
British Standard Specification for

Light sources for miners' portable electric lamps

Sources lumineuses pour lampes de mineurs portatives — Spécifications

Glühlampen für tragbare Bergmannsleuchten

Foreword

This revision of BS 535 has been prepared under the direction of the Electrical Illumination Standards Committee and it supersedes BS 535 : 1973 which is withdrawn.

The term 'light source' has been used in this standard to avoid the alternative use of 'bulb', which normally means the glass envelope, or 'lamp', which may be confused with the term 'cap lamp' which is used to identify the complete fitting containing the light source and power supply.

In this revision, the opportunity has been taken to include a number of halogen light sources, to include a type test for the approval of a new or modified light source design and to bring the sampling plans broadly in line with BS 6001.

The presentation of the information has also been changed. Section one specifies the general requirements for all light sources. Section two consists of individual standard data sheets for light sources intended for use in miners' lamps used in British coal mines. In this respect it should be noted that BS 4945 which specifies miners' cap lamp assemblies states 'The head piece shall be fitted with a main light source complying with sections one and two of BS 535 : 1987'. Section three consists of individual standard data sheets for light sources intended for applications other than in British coal mines.

Attention is drawn to Regulations made under the Mines and Quarries Act (1954) which require that certain light sources for use in miners' lamps used in British mines be approved. Details of approval requirements and procedures are given in the Health and Safety Executive Testing Memorandum No. 1, 'Test and approval of safety lamps and their component parts for use in mines'.

The statistical basis for the tests on which the standard is based is given in appendix A.

The numbering system for the standard light source data sheets is explained in appendix D.

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

Amendment No. 1
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Specification for light sources for
miners' portable electric lamps

Revised text

AMD 5863
March 1989

Section two. Standard data sheets for light sources intended for use in British coal mines

Delete the existing page containing the table of main light source types and substitute the revised page attached.

AMD 5863
March 1989

New standard sheet 535-83-1

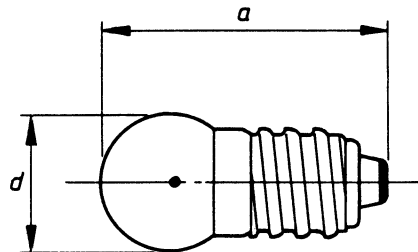
In section two after standard sheet 535-82-1, insert the new standard sheet 535-83-1, attached.

Section two. Standard data sheets for light sources intended for use in British coal mines

Main light source types				
Type	Cap reference	Rated voltage	Rated current	Sheet
Halogen prefocus cap	P13.5s or PX13.5s	V 4.0	A 1.0	535-01-1
Halogen prefocus cap	P13.5s or PX13.5s	4.2	1.0	535-02-1
Prefocus cap	P13.5s or PX13.5s	4.0	1.0	535-21-1
Miniature Edison screw cap	E10/13	4.0	0.9	535-41-1
Miniature Edison screw cap	E10/13	4.0	1.0	535-42-1
Auxiliary light source types				
Type	Cap reference	Rated voltage	Rated current	Sheet
Miniature Edison screw cap	E10/13	V 4.0	A 0.25	535-81-1
Miniature Edison screw cap	E10/13	4.0	0.46	535-82-1
Miniature Edison screw cap	E10/13	4.0	0.3	535-83-1

Standard sheet 535 – 83 – 1

Miners' cap lamp auxiliary light source: miniature Edison screw cap 4.0 V 0.3 A



Dimensions:

<i>a</i>	25.0 mm max.
<i>d</i>	∅ 12.0 mm max.

