BRITISH STANDARD

BS 5501-9:1982
EN 50 039
Incorporating
Amendments No. 1

Electrical apparatus for potentially explosive atmospheres —

Part 9: Specification for intrinsically safe electrical systems "i" —

[EN title: Electrical apparatus for potentially explosive atmospheres. Intrinsically safe electrical systems "i"]

This European Standard EN 50 039 was given as from 31 March 1982 the status of a British Standard.

UDC 621.3-213.34-78:614.838.4:001.4:620.1

Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the National Committees of the following countries.

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Summary of pages

This document comprises a front cover, an inside front cover, page i and ii, the EN title page, pages 2 to 7, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

This British Standard, having been prepared under the direction of the General Electrotechnical Engineering Standards Committee, was published under the authority of the Board of BSI on 31 March 1982

The following BSI references relate to the work on this standard:
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EUROPEAN STANDARD

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EUROPÄISCHE NORM

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Key words: Electrical apparatus, potentially explosive atmosphere, explosive atmosphere, explosion proofing, specific requirement, intrinsic safety "i", intrinsically safe system "i"

English version

Electrical apparatus for potentially explosive atmospheres Intrinsically safe electrical systems "i"

Matériel électrique pour atmosphères explosibles.
Systèmes électriques de sécurité intrinsèque "i".

Elektrische Betriebsmittel für explosionsgefährdete Bereiche.
Eigensichere elektrische Systeme "i".

This European Standard was accepted by CENELEC on 1980-01-21. The CENELEC members are bound to adhere to the CENELEC Internal Regulations which specify under which conditions this European Standard has to be given, without any alteration, the status of a national standard.
Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CENELEC General Secretariat or to any CENELEC member.
This European Standard is established by CENELEC in three official versions (English, French, German). A translation made by another member under its own responsibility, in its own language, and notified to CENELEC has the same status.
CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

General Secretariat: rue Bréderode 2, B-1000 Brussels

NOTE In Germany, the word “Anlage” is used instead of “System” in mines susceptible to firedamp.

Contents

European Standards referred to in European Standard EN 50 039:

EN 50 014 (1977): (1st edition) Electrical apparatus for potentially explosive atmospheres. General requirements.

EN 50 020 (1977): (1st edition) Electrical apparatus for potentially explosive atmospheres. Intrinsic safety "i".

This European Standard has been prepared by CENELEC Technical Subcommittee 31-3.

1 Scope

1.1 This European Standard contains the specific requirements for construction and testing of intrinsically safe electrical systems, type of protection "i", intended for use, as a whole or in part, in potentially explosive atmospheres.

1.2 European Standard EN 50 020 "intrinsic safety "i", the requirements of which, except for those in clause **10** (Marking), apply to electrical apparatus used in intrinsically safe electrical systems.

1.3 This European Standard does not take the place of installation requirements for intrinsically safe electrical apparatus, for associated electrical apparatus and for intrinsically safe electrical systems.

2 Definitions

The following definitions, specific to intrinsically safe electrical systems, are applicable in this European Standard; they supplement the definitions which are given in European Standards EN 50 014 "General requirements" and EN 50 020 "Intrinsic safety "i" ".

2.1
intrinsically safe electrical system

an assembly of interconnected items of electrical apparatus, described in a descriptive system document, in which the circuits or parts of circuits, intended to be used in a potentially explosive atmosphere, are intrinsically safe circuits

2.2
certified intrinsically safe electrical system

an electrical system conforming to **2.1** for which a certificate has been issued confirming that the type of electrical system complies with this European Standard

NOTE It is not necessary for each item of electrical apparatus in an intrinsically safe electrical system to be certified individually provided that each such item of electrical apparatus is positively identifiable.

2.3
uncertified intrinsically safe electrical system

an electrical system conforming to **2.1** for which the knowledge of the electrical parameters of the items of certified intrinsically safe electrical apparatus, certified associated electrical apparatus, non-certified devices conforming to **1.3** of European Standard EN 50 014 "General requirements" and the knowledge of the electrical and physical parameters of the interconnecting wiring permit the unambiguous deduction that intrinsic safety is preserved

NOTE For accessories, clause **6** applies.

2.4
descriptive system document

a document prepared by the system designer in which the items of electrical apparatus, their electrical parameters and those for the interconnecting wiring (see **5.1**) are specified

NOTE The term "system designer" is intended to describe the person who is responsible for the intrinsic safety of the system.

3 Grouping and classification of intrinsically safe electrical systems

Intrinsically safe electrical systems shall be placed in Group I or Group II or both as defined in European Standard EN 50 014 "General requirements".

For Group II intrinsically safe electrical systems or parts thereof, the subdivisions A, B, C specified in European Standard EN 50 014 "General requirements" are also applicable.

