

Australian/New Zealand Standard™

## Explosive atmospheres

### Part 29.2: Gas detectors—Selection, installation, use and maintenance of detectors for flammable gases and oxygen



## **AS/NZS 60079.29.2:2016**

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-014, Equipment for Explosive Atmospheres. It was approved on behalf of the Council of Standards Australia on 26 October 2015 and on behalf of the Council of Standards New Zealand on 12 February 2016.  
This Standard was published on 5 April 2016.

---

The following are represented on Committee EL-014:

Auckland Regional Chamber of Commerce  
Australian Chamber of Commerce and Industry  
Australian Industry Group  
Australian Institute of Petroleum  
Australian Petroleum Production and Exploration Association  
Australian Pipeline and Gas Association  
Aviation and Marine Engineers Association  
Bureau of Steel Manufacturers of Australia  
Department of Natural Resources and Mines, Qld  
Department of Trade and Investment, NSW  
Electrical Compliance Testing Association  
Electrical Contractors Association of New Zealand  
Electrical Regulatory Authorities Council  
Engineers Australia  
Institute of Electrical Inspectors  
Institute of Instrumentation, Control & Automation Australia  
Institution of Professional Engineers New Zealand  
Mining Electrical and Mining Mechanical Engineering Society  
Ministry of Business, Innovation and Employment, New Zealand  
University of Newcastle  
WorkCover New South Wales

---

### **Keeping Standards up-to-date**

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at [www.saiglobal.com.au](http://www.saiglobal.com.au) or Standards New Zealand web site at [www.standards.co.nz](http://www.standards.co.nz) and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

---

*This Standard was issued in draft form for comment as DR AS/NZS 60079.29.2:2015.*

---

# Australian/New Zealand Standard™

## Explosive atmospheres

### **Part 29.2: Gas detectors—Selection, installation, use and maintenance of detectors for flammable gases and oxygen**

Originated as AS/NZS 61779.6:2000.  
Previous edition AS/NZS 60079.29.2:2008.  
Second edition 2016.

#### **COPYRIGHT**

© Standards Australia Limited/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, Private Bag 2439, Wellington 6140.

## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-014, Equipment for Explosive Atmospheres, to supersede AS/NZS 60079.29.2:2008.

The objective of this Standard is to provide guidance on, and recommended practice for, the selection, installation, safe use and maintenance of electrically operated group II equipment intended for use in industrial and commercial safety applications and group I equipment in underground coal mines for the detection and measurement of flammable gases complying with the requirements of AS/NZS 60079.29.1 or AS/NZS 60079.29.4.

This Standard is identical with, and has been reproduced from IEC 60079-29-2, Ed.2.0 (2015), *Explosive atmospheres, Part 29-2: Gas detectors—Selection, installation, use and maintenance of detectors for flammable gases and oxygen*. Changes to the Standard introduced by this edition are listed in the IEC Foreword.

As this Standard is reproduced from an International Standard, the following applies:

- (a) In the source text ‘this part of IEC 60079-29’ should read ‘this part of AS/NZS 60079.29’.
- (b) A full point substitutes for a comma when referring to a decimal marker.

References to International Standards should be replaced by references to Australian or Australian/New Zealand Standards. The replacements at the time of publication are detailed in the following table but reference to the latest Australian or Australian/New Zealand Standard should be applied for any revisions after the publication of this Standard.

