment Protection Level Gc or Dc

Note 1 to entry: This permits unprotected equipment to be installed within the pressurized enclosure except for safety devices, see 3.23.

**3.24****safety device**

device used to implement or maintain the integrity of the type of protection

**3.25****lower flammable limit****LFL**

volume fraction of flammable gas or vapour in air below which an explosive gas atmosphere will not form, expressed as a percentage (see IEC 60079-20-1)

Note 1 to entry: This is also known as Lower Explosive Limit (LEL).

**3.26****upper flammable limit****UFL**

volume fraction of flammable gas or vapour in air above which an explosive gas atmosphere will not form, expressed as a percentage (see IEC 60079-20-1)

Note 1 to entry: This is also known as Upper Explosive Limit (UEL).

**4 Protection levels**

Protection by pressurization is subdivided into three Levels of Protection ("pxb", "pyb" and "pzc") which are selected based upon the Equipment Protection Level required (Mb, Gb, Db, Gc or Dc), whether there is the potential for an internal release, and whether the equipment within the pressurized equipment is ignition-capable; see Table 1. The Level of Protection then defines design criteria for the pressurized enclosure and the pressurization control system; see Table 2.

**Table 1 – Determination of protection level**

| Is there an internal release condition?                                                                | Highest Equipment Protection Level requirement for external explosive atmosphere | Does enclosure contain ignition-capable equipment?                               | Level of Protection               |
|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-----------------------------------|
| No                                                                                                     | Mb, Gb or Db                                                                     | Yes or no                                                                        | Level of Protection "pxb"         |
| No                                                                                                     | Gb or Db                                                                         | No                                                                               | Level of Protection "pyb"         |
| No                                                                                                     | Gc or Dc                                                                         | Yes or no                                                                        | Level of Protection "pzc"         |
| Yes, gas/vapour                                                                                        | Mb, Gb, or Db                                                                    | No or Yes and the ignition-capable equipment is not located in the dilution area | Level of Protection "pxb"         |
| Yes, gas/vapour                                                                                        | Gb or Db                                                                         | No                                                                               | Level of Protection "pyb"         |
| Yes, gas/vapour                                                                                        | Gc or Dc                                                                         | Yes and the ignition-capable equipment is not located in the dilution area       | Level of Protection "pxb"         |
| Yes, gas/vapour                                                                                        | Gc or Dc                                                                         | No                                                                               | Level of Protection "pzc"         |
| Yes liquid                                                                                             | Gb or Db                                                                         | Yes or No                                                                        | Level of Protection "pxb" (inert) |
| Yes liquid                                                                                             | Gb or Db                                                                         | No                                                                               | Level of Protection "pyb" (inert) |
| Yes liquid                                                                                             | Gc or Dc                                                                         | Yes or No                                                                        | Level of Protection "pzc" (inert) |
| If the flammable substance is a liquid, normal release is never permitted.                             |                                                                                  |                                                                                  |                                   |
| The protective gas shall be inert if "(inert)" is shown after the pressurization level; see Clause 14. |                                                                                  |                                                                                  |                                   |

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**Table 2 – Design criteria based upon level of protection**