Group II intrinsically safe electrical systems or parts thereof, intended for use in potentially explosive atmospheres, shall be given a surface temperature class in accordance with European Standard EN 50 014 "General requirements".

NOTE 1 For Group II intrinsically safe electrical systems, or parts thereof, the subdivisions A, B, C and surface temperature classes may not be the same as those of the intrinsically safe electrical apparatus and associated electrical apparatus included in the system or part thereof.

NOTE 2 Different parts of the same intrinsically safe electrical system may have different subdivisions A, B, C and different surface temperature classes.

4 Categories of intrinsically safe electrical systems

Each part of an intrinsically safe electrical system intended for use in a potentially explosive atmosphere shall be placed in either category ia or ib. The complete system need not necessarily be placed in a single category. The requirements of this European Standard apply to both categories.

NOTE Intrinsically safe electrical systems, or parts thereof, may have different categories to those of the intrinsically safe electrical apparatus and associated electrical apparatus included in the system or part thereof.

4.1 Category "ia". Parts of intrinsically safe electrical systems are of category ia if they comply with the requirements applicable to electrical apparatus of category ia (see **4.1** of European Standard EN 50 020 "Intrinsic safety "i" ") but the faults shall be applied to the electrical system as an entity and not to each item of electrical apparatus in the system.

4.2 Category "ib". Parts of intrinsically safe electrical systems are of category ib if they comply with the requirements applicable to electrical apparatus of category ib (see **4.2** of European Standard EN 50 020 "Intrinsic safety "i" ") but the fault shall be applied to the electrical system as an entity and not to each item of electrical apparatus in the system.

5 Interconnecting wiring of an intrinsically safe electrical system

5.1 General

5.1.1 The electrical parameters and all characteristics of the interconnecting wiring specific to an intrinsically safe electrical system, insofar as intrinsic safety depends on them, shall be specified in the descriptive system document.

5.1.2 Multicore cables may contain one or more intrinsically safe circuits but shall not contain any non-intrinsically safe circuit except in the case of special applications specified in **5.4.2** of European Standard EN 50 020 "Intrinsic safety "i" ".

5.2 Multicore cables containing more than one intrinsically safe circuit

5.2.1 *Cores.* The radial thickness of the insulation shall be appropriate to the conductor diameter and the nature of the insulation. For insulating materials currently used, e.g. polyethylene, the minimum radial thickness shall be 0,2 mm.

The insulation of each core shall be such that it will be capable of withstanding an r.m.s. a.c, test voltage of twice the nominal voltage of the intrinsically safe circuit with a minimum of 500 V.

5.2.2 *Conducting screens.*When conducting screens provide individual protection for intrinsically safe circuits in order to prevent such circuits becoming connected to one another the coverage of those screens shall be at least 60 % of the surface area.

5.2.3 *Cables.* Multicore cables shall be of a type capable of withstanding an r.m.s.a.c, dielectric test of at least:

500 V applied between any armouring and/or screen joined together and all the cores joined together;

1 000 V applied between a bundle comprising one half of the cable cores joined together and the bundle comprising the other half of the cores joined together.

5.2.4 *Tests.* Any testing necessary to show conformity with the requirements **5.2.1**, **5.2.2** and **5.2.3** shall be carried out by the manufacturer of the cable. Any voltage tests shall be carried out by a method specified in an appropriate cable standard. Where no such method is available, the tests shall be carried out as follows:

the voltage shall be an a.c. voltage of substantially sinusoidal waveform at a frequency of between 48 Hz and 62 Hz;

the voltage shall be derived from a transformer of at least 500 V A output;

the voltage shall be increased steadily to the specified value in a period of not less than 10 s and then maintained at this value for at least 60 s.

5.3 Types of multicore cables. The failures, if any, which shall be taken into consideration in multicore cables used in intrinsically safe electrical systems depend upon the type of cable used.

5.3.1 *Type A cable.* Cables complying with the requirements of **5.1.1**, **5.1.2**, **5.2.1**, **5.2.2** and **5.2.3**.

No failures between circuits shall be taken into consideration if each circuit is enclosed in an individual conducting screen.

NOTE For any connection of the screen, for example to earth, see the installation rules.

5.3.2 *Type B cable.* Cable which is fixed, effectively protected against damage and complies with the requirements of **5.1.1**, **5.1.2**, **5.2.1** and **5.2.3**.

No failures between circuits shall be taken into consideration if no circuit contained within the cable has a peak voltage exceeding 60 V.

5.3.3 *Type C cable.* Cable complying with the requirements of **5.1.1**, **5.1.2**, **5.2.1** and **5.2.3**.

In addition to the application of **4.1** or **4.2**, it is necessary to take into consideration up to two connections between conductors and, simultaneously, up to four open circuits of conductors. In the case of identical circuits, failures shall not be taken into consideration provided that each circuit passing through the cable has a safety factor of four times that required by **4.1** or **4.2**.