| <i>Reference to International Standard</i> |                                                                                              | <i>Australian/New Zealand Standard</i> |                                                                                                  |
|--------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------------------------------------------------------------------------|
| IEC                                        |                                                                                              | AS/NZS                                 |                                                                                                  |
| 60079                                      | Explosive atmospheres                                                                        | 60079                                  | Explosive atmospheres                                                                            |
| 60079-0                                    | Part 0: Equipment—General requirements                                                       | 60079.0                                | Part 0: Equipment—General requirements                                                           |
| 60079-10-1                                 | Part 10-1: Classification of areas—Explosive gas atmospheres                                 | 60079.10.1                             | Part 10.1: Classification of areas—Explosive gas atmospheres (IEC 60079-10-1, Ed.1.0 (2008) MOD) |
| 60079-10-2                                 | Part 10-2: Classification of areas—Combustible dust atmospheres                              | 60079.10.2                             | Part 10.2: Classification of areas—Combustible dust atmospheres                                  |
| 60079-17                                   | Part 17: Electrical installations inspection and maintenance                                 | 60079.17                               | Part 17: Electrical installations inspection and maintenance (IEC 60079-17, Ed.4.0 (2007) MOD)   |
| 60079-29-1                                 | Part 29-1: Gas detectors—Performance requirements of detectors for flammable gases           | 60079.29.1                             | Part 29.1: Gas detectors—Performance requirements of detectors for flammable gases               |
| 60079-29-4                                 | Part 29-4: Gas detectors—Performance requirements of open path detectors for flammable gases | 60079.29.4                             | Part 29.4: Gas detectors—Performance requirements of open path detectors for flammable gases     |

Only normative references that have been adopted as Australian or Australian/New Zealand Standard have been listed.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the annex to which they apply. A ‘normative’ annex is an integral part of a Standard, whereas an ‘informative’ annex is only for information and guidance.

## CONTENTS

|       |                                                                                                                     |    |
|-------|---------------------------------------------------------------------------------------------------------------------|----|
| 1     | Scope .....                                                                                                         | 13 |
| 2     | Normative references .....                                                                                          | 14 |
| 3     | Terms and definitions .....                                                                                         | 14 |
| 3.1   | Gas properties and other physics .....                                                                              | 14 |
| 3.2   | Types of equipment .....                                                                                            | 16 |
| 3.3   | Sensors and detectors .....                                                                                         | 18 |
| 3.4   | Supply of gas to instruments .....                                                                                  | 19 |
| 3.5   | Signals and alarms .....                                                                                            | 19 |
| 3.6   | Times, checks and equipment behaviour .....                                                                         | 20 |
| 3.7   | Terms exclusive to open path equipment .....                                                                        | 21 |
| 4     | Basic information on the properties, behaviour, gases and vapours, and specific applications of gas detection ..... | 23 |
| 4.1   | Detecting gases and vapours .....                                                                                   | 23 |
| 4.1.1 | General .....                                                                                                       | 23 |
| 4.1.2 | Safety when monitoring for flammable gases where personnel could be present .....                                   | 24 |
| 4.2   | Some common properties of gases and vapours .....                                                                   | 25 |
| 4.3   | The differences between detecting gases and vapours .....                                                           | 26 |
| 4.3.1 | General .....                                                                                                       | 26 |
| 4.3.2 | Detection of gases .....                                                                                            | 26 |
| 4.3.3 | Detection of vapours .....                                                                                          | 28 |
| 4.4   | Oxygen deficiency .....                                                                                             | 31 |
| 4.4.1 | General .....                                                                                                       | 31 |
| 4.4.2 | Chemical reaction of oxygen, with solid products .....                                                              | 31 |
| 4.4.3 | Chemical reaction of oxygen, with gaseous products .....                                                            | 31 |
| 4.4.4 | Dilution of the air by displacement by some other gas or vapour .....                                               | 32 |
| 4.5   | Specific applications of gas detection .....                                                                        | 32 |
| 4.5.1 | Gas detection as means of reducing risk of explosion .....                                                          | 32 |
| 4.5.2 | Gas free work permit .....                                                                                          | 35 |
| 4.5.3 | Monitoring of air inlets .....                                                                                      | 36 |
| 4.6   | Specific considerations for open path detection .....                                                               | 36 |
| 5     | Measuring principles .....                                                                                          | 37 |
| 5.1   | General .....                                                                                                       | 37 |
| 5.2   | Catalytic sensors .....                                                                                             | 39 |
| 5.2.1 | General .....                                                                                                       | 39 |
| 5.2.2 | Common applications .....                                                                                           | 39 |
| 5.2.3 | Limitations .....                                                                                                   | 39 |
| 5.2.4 | Interferences .....                                                                                                 | 40 |
| 5.2.5 | Poisoning .....                                                                                                     | 40 |
| 5.3   | Thermal conductivity sensors .....                                                                                  | 41 |
| 5.3.1 | General .....                                                                                                       | 41 |
| 5.3.2 | Common applications .....                                                                                           | 41 |
| 5.3.3 | Limitations .....                                                                                                   | 41 |
| 5.3.4 | Interferences .....                                                                                                 | 41 |