| Design criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Level of Protection<br>“pxb”                                                                      | Level of Protection<br>“pyb”                 | Level of Protection<br>“pzc” with indicator                                                       | Level of Protection<br>“pzc” with alarm                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Degree of enclosure protection according to IEC 60529 or IEC 60034-5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | IP4X minimum                                                                                      | IP4X minimum                                 | IP4X minimum                                                                                      | IP3X minimum                                                                                      |
| Resistance of enclosure to impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | IEC 60079-0 applies                                                                               | IEC 60079-0 applies                          | IEC 60079-0 applies                                                                               | apply half the value shown in IEC 60079-0                                                         |
| Verifying purge period for Group I and Group II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Requires a timing device and monitoring of pressure and flow                                      | Time and flow marked                         | Time and flow marked                                                                              | Time and flow marked                                                                              |
| Preventing incandescent particles from exiting a normally closed relief vent into an area requiring EPL Mb, Gb or Db                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Spark and particle barrier required, see 6.5, unless incandescent particles not normally produced | No requirement <sup>a)</sup>                 | Level of protection “pzc” does not apply to areas requiring EPL Mb, Gb or Db                      | Level of protection “pzc” does not apply to areas requiring EPL Mb, Gb or Db                      |
| Preventing incandescent particles from exiting a normally closed relief vent into an area requiring EPL Gc or Dc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | No requirement <sup>b)</sup>                                                                      | No requirement <sup>b)</sup>                 | No requirement, see footnote b)                                                                   | No requirement <sup>b)</sup>                                                                      |
| Preventing incandescent particles from exiting a vent that opens during normal operation, to an area requiring EPL Mb, Gb or Db                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Spark and particle barrier required, see 5.9                                                      | Spark and particle barrier required, see 6.5 | Level of Protection “pzc” does not apply to areas requiring EPL Mb, Gb or Db                      | Level of Protection “pzc” does not apply to areas requiring EPL Mb, Gb or Db                      |
| Preventing incandescent particles from exiting a vent that opens during normal operation to an area requiring EPL Gc, or Dc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Spark and particle barrier required, see 6.5, unless incandescent particles not normally produced | No requirement <sup>a)</sup>                 | Spark and particle barrier required, see 6.5, unless incandescent particles not normally produced | Spark and particle barrier required, see 6.5, unless incandescent particles not normally produced |
| Door or cover opens only with use of a tool                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Warning, see 5.3 and 7.2 b) ii)                                                                   | Warning, see 5.3.6 <sup>b)</sup>             | Warning, see 5.3.6 <sup>c)</sup>                                                                  | Warning, see 5.3.6 <sup>c)</sup>                                                                  |
| Door or cover opens without use of a tool                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Interlock, see 8.14<br>(no internal hot parts)                                                    | Warning, see 5.3.6 <sup>a)</sup>             | Warning, see 5.3.6 <sup>c)</sup>                                                                  | Warning, see 5.3.6 <sup>c)</sup>                                                                  |
| Internal hot parts that require a cool-down period before opening enclosure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Comply with 7.2 b) ii)                                                                            | No requirement <sup>a)</sup>                 | Warning, see 5.3.6                                                                                | Warning, see 5.3.6                                                                                |
| <sup>a)</sup> 7.2b) ii) is not applicable for Level of Protection “pyb” since neither hot internal parts nor normally created incandescent particles are permitted.<br><sup>b)</sup> There is no requirement for spark and particle barriers since in abnormal operation, where the relief vent opens, it is unlikely that the external atmosphere is within the explosive limits.<br><sup>c)</sup> There is no requirement for tool accessibility on a Level of Protection “pzc” enclosure since in normal operation the enclosure is pressurized with all covers and doors in place. If a cover or door is removed, it is unlikely that the atmosphere is within the explosive limits. |                                                                                                   |                                              |                                                                                                   |                                                                                                   |

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## **5 Constructional requirements for pressurized enclosures**

### **5.1 Enclosure**

The pressurized enclosure shall have a degree of protection in accordance with Table 2.

For Level of Protection “pxb” with no internal components that exceed the marked temperature class and for Levels of Protection “pyb” and “pzc”, the tests for thermal endurance to heat and thermal endurance to cold for non-metallic enclosures and non-metallic parts of enclosures of IEC 60079-0 need not be applied to the pressurized enclosure.

Note: This is because degradation of the enclosure that results in increased leakage will result in alarm or removal of power to ignition capable circuits. Therefore, the pre-conditioning testing of non-metallic enclosures and non-metallic parts of enclosures is not considered necessary.

### **5.2 Materials**

The materials used for the enclosure, ducts and connecting parts shall not be adversely affected by the specified protective gas.