Cap:

E10/13 as specified in sheet 7004-22 of BS 5101 : Part 1

Electrical and photometric performance:

Rated voltage	4.0 V
Rated current	0.3 A
Test voltage	4.0 V
Maximum current	0.33 A
Minimum average life	50 h

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Section one. General

1 Scope

This British Standard specifies requirements for main and auxiliary light sources for use in miners' portable electrical lamps, describes the methods of test to be used and gives the conditions of compliance for a batch of light sources. Section one specifies general requirements. Section two consists of standard light source data sheets that give particular requirements for light sources intended for use in British coal mines. Section three consists of standard light source data sheets that give particular requirements for light sources intended for use in applications other than British coal mines.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the following definitions apply:

- 2.1 light source.** A filament lamp.
- 2.2 bulb.** The outer envelope of glass or other transparent or translucent material enclosing the essential components of a light source.
- 2.3 rated voltage.** The voltage at which the light source is designed to operate.
- 2.4 rated current.** The current which the light source is designed to take when operated at rated voltage.
- 2.5 initial readings.** The photometric and electrical measurements made at the end of the ageing period.
- 2.6 batch.** All the light sources of one type put forward at one time for acceptance as specified in this standard.
- 2.7 inspection test.** The test for visual, mechanical and physical characteristics.
- 2.8 rating test.** The test for initial current and luminous flux made at the end of the ageing period.
- 2.9 life test.** The test for maintenance of luminous flux and duration of life.
- 2.10 type test.** A test or series of tests made on a type test sample for the purpose of checking compliance of the design of a given product with the requirements of this standard.
- 2.11 type test sample.** A sample consisting of one or more similar units submitted by the manufacturer or responsible vendor for the purpose of a type test.
- 2.12 inspection test quantity (ITQ).** The sample of light sources required to be tested in accordance with the inspection test.
- 2.13 rating test quantity (RTQ).** The sample of light sources required to be tested in accordance with the rating test.

2.14 life test quantity (LTQ). The sample of light sources required to be tested in accordance with the life test.

2.15 type test quantity (TTQ). The sample of light sources required to be tested in accordance with the type test.

2.16 light centre length (LCL). The distance from the centre of the rectangle which encloses the luminous section of the filament, or a defined point on the filament, to the reference plane on the cap.

2.17 lateral deviation. The perpendicular distance from the geometric centre of the filament to the reference axis of the cap.

2.18 ageing. The operation of a new light source for a specified period in order to stabilize its electrical and photometric characteristics before initial readings are taken.

2.19 lumen maintenance. The luminous flux of an individual light source at the specified time of measurement during the life test expressed as a percentage of that in the rating test.

2.20 life

(1) Of an individual light source. The number of hours that a light source operates to burn out or the number of hours of life the light source is deemed to have, as specified in this standard.

(2) Of the life or type test quantity. The arithmetic mean of the lives of the individual light sources of the LTQ or TTQ.

2.21 reference plane. A plane defined with reference to the cap or base and with respect to which the positions of certain parts of the light source are measured.

2.22 reference axis. An axis defined with reference to the cap or base and with respect to which the positions of certain parts of the light source are measured.

3 Batch acceptance on a statistical basis

3.1 A batch of main light sources intended for use in British coal mines shall be deemed to comply with this standard if, when a sample is tested in accordance with this standard, in all the test quantities the numbers of light sources which fail to satisfy the specified test requirements are not greater than the related compliance numbers (see clause 5) and the average life is not less than the related compliance life (see clause 5).

3.2 A batch of auxiliary light sources shall be deemed to comply with this standard if the requirements of appendix B are satisfied.

3.3 A batch of light sources intended for use in applications other than British coal mines shall be deemed to comply with this standard if the requirements of appendix C are satisfied.

4 Requirements and tests for inspection, rating and life

4.1 Test temperature

Tests shall be carried out at an ambient temperature of 15 °C to 30 °C unless otherwise specified.

4.2 Test quantities

4.2.1 Inspection test quantity (ITQ). The inspection test quantity shall be 5 % of the batch, with a minimum of 35 light sources and a maximum of 70 light sources.

In order to ensure proper representation of the batch the ITQ shall be selected at random as given in (a) to (c).