|        |                                             |    |
|--------|---------------------------------------------|----|
| 5.3.5  | Poisoning .....                             | 41 |
| 5.4    | Infrared sensors .....                      | 41 |
| 5.4.1  | General .....                               | 41 |
| 5.4.2  | Common applications .....                   | 42 |
| 5.4.3  | Limitations .....                           | 42 |
| 5.4.4  | Interferences .....                         | 42 |
| 5.4.5  | Poisoning .....                             | 42 |
| 5.5    | Semiconductor sensors .....                 | 43 |
| 5.5.1  | General .....                               | 43 |
| 5.5.2  | Common applications .....                   | 43 |
| 5.5.3  | Limitations .....                           | 43 |
| 5.5.4  | Interferences .....                         | 43 |
| 5.5.5  | Poisoning .....                             | 43 |
| 5.6    | Electrochemical sensors .....               | 44 |
| 5.6.1  | General .....                               | 44 |
| 5.6.2  | Common applications .....                   | 44 |
| 5.6.3  | Limitations .....                           | 44 |
| 5.6.4  | Interferences .....                         | 44 |
| 5.6.5  | Poisoning .....                             | 44 |
| 5.7    | Flame ionization detectors (FID) .....      | 45 |
| 5.7.1  | General .....                               | 45 |
| 5.7.2  | Common applications .....                   | 45 |
| 5.7.3  | Limitations .....                           | 45 |
| 5.7.4  | Interferences .....                         | 45 |
| 5.7.5  | Poisoning .....                             | 45 |
| 5.8    | Flame temperature analysers (FTA) .....     | 45 |
| 5.8.1  | General .....                               | 45 |
| 5.8.2  | Common applications .....                   | 45 |
| 5.8.3  | Limitations .....                           | 46 |
| 5.8.4  | Interferences .....                         | 46 |
| 5.8.5  | Poisoning .....                             | 46 |
| 5.9    | Photo ionisation detector (PID) .....       | 46 |
| 5.9.1  | General .....                               | 46 |
| 5.9.2  | Common applications .....                   | 46 |
| 5.9.3  | Limitations .....                           | 46 |
| 5.9.4  | Interferences .....                         | 46 |
| 5.9.5  | Poisoning .....                             | 47 |
| 5.10   | Paramagnetic oxygen detector .....          | 47 |
| 5.10.1 | General .....                               | 47 |
| 5.10.2 | Common applications .....                   | 47 |
| 5.10.3 | Limitations .....                           | 47 |
| 5.10.4 | Interference .....                          | 47 |
| 5.10.5 | Poisoning .....                             | 47 |
| 6      | Selection of equipment .....                | 47 |
| 6.1    | General .....                               | 47 |
| 6.2    | Selection criteria .....                    | 48 |
| 6.2.1  | General criteria .....                      | 48 |
| 6.2.2  | Gases to be detected by the equipment ..... | 49 |
| 6.2.3  | Application of fixed equipment .....        | 50 |