5.3.4 *Type D cable.* Cable complying with the requirements of **5.1.1** and **5.1.2**.

In addition to the application of **4.1** or **4.2**, there is no limit to the number of connections between conductors and simultaneous open circuits of conductors which shall be taken into consideration.

NOTE In the case where failures in the cable cause the voltage applied to intrinsically safe electrical apparatus in the system to be reversed, measures should be taken to prevent an unsafe condition arising in such circumstances. When taking such measures, e.g. by using shunt diodes, duplication or triplication of components is not necessary.

6 Accessories for intrinsically safe electrical systems

Accessories such as terminal boxes, junction boxes, plugs and sockets, switches and similar items shall comply with the following requirements.

6.1 Group I accessories. Accessories which are intended to be used in a potentially explosive atmosphere shall comply with the requirements of clauses **6** and **7** of European Standard EN 50 014 "General requirements".

If these accessories are listed in the certificate as parts of an intrinsically safe system, and if their construction affects the intrinsic safety of that system, they shall comply with the requirements of clause **5** and of **10.3** of European Standard EN 50 020 "Intrinsic safety" "i" .

6.2 Group II accessories. Accessories shall comply with the appropriate requirements of European Standard EN 50 020 "Intrinsic safety "i" ", but need be neither certified nor marked.

7 Type tests

Certified intrinsically safe electrical systems shall be subjected to type tests in accordance with clause **9** of European Standard EN 50 020 "Intrinsic safety "i" " but taking into account the specific requirements of this European Standard.

8 Marking of intrinsically safe electrical systems

8.1 Certified electrical systems. These systems shall be marked by the holder of the system certificate in a "strategic" position. The marking shall include the reference of the testing station, the letters "SYST" and the certificate reference.

This certificate reference shall be presented as specifed in European Standard EN 50 014 "General requirements".

NOTE The marking should normally appear on or adjacent to the principal item of electrical apparatus in the system or at the interface between the intrinsically safe and non intrinsically safe circuits.

8.2 Uncertified electrical systems. These systems shall be marked. The marking shall permit positive identification of the system, but need only give a reference to the descriptive system document.

National appendix A

The United Kingdom participation in the preparation of this British Standard came under the direction of the General Electrotechnical Engineering Standards Committee of BSI. This committee consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices Technical Committee
British Approvals Service for Electric Cables Ltd
British Electrical and Allied Manufacturers Association (BEAMA)*
British Radio Equipment Manufacturers' Association
British Steel Corporation
British Steel Industry
Department of Energy — Electricity
Electric Cable Makers' Confederation
Electrical Contractors' Association*
Electrical Contractors' Association of Scotland
Electrical Research Association
Electricity Supply Industry in England and Wales*
Electronic Components Industry Federation*
Electronic Engineering Association
Energy Industries Council*
Engineering Equipment Users' Association*
ERA Technology Ltd.*
Health and Safety Executive*
Home Office
Institution of Electrical Engineers
Ministry of Defence*
National Coal Board*
Oil Companies' Materials Association*
Post Office*
Telecommunication Engineering and Manufacturing Association (TEMA)*
Trades Union Congress

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee involved with the work on this standard:

Association of British Mining Equipment Companies
Association of Consulting Engineers
Association of Mining, Electrical and Mechanical Engineers
Association of Supervisory and Executive Engineers
British Electrical Systems Association (BEAMA)
British Gas Corporation
British Industrial Measuring and Control Apparatus Manufacturers Association
British Industrial Truck Association
Chemical Industries Association
Civil Aviation Authority (Airworthiness Division)
Department of the Environment (PSA)
Department of Trade (Marine Division)
Fire Offices Committee
Fire Protection Association
General Council of British Shipping
Institute of Petroleum
Institution of Mining Engineers
Lighting Industry Federation Ltd
National Union of Mineworkers
Rotating Electrical Machines Association (BEAMA)
Scientific Instrument Manufacturers Association
Sira Institute

National appendix B

The British Standards corresponding to the European Standards listed immediately prior to clause **1**, Scope, are as follows:

European Standards	**British Standards** (titles and content identical)
EN 50 014 (1997)	BS 5501-1:1977
EN 50 020 (1977)	BS 5501-7:1977

Product Certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard. Enquiries as to the availability of the third party certification schemes will be forwarded by BSI to the Association of Certification Bodies.

The recognized authorities in the United Kingdom[1)] for the certification and approval of electrical equipment for use in hazardous areas are as follows:

For Group I (coal mining) apparatus:

For Group II (non-mining) apparatus:
Health & Safety Executive
BASEEFA
Harpur Hill
Buxton, Derbyshire
SK17 9JN

[1)] There are other recognized authorities in other countries.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

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