### **5.3 Doors and covers**

#### **5.3.1 Group I pressurized enclosures**

Doors and covers shall either

- have special fasteners complying with IEC 60079-0; or
- be interlocked so that the electrical supply to equipment not providing an EPL as shown in 8.15 is disconnected automatically when they are opened and so that the supply cannot be restored until they are closed. The requirements of 8.7 shall also apply.

#### **5.3.2 Group I pressurized enclosures with static pressurization**

Doors and covers shall have special fasteners complying with IEC 60079-0.

#### **5.3.3 Group II and Group III pressurized enclosures**

The requirements for special fasteners in IEC 60079-0 do not apply.

For Level of Protection “pxb”, doors and covers which can be opened without the use of a tool or key shall be interlocked so that the electrical supply to electrical equipment not identified in 8.15 is disconnected automatically when they are opened and so that the supply cannot be restored until they are closed.

For Level of Protection “pyb” and Level of Protection “pzc”, the use of a tool or key is not required.

Consideration should be given to the possibility that the internal pressure could cause a door or cover to open violently when the fastener is moved. The operator or maintenance personnel should be protected from injury by methods such as the following:

- a) use multiple fasteners so that the enclosure will safely vent before all fasteners are released; or
- b) use a two-position fastener to allow safe venting of the pressure when opening the enclosure; or
- c) limit the maximum internal pressure to not greater than 2,5 kPa.

#### **5.3.4 Group II and Group III pressurized enclosures with static pressurization**

Doors and covers shall not be capable of being opened readily without the use of a key or tool.

**5.3.5 Group II and Group III Level of Protection “pxb”**

A pressurized enclosure that contains hot parts requiring a cool-down period shall not be capable of being opened readily without the use of a key or tool.

**5.3.6 Group II and Group III Door and Cover warning**

To prevent the ignition of an explosive gas atmosphere or an explosive dust atmosphere which may be present when an enclosure is opened, doors and covers shall be marked:

WARNING – DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

**5.4 Mechanical strength**

The pressurized enclosure, ducts if any, and their connecting parts shall withstand a pressure equal to 1,5 times the maximum overpressure specified by the manufacturer for normal service with all outlets closed with a minimum of 200 Pa.

If a pressure can occur in service that can cause a deformation of the enclosure, ducts if any, or connecting parts, a safety device shall be fitted to limit the maximum internal overpressure to a level below that which could adversely affect the type of protection. If the manufacturer does not provide the safety device, the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0 and the Specific Conditions of Use listed on the certificate shall detail the necessary information required by the user to ensure conformity with the requirements of this standard.

**6 Constructional requirements for pressurized equipment****6.1 Group I and Group II Apertures, partitions, compartments and internal components****6.1.1 Apertures and partitions shall be located in such a way that effective purging is ensured.**

Unpurged areas can be eliminated by the proper location of the protective gas supply inlet and outlet and by consideration of the effect of partitions.

For gases or vapours that are heavier than air the inlet for the protective gas should be near the top of the pressurized enclosure, with the outlet near the bottom of the enclosure.

For gases or vapours that are lighter than air, the inlet for the protective gas should be near the bottom of the enclosure, with the outlet near the top of the enclosure.

Locating inlets and outlets at opposite sides of the enclosure promotes cross ventilation.

Internal partitions (for example, circuit boards) should be located in such a way that the flow of protective gas is not obstructed. The use of a manifold or baffles can also improve the flow around obstructions.

The number of apertures should be chosen with regard to the design of the equipment, particular consideration being given to the purging of sub-compartments into which the equipment might be divided.

**6.1.2 Internal compartments shall be vented to the main enclosure or separately purged.**

Vents providing not less than 1 cm<sup>2</sup> of vent area for each 1 000 cm<sup>3</sup>, with a minimum vent size of 6,3 mm diameter are typically sufficient for adequate purging.