|        |                                                                                     |    |
|--------|-------------------------------------------------------------------------------------|----|
| 6.2.4  | Application of transportable and portable equipment.....                            | 54 |
| 6.3    | Miscellaneous factors affecting selection of equipment .....                        | 55 |
| 6.3.1  | Electromagnetic immunity .....                                                      | 55 |
| 6.3.2  | Intended Zone(s) of use.....                                                        | 55 |
| 7      | Behaviour of gas releases .....                                                     | 55 |
| 7.1    | Nature of a release .....                                                           | 55 |
| 7.1.1  | General .....                                                                       | 55 |
| 7.1.2  | Release rate of gas or vapour.....                                                  | 55 |
| 7.1.3  | Flammable limits.....                                                               | 56 |
| 7.1.4  | Ventilation .....                                                                   | 56 |
| 7.1.5  | Relative density of the released gas or vapour.....                                 | 56 |
| 7.1.6  | Temperature and/or pressure.....                                                    | 57 |
| 7.1.7  | Other parameters to be considered.....                                              | 57 |
| 7.1.8  | Outdoor sites and open structures .....                                             | 57 |
| 7.2    | Buildings and enclosures .....                                                      | 57 |
| 7.2.1  | General .....                                                                       | 57 |
| 7.2.2  | Unventilated buildings and enclosures .....                                         | 57 |
| 7.2.3  | Ventilated buildings and enclosures .....                                           | 58 |
| 7.3    | Environmental considerations .....                                                  | 59 |
| 8      | Design and installation of fixed gas detection systems.....                         | 59 |
| 8.1    | General.....                                                                        | 59 |
| 8.2    | Basic considerations for the installation of fixed systems .....                    | 59 |
| 8.2.1  | General .....                                                                       | 59 |
| 8.2.2  | Point detection equipment and remote sensors.....                                   | 60 |
| 8.2.3  | Systems consisting of sampling equipment.....                                       | 60 |
| 8.2.4  | Open path (line of sight) equipment .....                                           | 61 |
| 8.3    | Location of detection points .....                                                  | 61 |
| 8.3.1  | General .....                                                                       | 61 |
| 8.3.2  | General site considerations .....                                                   | 61 |
| 8.3.3  | Environmental conditions.....                                                       | 62 |
| 8.4    | Access for calibration and maintenance .....                                        | 65 |
| 8.5    | Additional considerations for sample lines.....                                     | 65 |
| 8.6    | Additional considerations for open path equipment .....                             | 66 |
| 8.7    | Summary of considerations for the location of measuring points and open paths ..... | 66 |
| 8.8    | Installation of measuring point and open path equipment .....                       | 67 |
| 8.9    | Integrity and safety of fixed systems .....                                         | 67 |
| 8.9.1  | General .....                                                                       | 67 |
| 8.9.2  | Redundancy in fixed systems.....                                                    | 68 |
| 8.9.3  | Protection against loss of main power supply.....                                   | 68 |
| 8.10   | Timing of installation during construction operations .....                         | 68 |
| 8.11   | Commissioning .....                                                                 | 68 |
| 8.11.1 | Inspection.....                                                                     | 68 |
| 8.11.2 | Initial gas calibration.....                                                        | 69 |
| 8.11.3 | Adjustment of alarm set points.....                                                 | 69 |
| 8.12   | Operating instructions, plans and records .....                                     | 70 |
| 9      | Use of portable and transportable flammable gas detection equipment.....            | 70 |
| 9.1    | General.....                                                                        | 70 |

