

Emergency lighting

Part 5. Specification for component parts of optical fibre systems

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee CPL/34/9, Emergency lighting, upon which the following bodies were represented:

- Association of British Theatre Technicians
- Association of Building Engineers
- Association of County Councils
- Association of Manufacturers of Power Generating Systems
- British Cable Makers Confederation
- British Fire Consortium
- Chartered Institution of Building Services Engineers
- Chief and Assistant Chief Fire Officers Association
- Cinema Exhibitors Association
- Department of the Environment, Transport and the Regions
(Construction Directorate)
- Department of Trade and Industry (Consumer Safety Unit, CA Division)
- District Surveyors Association
- Electrical Contractors Association
- Electricity Association
- Engineering Industries Association
- GAMBICA (BEAMA Ltd.)
- Home Office
- Industry Committee For Emergency Lighting Ltd. (ICEL)
- Institute of Fire Prevention Officers
- Institute of Fire Safety
- Institution of Electrical Engineers
- Institution of Lighting Engineers
- Lighting Industry Federation Ltd.
- London Transport
- National Illumination Committee of Great Britain
- National Inspection Council for Electrical Installation Contracting
- Photoluminescent Safety Products Association
- Tenpin Bowling Proprietors' Association
- Coopted members

This British Standard, having been prepared under the direction of the Electrotechnical Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 July 1999

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Foreword

This British Standard has been prepared by Technical Committee CPL/34/9.

Optical fibre systems can provide a viable alternative solution for emergency lighting applications where the traditional electric lamp systems described in BS 5266 : Part 1 are either impractical, unsuitable or costly, for example, in explosive atmospheres, low level applications, inaccessible positions or small systems.

This standard has been prepared with the specific aim of providing for interchangeability to:

- a) allow an emergency lighting system to be designed for an application using component parts from many different manufacturers;
- b) allow component parts to be upgraded to keep pace with technological advances or to be changed to accord with aesthetic requirements;
- c) allow the potential long life of an optical fibre system to be realized (optical fibres are virtually ageless and only the light source is liable to deteriorate with age).

To avoid the introduction of new test procedures use is made of established test procedures in other British Standards wherever they are considered applicable.

This standard is complementary to BS 5266 : Part 4 which provides specific guidance on design, installation and maintenance of optical fibre emergency lighting systems additional to the general guidance and recommendations given on electric lamp emergency lighting systems in BS 5266 : Part 1.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

1 Scope

This Part of BS 5266 specifies requirements for optical fibres, lightguides, connectors, emission end mounting arrangements and light sources to be used in optical fibre emergency lighting systems. Constructional and performance requirements are given, including performance under fire conditions. The standard is applicable to the component parts of an emergency lighting system using optical fibre lightguides to distribute light from a light source to one or more lighting positions remote to that light source.

The standard specifies the use of optical fibres with end illumination and end emission. It is not applicable to optical fibres with end illumination and side wall emission.

NOTE. This Part is to be used in conjunction with BS 5266 : Part 1 and BS 5266 : Part 4.

2 References

2.1 Normative references

This Part of BS 5266 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on page 12. For dated references only, the cited edition applies; any subsequent amendments to or revisions of any of the cited publications apply to this Part of BS 5266 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

2.2 Informative references

This Part of BS 5266 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this Part of BS 5266 the definitions given in BS 5266 : Part 1 : 1988 and BS 5266 : Part 4 : 1999 apply.

4 General

NOTE. The components specified in this Part of BS 5266 are suitable for systems to be used in air. Where component parts are to be used in any other environment, for example in an explosive atmosphere, their suitability for use in that particular environment should be checked with the manufacturer.

4.1 Working life

The manufacturer shall assign a recommended working life to each component part of an optical fibre system, or assembly of such parts to allow the purchaser to plan and make provision for future replacement.

The assigned working life shall be qualified by recommended maintenance where this is necessary to achieve or optimize the working life.

NOTE 1. For innovative materials the results of accelerated ageing tests may be used to establish the potential working life.

NOTE 2. The manufacturer should state the basis upon which the recommended working life has been established.

NOTE 3. In the case of light sources the recommended working life should not include the lamp. However, the light source design should be such as to allow the lamp to achieve the rated life declared by the lamp manufacturer.

NOTE 4. The requirements for battery working life are given in 9.5.2.

4.2 Corrosion resistance

The component parts of an optical fibre system, particularly metallic parts, shall either have inherent resistance to corrosion or be given a corrosion resistant finish or treatment suitable for the application.

5 Optical fibres

5.1 Composition

Fibres shall:

- a) have a silicate core and silicate cladding; or
- b) be manufactured from silica; or
- c) be manufactured from multi-component glass; or
- d) be manufactured from any other material having equivalent light transmission and survivable thermal characteristics.

NOTE 1. Whilst minor dimensional inaccuracies in individual fibres do not significantly affect lightguide performance, manufacturing techniques should be used which keep these inaccuracies to a minimum.

