PD CLC/TR 60079-33:2015

Incorporating corrigendum January 2016

BSI Standards Publication

Explosive atmospheres

Part 33: Equipment protection by special protection 's'

bsi.

...making excellence a habit.™

Document Sharing Hub

Full document details: PD CLC/TR 60079-33:2015

National foreword

This Published Document is the UK implementation of PD CLC/TR 60079-33:2015. It is identical to IEC 60079-33:2012. It supersedes BS IEC 60079-33:2012 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EXL/31, Equipment for explosive atmospheres.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2016.
Published by BSI Standards Limited 2016

ISBN 978 0 580 93194 9

ICS 29.260.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 November 2013.

Amendments/corrigenda issued since publication

Date	Text affected
31 May 2015	This corrigendum renumbers BS IEC 60079-33:2012 as PD CLC/TR 60079-33:2015
31 January 2016	Correction to CEN foreword page

Documents
Document Sharing Hub

Full document details: PD CLC/TR 60079-33:2015

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CLC/TR 60079-33

April 2015

ICS 29.260.20

English Version

Explosive atmospheres - Part 33: Equipment protection by special protection 's' (IEC 60079-33:2012)

Atmosphères explosives - Partie 33: Protection du matériel par protection spéciale "s" (IEC 60079-33:2012)

Explosionsgefährdete Bereiche - Teil 33: Geräteschutz durch Sonderschutz "s" (IEC 60079-33:2012)

This Technical Report was approved by CENELEC on 2014-06-02.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2015 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. CLC/TR 60079-33:2015 E

Documents Document Sharing Hub

Full document details: PD CLC/TR 60079-33:2015

Foreword

This document (CLC/TR 60079-33:2015) consists of the text of IEC 60079-33:2012 prepared by IEC/TC 31 "Equipment for explosive atmospheres ".

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60079-33:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60079-26	NOTE	Harmonized as EN 60079-26.
IEC 60079-1	NOTE	Harmonized as EN 60079-1.
IEC 60079-11	NOTE	Harmonized as EN 60079-11.
IEC 60079-29-3	NOTE	Harmonized as EN 60079-29-3.
IEC 60079-15	NOTE	Harmonized as EN 60079-15.
IEC 60079-2	NOTE	Harmonized as EN 60079-2.
IEC 60079-18	NOTE	Harmonized as EN 60079-18.
IEC 60079-7	NOTE	Harmonized as EN 60079-7.
IEC 60228	NOTE	Harmonized as EN 60228.
IEC 60079-10-1	NOTE	Harmonized as EN 60079-10-1.
IEC 60079-10-2	NOTE	Harmonized as EN 60079-10-2.
IEC 60079-14	NOTE	Harmonized as EN 60079-14.
IEC 60079-1	NOTE	Harmonized as EN 60079-1.
IEC 60300 (Series)	NOTE	Harmonized as EN 60300 (Series).
ISO/IEC 80079 (Series)	NOTE	Harmonized as EN ISO/IEC 80079 (Series).

Documents
Document Sharing Hub

Full document details: PD CLC/TR 60079-33:2015

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60079-0	-	Explosive atmospheres -- Part 0: Equipment - General requirements	EN 60079-0	-
-	-		+A11	-
IEC 60079	series	Explosive atmospheres	EN 60079	series
IEC 60079-29-1	-	Explosive atmospheres -- Part 29-1: Gas detectors - Performance requirements of detectors for flammable gases	EN 60079-29-1	-
IEC 60079-29-2	2007	Explosive atmospheres -- Part 29-2: Gas detectors - Selection, installation, use and maintenance of detectors for flammable gases and oxygen	EN 60079-29-2	2007
-	-		+corrigendum Dec.	2007
IEC 61508-1	-	Functional safety of electrical/electronic/programmable electronic safety-related systems -- Part 1: General requirements	EN 61508-1	-
IEC 61508	series	Functional safety of electrical/electronic/programmable electronic safety-related systems	EN 61508	series
IEC 61511	series	Functional safety - Safety instrumented systems for the process industry sector	EN 61511	series
IEC 62061	-	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems	EN 62061	-
-	-		+corrigendum Feb.	-
ISO 13849-1	2006	Safety of machinery - Safety-related parts of control systems -- Part 1: General principles for design	EN ISO 13849-1	2008
ISO 13849-2	-	Safety of machinery_- Safety-related parts of control systems_- Part_2: Validation	EN ISO 13849-2	-