|        |                                                                                            |    |
|--------|--------------------------------------------------------------------------------------------|----|
| 9.2    | Initial and periodic check procedures for portable and transportable instrumentation ..... | 71 |
| 9.2.1  | General .....                                                                              | 71 |
| 9.2.2  | Inspection and functional checks .....                                                     | 72 |
| 9.2.3  | Routine tests and recalibration .....                                                      | 73 |
| 9.2.4  | Maintenance and recalibration .....                                                        | 73 |
| 9.3    | Guidance on the use of portable and transportable equipment .....                          | 74 |
| 9.3.1  | Electrical safety in hazardous atmospheres .....                                           | 74 |
| 9.3.2  | Safety of personnel .....                                                                  | 74 |
| 9.3.3  | Spot tests and sampling .....                                                              | 75 |
| 9.3.4  | Sampling above liquids .....                                                               | 75 |
| 9.3.5  | Avoidance of condensation .....                                                            | 75 |
| 9.3.6  | Poisoning of sensors .....                                                                 | 75 |
| 9.3.7  | Changes of temperature .....                                                               | 76 |
| 9.3.8  | Accidental damage .....                                                                    | 76 |
| 9.3.9  | Minimalist operation, the “Read and run” concept .....                                     | 76 |
| 10     | Training of operational personnel .....                                                    | 76 |
| 10.1   | General .....                                                                              | 76 |
| 10.2   | General training – Basic limitations and safety .....                                      | 77 |
| 10.3   | Operator training .....                                                                    | 77 |
| 10.4   | Maintenance training .....                                                                 | 78 |
| 11     | Maintenance, routine procedures and general administrative control .....                   | 78 |
| 11.1   | General .....                                                                              | 78 |
| 11.2   | Operational checks .....                                                                   | 80 |
| 11.2.1 | General .....                                                                              | 80 |
| 11.2.2 | Fixed systems .....                                                                        | 80 |
| 11.2.3 | Portable and transportable gas detection equipment .....                                   | 81 |
| 11.3   | Maintenance .....                                                                          | 81 |
| 11.3.1 | General .....                                                                              | 81 |
| 11.3.2 | Fixed equipment .....                                                                      | 81 |
| 11.3.3 | Portable and transportable gas detection equipment .....                                   | 82 |
| 11.3.4 | Off-site maintenance, general .....                                                        | 82 |
| 11.3.5 | Maintenance procedures .....                                                               | 82 |
| 11.4   | Sensors .....                                                                              | 82 |
| 11.4.1 | General .....                                                                              | 82 |
| 11.4.2 | Flame arrestor .....                                                                       | 83 |
| 11.5   | Flow systems .....                                                                         | 83 |
| 11.5.1 | General .....                                                                              | 83 |
| 11.5.2 | Inspection .....                                                                           | 83 |
| 11.5.3 | Filters, traps and flame arrestors .....                                                   | 83 |
| 11.5.4 | Flow system and sample chamber .....                                                       | 83 |
| 11.5.5 | Flow connections .....                                                                     | 83 |
| 11.5.6 | Moving parts .....                                                                         | 83 |
| 11.5.7 | Automatic sample-draw systems .....                                                        | 83 |
| 11.5.8 | Loss-of-flow signals .....                                                                 | 83 |
| 11.6   | Readout devices .....                                                                      | 83 |
| 11.6.1 | General .....                                                                              | 83 |
| 11.6.2 | Other readouts .....                                                                       | 84 |
| 11.7   | Alarms .....                                                                               | 84 |

|         |                                           |     |
|---------|-------------------------------------------|-----|
| 11.8    | Calibration .....                         | 84  |
| 11.8.1  | Calibration kits and test equipment ..... | 84  |
| 11.8.2  | Calibration procedure .....               | 85  |
| Annex A | (normative) Measuring principles .....    | 87  |
| A.1     | General .....                             | 87  |
| A.2     | Catalytic sensors .....                   | 89  |
| A.2.1   | General .....                             | 89  |
| A.2.2   | Common applications .....                 | 90  |
| A.2.3   | Limitations .....                         | 90  |
| A.2.4   | Interferences .....                       | 90  |
| A.2.5   | Poisoning .....                           | 91  |
| A.3     | Thermal conductivity sensors .....        | 92  |
| A.3.1   | General .....                             | 92  |
| A.3.2   | Common applications .....                 | 92  |
| A.3.3   | Limitations .....                         | 93  |
| A.3.4   | Interferences .....                       | 93  |
| A.3.5   | Poisoning .....                           | 93  |
| A.4     | Infrared sensors .....                    | 93  |
| A.4.1   | General .....                             | 93  |
| A.4.2   | Common applications .....                 | 95  |
| A.4.3   | Limitations .....                         | 96  |
| A.4.4   | Interferences .....                       | 96  |
| A.4.5   | Poisoning .....                           | 97  |
| A.5     | Semi-conductor sensors .....              | 97  |
| A.5.1   | General .....                             | 97  |
| A.5.2   | Common applications .....                 | 97  |
| A.5.3   | Limitations .....                         | 97  |
| A.5.4   | Interferences .....                       | 98  |
| A.5.5   | Poisoning .....                           | 98  |
| A.6     | Electrochemical sensors .....             | 98  |
| A.6.1   | General .....                             | 98  |
| A.6.2   | Common applications .....                 | 99  |
| A.6.3   | Limitations .....                         | 99  |
| A.6.4   | Interferences .....                       | 100 |
| A.6.5   | Poisoning .....                           | 100 |
| A.7     | Flame ionization detectors (FID) .....    | 101 |
| A.7.1   | General .....                             | 101 |
| A.7.2   | Common applications .....                 | 102 |
| A.7.3   | Limitations .....                         | 102 |
| A.7.4   | Interferences .....                       | 102 |
| A.7.5   | Poisoning .....                           | 102 |
| A.8     | Flame temperature analysers (FTA) .....   | 103 |
| A.8.1   | General .....                             | 103 |
| A.8.2   | Common applications .....                 | 103 |
| A.8.3   | Limitations .....                         | 103 |
| A.8.4   | Interferences .....                       | 103 |
| A.8.5   | Poisoning .....                           | 103 |
| A.9     | Photo ionisation detector (PID) .....     | 104 |
| A.9.1   | General .....                             | 104 |