- (a) For a batch of 1000 light sources or less packed in 10 or less containers, light sources shall be selected from every container.
- (b) For a batch of 1000 light sources or less packed in more than 10 containers, light sources shall be selected from at least one-half of the total number of containers, with a minimum of 10.
- (c) For a batch of more than 1000 light sources, light sources shall be selected as far as possible from one-third of the total number of containers with a minimum of 10.

4.2.2 Rating test quantity (RTQ). The rating test quantity shall be five-sevenths of the ITQ selected at random from the light sources of the ITQ which satisfy the individual light source requirements of the inspection test. In the case of a fraction resulting from this calculation, the next higher whole number shall be taken.

4.2.3 Life test quantity (LTQ). The life test quantity shall be half of the RTQ selected at random from the light sources of the RTQ which satisfy the individual light source requirements of the rating test. In the case of a fraction resulting from this calculation, the next higher whole number shall be taken.

4.2.4 Type test quantity (TTQ). The type test quantity shall be a minimum of 13 light sources and shall be representative of the materials, processing and construction of the manufactured product.

4.2.5 Accidentally broken light sources. Light sources which are accidentally broken during the test shall, when necessary, be replaced to ensure that the required number of light sources complete the test.

The results obtained with a replacement light source shall be substituted for those of a broken light source.

NOTE. In order to avoid unnecessary delay, it is recommended that spare light sources be tested with each test quantity.

4.3 Inspection

4.3.1 Marking

4.3.1.1 The cap of each light source shall be distinctly and durably marked with the following information:

- (a) rated voltage (see note 3);
- (b) rated current (see note 3);
- (c) trade mark;
- (d) batch identification.

NOTE 1. Marking with an approval mark may be required by the approving authority (see foreword).

NOTE 2. Other markings are permitted provided they do not lead to confusion.

NOTE 3. It is permissible to use the abbreviated code for voltage and current ratings shown on the appropriate standard light source data sheet.

For example:

- 4.0 V 0.9 A may be abbreviated to 4009
- 4.0 V 1.0 A may be abbreviated to 4010
- 4.2 V 1.0 A may be abbreviated to 4210

4.3.1.2 The packaging of each light source shall be distinctly and durably marked with the information specified in 4.3.1.1 and in addition with the following information:

- (a) cap type;
- (b) halogen, if appropriate.

NOTE. Other markings are permitted provided they do not lead to confusion.

4.3.2 Bulbs. The bulbs shall be:

- (a) either
 - (1) clear;
 - (2) granulated.

NOTE. The bulbs will be supplied clear unless granulated bulbs are specifically requested by the purchaser at the time of enquiry or order.

- (b) uncoloured;
- (c) free from defects detrimental to service;
- (d) for E10/13 caps, sufficiently strong to withstand, without collapse, the torque test specified in 4.3.4.

4.3.3 Dimensions. The light sources shall comply with the dimensions shown on the appropriate standard light source data sheet.

4.3.4 Cap. The cap of each light source shall comply with the requirements of BS 5101 : Part 1.

For light sources with E10/13 caps, the cap and bulb shall withstand a torque of 0.23 N·m without visible relative movement between cap and bulb. The cap shall be held firmly without distortion and the torque gradually applied to the bulb in a clockwise direction and held for 5 ± 2 s. This test shall be repeated on the LTQ after the completion of the life test.

4.3.5 Solder. Solder shall be evenly applied in such quantity as to allow proper engagement of the cap in the appropriate holder for the light source and to ensure satisfactory electrical contact.

NOTE. It is not essential that the surface of the contact plate be completely covered with solder.

4.4 Rating

4.4.1 Ageing. The light source shall be aged in a vertical cap down or horizontal position for 2 h at the rated voltage.

4.4.2 Operating position for photometry. The light source shall be operated in the vertical cap down position.

4.4.3 Photometry. A suitable integrating photometer shall be used.

4.4.4 Test voltage. The test voltage shall be the rated voltage.

4.4.5 Measurement. After ageing as described in 4.4.1 measurements for initial current and luminous flux shall be made following a 4 min period of operating in the photometer without interruption of the supply.