Documents
Document Sharing Hub
Full document details: PD CLC/TR 60079-33:2015

CONTENTS

FOREWORD ... 6
INTRODUCTION ... 8
1 Scope ... 11
2 Normative references ... 11
3 Terms and definitions ... 12
4 General ... 13
4.1 Application ... 13
4.2 Equipment group and temperature classification ... 13
4.3 Level of protection (equipment protection level (EPL)) ... 13
4.4 Manufacturer's justification ... 14
4.5 Verification ... 14
5 Independent verifier ... 14
5.1 General ... 14
5.2 Competence ... 14
5.3 Duties ... 15
5.4 Acceptance ... 15
5.5 Independence ... 15
6 Design and construction ... 15
6.1 Principles of an integrated approach to explosion safety ... 15
6.2 Design and construction ... 16
6.3 Overloading of equipment ... 16
6.4 Potential ignition sources ... 16
6.4.1 Hazards arising from different ignition sources ... 16
6.4.2 Hazards arising from overheating ... 16
6.4.3 Hazards arising from pressure compensation operations ... 16
6.5 Requirements in respect of safety-related devices ... 16
7 Application of equipment protection levels (EPL) ... 17
7.1 Equipment with EPL Ma ... 17
7.2 Equipment with EPL Mb ... 17
7.3 Equipment with EPL Ga ... 18
7.4 Equipment with EPL Gb ... 19
7.5 Equipment with EPL Gc ... 19
7.6 Equipment with EPL Da ... 19
7.7 Equipment with EPL Db ... 20
7.8 Equipment with EPL Dc ... 20
8 Preparation of assessment and test specification ... 20
8.1 General ... 20
8.2 Assessment and test specification ... 21
8.3 Assessment and testing ... 21
8.4 Reporting results of the assessment and test specification ... 21
9 Ignition hazard assessment ... 21
9.1 General ... 21
9.2 Protective measures ... 21
9.3 Explanation of the ignition hazard assessment procedure ... 21
9.4 Examples of ignition hazard assessment ... 21
10 Application of special protection "s" ... 21

AVA Documents
Document Sharing Hub
Full document details: PD CLC/TR 60079-33:2015

10.1 General ... 22
10.2 Justification for the application of special protection “s” ... 22
10.2.1 Application ... 22
10.2.2 Equipment substantially meeting the requirements for the recognized types of protection ... 23
10.2.3 Equipment outside the scope of recognized types of protection ... 23
10.2.4 Protection technique with no alignment to the recognized types of protection ... 23
10.2.5 Enhanced EPL through additional means of protection ... 24
10.2.6 Combination of approaches ... 24
10.3 Adaption of recognized types of protection ... 24
10.4 Other innovative means of ensuring safety ... 24
10.5 Connection of conductor and cables ... 24
11 Type verification and tests ... 25
11.1 General ... 25
11.2 Temperature measurement test ... 25
12 Routine verification and test ... 25
13 Documentation ... 25
14 Ex components ... 25
15 Marking ... 25
15.1 General ... 25
15.2 Marking for Ex “s” only ... 25
15.3 Marking for Ex “s” with other recognized types of protection ... 25
16 Certificate information ... 26
16.1 Certificate for Ex “s” only ... 26
16.2 Certificate for Ex “s” with other recognized types of protection ... 26
16.3 Specific conditions of use ... 26
16.4 Schedule of limitations ... 26
17 Instructions ... 26
Annex A (informative) Explanation of the ignition hazard assessment procedure ... 27
Annex B (informative) Examples of ignition hazard assessment ... 33
Bibliography ... 39

Figure A.1 – Relationship between ignitions source definitions ... 28

Table A.1 – Recommended documentation of initial assessment of equipment related ignition sources ... 29
Table A.2 – Example for reporting identification of ignition hazards (step 1) and first assessment (step 2) ... 30
Table A.3 – Example for reporting determination of preventive or protective measures (step 3) and concluding estimation and EPL assignment (step 4) ... 31
Table B.1 – Common cases demonstrating the use of the reporting method – Electrostatic discharge ... 35
Table B.2 – Ignition hazard assessment report for a linear motor with permanent magnets in the table-track, EPL Gb, in addition to the basic requirements of IEC 60079-0 (for example material characteristics, electrostatic, earthing) ... 37

Documents
Document Sharing Hub
Full document details: PD CLC/TR 60079-33:2015

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES –

Part 33: Equipment protection by special protection “s”

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60079-33 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

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

FDIS	Report on voting
31/997/FDIS	31/1011/RVD

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

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

Documents
Document Sharing Hub

Full document details: PD CLC/TR 60079-33:2015

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.