|                       |                                                                                                                                 |     |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------|-----|
| A.9.2                 | Common applications .....                                                                                                       | 104 |
| A.9.3                 | Limitations .....                                                                                                               | 105 |
| A.9.4                 | Interferences .....                                                                                                             | 105 |
| A.9.5                 | Poisoning .....                                                                                                                 | 105 |
| A.10                  | Paramagnetic oxygen detector .....                                                                                              | 105 |
| A.10.1                | General .....                                                                                                                   | 105 |
| A.10.2                | Common applications .....                                                                                                       | 106 |
| A.10.3                | Limitations .....                                                                                                               | 106 |
| A.10.4                | Interference .....                                                                                                              | 106 |
| A.10.5                | Poisoning .....                                                                                                                 | 106 |
| Annex B (informative) | Environmental parameters .....                                                                                                  | 107 |
| Annex C (informative) | Typical environmental and application check-list for flammable<br>gas detectors (for both Group I and Group II equipment) ..... | 108 |
| Annex D (informative) | Typical instrument maintenance record for flammable gas<br>detectors .....                                                      | 110 |
| Annex E (informative) | Atmospheric visibility .....                                                                                                    | 112 |
| Bibliography          | .....                                                                                                                           | 113 |
| Figure 1              | – Integral concentration over the path length .....                                                                             | 37  |
| Figure 2              | – Average concentration over the path length .....                                                                              | 37  |
| Table 1               | – Typical Tasks and Most Relevant Causes .....                                                                                  | 12  |
| Table 2               | – Overview of gas detection equipment with different measuring principles .....                                                 | 38  |
| Table A.1             | – Overview of gas detection equipment with different measuring principles .....                                                 | 88  |
| Table B.1             | – Environmental parameters .....                                                                                                | 107 |

## IEC FOREWORD

This edition includes the following significant changes with respect to the previous edition:

| Changes                              | Clause                                           | Type                        |           |                         |
|--------------------------------------|--------------------------------------------------|-----------------------------|-----------|-------------------------|
|                                      |                                                  | Minor and editorial changes | Extension | Major technical changes |
| Addition of group 1 to scope         | 1                                                |                             | x         |                         |
| Addition of Open Path Gas Detection  | 3, 4.6, 5.4, 6.2.3.5, 8.2, 8.6, 8.7, 8.8, 11, A4 |                             | x         |                         |
| Changed “combustible” to “flammable” | Throughout                                       | x                           |           |                         |
| Addition of specific applications    | 4.5                                              |                             | x         |                         |
| Improvements to sampling systems     | 6.2.3.4, 8.2.3, 8.5, 11.2.2                      | x                           |           |                         |

NOTE The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version. More guidance may be found by referring to the Redline Version of the standard.

### Explanations:

- 1) **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.

- 2) **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.

NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

- 3) **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 fulfil the requirements given in the later edition. These changes have to be considered for products in conformity with the preceding edition.

NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.