4.5 Life

4.5.1 Operating position. The light source shall be operated in a horizontal position.

4.5.2 Supply voltage and control. The supply voltage shall be the rated voltage and shall be either d.c. or a.c. at a nominal frequency of 50 Hz. The mean value of the test voltage throughout the test shall be within $\pm 1\%$ of the rated voltage.

NOTE. In cases of doubt, the test with d.c. is the reference test.

4.5.3 Test procedure. Light sources shall be switched off for two periods of not less than 15 min of each day. Such periods shall not be included as part of the life of the light source.

4.5.4 Duration of test. The test shall be deemed to have terminated at 150 % of the minimum average life specified on the appropriate standard light source data sheet. Any light source still operating shall be deemed to have a life 150 % of the specified minimum average life. A light source which burns out at less than 150 % of the specified minimum average life shall be deemed to have a life of the number of hours at burn out.

4.5.5 Lumen maintenance. The lumen maintenance of individual light sources shall be measured at $75 \pm 5\%$ of the minimum average life specified in the appropriate standard light source data sheet. If any light source fails to comply with the specified minimum lumen maintenance it shall be deemed to have a life 75 % of the specified minimum life.

4.5.6 Life of the LTQ. The life of the LTQ (see 2.20) shall be taken as being the arithmetic mean of the lives of the individual light sources of the LTQ.

4.6 Type test (see reference to 5.5 in 5.1(a) for applicability)

4.6.1 Operating position. The light source shall be operated in a horizontal position.

4.6.2 Ambient temperature. The light source shall be life tested at an ambient temperature of $80 \pm 2^\circ\text{C}$.

4.6.3 Supply voltage and control. The supply voltage shall be the rated voltage and shall be either d.c. or a.c. at a nominal frequency of 50 Hz. The mean value of the test voltage throughout the test shall be within $\pm 1\%$ of the rated voltage.

NOTE. In cases of doubt, the test with d.c. is the reference test.

4.6.4 Test procedure. Light sources shall be switched off for two periods of not less than 15 min of each day. Such periods shall not be included as part of the life of the light source.

4.6.5 Duration of test. The test shall be deemed to have terminated at 150 % of the minimum average life specified on the appropriate standard light source data sheet. Any light source still operating shall be deemed to have a life 150 % of the specified minimum average life. A light source which burns out at less than 150 % of the specified minimum average life shall be deemed to have a life of the number of hours at burn out.

4.6.6 Lumen maintenance. The lumen maintenance of individual light sources shall be measured at $75 \pm 5\%$ of the minimum average life specified in the appropriate standard light source data sheet. If any light source fails to comply with the specified minimum lumen maintenance it shall be deemed to have a life 75 % of the specified minimum life.

4.6.7 Life of the TTQ. The life of the TTQ (see 2.20) shall be taken as being the arithmetic mean of the lives of the individual light sources of the TTQ.

NOTE. A type test may be carried out periodically at the discretion of the light source manufacturer or user.

5 Conditions of compliance

5.1 General

A batch of light sources shall be deemed to comply with this standard if:

- (a) *for light sources of a new design or a modified version of a previously accepted design*, the requirements of 5.2, 5.3, 5.4 and 5.5 are satisfied;
- (b) *for light sources of a previously accepted design*, the requirements of 5.2, 5.3 and 5.4 are satisfied.

5.2 Inspection tests

The number of light sources failing to comply with the requirements of 4.3.1 to 4.3.5 shall not exceed the compliance numbers in table 1.

Table 1. Inspection test quantities and compliance numbers			
For any one subclause 4.3.1 to 4.3.5		For all subclauses 4.3.1 to 4.3.5	
ITQ	Compliance number	ITQ	Compliance number
35 to 54	3	35 to 44	5
55 to 70	4	45 to 56	6
		57 to 70	7

5.3 Rating tests

5.3.1 The number of light sources not operative at the end of the ageing period shall not exceed the compliance number in table 2.