Documents
Document Sharing Hub
Full document details: PD CLC/TR 60079-33:2015

INTRODUCTION

This part of IEC 60079 was created in response to a request from the IECEx certification system to provide a set of requirements to be used for certification within the IECEx product certification scheme when the standards for existing types of protection were not applicable.

The present standard refers to the use of one or more independent verifiers, in accordance with ISO/IEC rules on the writing of standards that mitigate against specifying particular forms of conformity assessment. The IECEx system will specify how the term "independent verifier" will be interpreted for the purposes of the scheme. For example, it may specify that in the case of three independent verifiers they shall all be certification body members of the scheme, each accepted specifically for the purpose of assessing special protection applications and each from a separate member country of the system.

The purpose of IEC 60079-33 special protection “s” for any equipment protection level (EPL) is to allow design, assessment and testing of equipment or parts of equipment that cannot be fully assessed within a recognized type of protection or combination of recognized types of protection because of functional or operational limitations and where the desired equipment protection level can be achieved by the use of this standard.

Special protection “s” allows a design concept that cannot comply in full with recognized types of protection, or where the design concept is not covered by recognized types of protection.

When specification for the equipment includes aspects as given above, additional information and data may be required from

- technical research,
- evaluation of existing data and information.

Manufacturers should first consider the possibilities for design to the recognized types of protection, or to combinations of recognized type of protection, before proceeding to special protection “s”.

This standard is intended to provide a framework to demonstrate how essential safety requirements can be met if not covered by established standards, thus allowing for innovation and dealing with unknowns.

When equipment intended to meet a recognized type of protection does not comply with all the provisions of the relevant standard, it is not to be considered under this standard unless:

- it can be clearly demonstrated that complete compliance with the type of protection is not practicable; and
- additional measures have been applied to establish an equivalent protection level.

Special protection “s” is based on identification of failure modes and ignition hazard assessment in the identified modes. In this regard, the assessed safety of the assigned EPL of the equipment will satisfy the EPL requirements and, where appropriate, be at least equivalent to the EPL provided by the defined levels for the recognized types of protection.

IEC 60079-26 [1][1] provides for requirements for equipment with EPL Ga and Ga/Gb but depends on combining types of protection already described in other parts of the IEC 60079 series.

The responsibility of initially demonstrating the need to design for special protection “s” and establishing the criteria for verification lies with the manufacturer. The specification defines

[1] Figures in square brackets refer to the Bibliography.

Documents
Document Sharing Hub
Full document details: PD CLC/TR 60079-33:2015

the safety concepts and shows how the essential safety requirements are to be achieved. It is likely this will be done in consultation with experts in the assessment of explosion protection techniques.

The requirements in this standard take into account:

- allowance for first, second or third party verification;
- the use of EPLs;
- the use of equipment groups for mining, gas and dust;
- alignment with existing temperature requirements;
- compatibility with the marking requirements given in IEC 60079-0.

Where requirements for a product/design concept are developed and intended for repeated use in subsequent designs, they should be reviewed and, provided the manufacturer is prepared to release the intellectual property, be included initially in an annex of this standard with the intention of being removed and relocated to an appropriate place at a later time, e.g. in an existing or new type of protection standard.

Unlike other recognized types of protection, special protection “s” may require the application of reliability engineering tools and procedures such as failure modes and effects analysis (FMEA), fault tree analysis (FTA) and failure modes, effects and criticality analysis (FMECA) to identify the failure modes of the equipment being tested. This type of analysis will ensure that the failure modes and corresponding mitigation designs are addressed by the most appropriate testing strategies, which simulate the environment in which the equipment will be operated, with appropriate factors of safety applied.

The probability of failure of the identified failure modes may need to be demonstrated to be of a similar likelihood as the failures expected in recognized types of protection.

Full life cycle conditions may need to be considered and any restrictions may form part of the mandatory directions for use of the equipment to ensure EPLs are maintained during the operational life of the equipment.

By its very nature, assessment and testing to special protection “s” cannot be as prescriptive as for the recognized types of protection. It is anticipated that considerable dialogue is required between the manufacturer and an independent verifier. Additional assessment and testing may be identified by the independent verifier to ensure the relevant EPL is achieved.

When undertaking verification, it is strongly recommended the guidance provided in this standard is followed including:

- applying different levels of verification to match the EPL (similar in concept to the approach given in the IEC 61508 series);
- always involving at least one independent person/organization (an independent verifier);
- not using personnel who have had any involvement in research or determining the criteria for establishing the essential safety requirements in conjunction with the manufacturer.