NOTE 2. Optical fibres for visible light applications need not be manufactured to the same purity or dimensional accuracy as optical fibres for data and communication transmission applications but the use of fibres of higher purity and dimensional accuracy is not excluded.

NOTE 3. Recommendations for safety when handling and using optical fibres are given in annex E of BS 5266 : Part 4 : 1999.

The core and cladding shall be hot drawn to provide a homogeneous fibre of circular cross-section and uniform construction. Multimode transmission shall be provided.

5.2 Refractive index

Fibres shall have a step index profile.

5.3 Numerical aperture

Fibres shall have a numerical aperture greater than 0.45 and less than 0.8.

5.4 Spectral bandwidth

Fibres shall have a spectral bandwidth between 400 nm and 700 nm.

5.5 Fibre attenuation loss

The fibre bundle shall have a fibre attenuation loss not greater than 500 dB/km (0.5 dB/m) at 550 nm.

6 Lightguides

6.1 Classification

There are two categories of lightguide.

- a) *Category 1*: A lightguide possessing no inherent integrity under fire conditions and limited resistance to environmental conditions and/or mechanical damage. Intended for applications where these aspects will be addressed by other means.
- b) *Category 2*: A lightguide possessing fire integrity not less than that corresponding to Category B of BS 6387 : 1994. Resistance to environmental conditions and/or mechanical damage may be inherent to the construction or provided by other means.

6.2 Fibre bundles

Individual fibres shall be laid up in random formation to produce a bundle of circular cross-section.

At least 80 % of the surface area of a bundle shall be formed by active fibre cores. It shall be permissible for propagation to occur through the fibre cladding to maximize transmission of light.

NOTE 1. Fibre bundles should generally be flexible to allow bending during installation but it is acceptable to fuse fibres together to form a solid bundle where this will have advantages. Fusing may be for the entire length of the bundle or at discrete points such as at connectors.

It shall be permissible for fibre bundles to incorporate one or more strength members where necessary to minimize fibre breakage during installation. Strength members shall be electrically non-conductive.

NOTE 2. Strength members should preferably be placed around the outer edge of the bundle adjacent to the covering or inner layer of a multi-layer construction to avoid blank spots in the active area.

6.3 Covering material and its application

6.3.1 General

Material in contact with optical fibres shall be such that it does not affect their physical or optical properties and does not have a long term detrimental effect upon the fibre material.

6.3.2 Hydrogen diffusion

Either the covering material shall be resistant to hydrogen diffusion, or the manufacturer shall provide information with the lightguide on how to protect the fibres from hydrogen diffusion.

6.3.3 Application of covering

Where a single layer covering is used it shall be homogeneous and closely applied to the fibre bundle. For a multi-layer covering the inner layer shall be such as to maintain the fibre bundle in accordance with 6.2.

It shall be possible to remove the covering, or inner layer, without damage to the fibres.

NOTE. A coating or wrapping may be applied to the fibre bundle prior to application of the covering or inner layer to assist with its removal.

6.4 Temperature and bending characteristics

6.4.1 Lightguides shall be tested in accordance with 6.4.2 and shall conform to the following.

- a) The change in fibre attenuation loss between 20 °C and 0 °C shall not exceed 0.5 dB.
- b) When the lightguide is bent with an internal bending radius not exceeding 8 times the nominal outer diameter of the lightguide, at 20 °C and at 0 °C, the fibre attenuation loss shall not increase by more than 0.5 dB.

It shall be permissible for stiffness to be incorporated into the lightguide by, for example, armouring or strength members to ensure that a smaller bending radius is not introduced during installation.

6.4.2 The light transmittance loss of the lightguide shall be measured using a light source and a detector. The light transmittance loss shall be measured before and after bending the lightguide with an internal bending radius not exceeding 8 times the nominal outer diameter of the lightguide in accordance with the method given in annex B of BS 6387 : 1994. The test shall be carried out at 20 °C and at 0 °C. The changes in attenuation loss can be calculated from the light transmittance losses by subtraction; the coupling losses, being the same, cancel out.

6.5 Resistance to impact

6.5.1 Covering materials shall provide protection against impact damage during handling, installation and subsequent service. The resistance provided shall be clearly detailed in the design information provided by the manufacturer to allow special handling techniques to be used or additional protection to be provided as part of the installation procedure. When tested in accordance with 6.5.2 lightguides shall conform to 6.5.3.

6.5.2 Lightguides shall be subjected to impacts using the apparatus and method given in annex C of BS 6387 : 1994. Six lightguides complete with connectors shall be tested. The test shall be carried out at ambient temperature (20 °C) and at $-15\text{ °C} \pm 2\text{ °C}$. At each temperature the light transmittance loss shall be measured before and after the test and the change in fibre attenuation loss calculated in accordance with 6.4.2. The covering shall be examined after the test with normal or corrected vision without magnification.

6.5.3 After the test, the covering, in the case of a single layer covering, or the outer layer, in the case of a multilayer covering, shall not show any cracking. The fibre attenuation loss shall not have increased by more than 0.5 dB.