Where it is intended to apply the requirements of this standard within a certification system/scheme, the following recommendations are made:

- the requirements laid down in EN 50495 [2] for safety devices are observed;
- an assessment should be performed by independent certification bodies (as the independent verifier) according to the requirements in this standard before issuing a certificate of conformity;
- a certification body performing an assessment for equipment not covered by recognized types of protection should have demonstrated expertise in the field under question.

AVA Documents
Document Sharing Hub
Full document details: PD CLC/TR 60079-33:2015

The need for a standard to address special protection “s” can be justified on the basis that:

- provision has been in IEC 60079-0 for many years with reference Ex “s” in a note in the marking requirements or elsewhere. This reference goes back to IEC standards that pre-date 1957;
- there have been standards used on a national basis for many years for certification to special protection “s”. Examples are SFA 3009 in the UK and AS/NZS 1826 in Australia and New Zealand;
- it is necessary to have an international approach that is consistent;
- there is an identified need and has been a request for a special protection “s” standard from IECEx.

Support for the approach in the standard:

- the approach draws on the experience of the use of verifiers already in other IEC standards.

Documents
Document Sharing Hub
Full document details: PD CLC/TR 60079-33:2015

EXPLOSIVE ATMOSPHERES –

Part 33: Equipment protection by special protection “s”

1 Scope

This part of IEC 60079 gives the specific methodology for the assessment and testing, and requirements for marking of electrical equipment, parts of electrical equipment and Ex components with special protection “s”.

This part of IEC 60079 applies to

- electrical equipment employing a method of protection not covered by any existing standard in the IEC 60079 series,
- electrical equipment employing one or more recognized types of protection where the design and construction is not fully compliant with the standard for the type of protection,
- electrical equipment where the intended use is outside the parameters of the scope of the standard for the type of protection.

This part of IEC 60079 is not intended for equipment that is covered by the scope of other IEC 60079 equipment standards unless

- it is clearly demonstrated that compliance with the type of protection is not feasible, and
- additional measures are applied to establish an equivalent equipment protection level.

This part of IEC 60079 for special protection “s” is applicable to Group I, Group II and Group III and for equipment protection levels Ma, Mb, Ga, Gb, Gc, Da, Db and Dc, as defined in IEC 60079-0.

Certain specific guidance for assessment and testing are provided in the annexes to this standard.

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 requirement of this standard shall take precedence.

NOTE 1 This standard may be used where equipment requires a higher EPL than the underlying protection techniques provide. Additional control measures or additional design and test requirements would be applied.

NOTE 2 Parts of equipment that can be designed and tested to standardized techniques should be so designed. Only those parts where conformance with essential safety requirements is achieved through alternative controls should be considered for special protection “s”. Equipment similar in attributes and performance to other equipment within a particular type of protection should be reviewed first to that method of protection prior to being considered for the use of Ex ”s”’. Some parts of IEC 60079 allow a degree of variance from the equipment requirements and where determined to be close enough by independent verifiers, then it is preferable to prescribe to the original type of protection.

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 60079 (all parts), *Explosive atmospheres*

Documents
Document Sharing Hub
Full document details: PD CLC/TR 60079-33:2015

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

IEC 60079-29-1, *Explosive atmospheres – Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases*

IEC 60079-29-2, *Explosive atmospheres – Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61508-1, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements*

IEC 61511 (all parts), *Functional safety – Safety instrumented systems for the process industry sector*

IEC 62061, *Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*

ISO 13849-1:2009, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

ISO 13849-2, *Safety of machinery – Safety-related parts of control systems – Part 2: Validation*

3 Terms and definitions

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

3.1
hybrid mixture
mixture of a flammable gas with a combustible dust

3.2
special protection “s”
concept to allow design, assessment and testing of equipment that cannot be fully assessed within a recognized type of protection or combination of recognized types of protection because of functional or operational limitations, but which can be demonstrated to provide the necessary equipment protection level (EPL)

3.3
recognized type of protection
type of protection, other than special protection “s”, as listed in IEC 60079-0 and with defined design, construction, assessment and test requirements

3.4
independent verifier
person or organization, with the appropriate competency in the applied explosion protection methodology, responsible for the verification of design calculations, assessment and testing who are separate and distinct by management and other resources including financial, from the person or organizations responsible for all the activities associated with the design, manufacture or sales of the equipment

Note 1 to entry: This may be a second or third party assessor, a test laboratory, a certifying body, etc.

AVA Documents
Document Sharing Hub

Full document details: PD CLC/TR 60079-33:2015