

Cinematography —

Part 7: Production and presentation — Section 7.5 Film and television location lighting —

Subsection 7.5.4 Specification for single pole high current plugs and socket connectors

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Cooperating organizations

The Cinematograph Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

- Association of Cinematograph, Television and Allied Technicians*
- Association of Film Laboratory Employers
- British Broadcasting Corporation*
- British Film Institute*
- British Kinematograph, Sound and Television Society*
- British Photographic Association
- Chartered Institution of Building Services
- Cinematograph Exhibitors' Association of Gt Britain and Ireland
- Film Production Association of Great Britain
- Independent Television Companies' Association*
- Royal Photographic Society*

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

- Association of Supervisory and Executive Engineers
- Electrical Installation Equipment Manufacturers' Association (BEAMA)
- Electrical, Electronic, Telecommunications and Plumbing Union
- Greater London Council
- Health and Safety Executive
- Lighting Industry Federation Ltd
- National Illumination Committee of Great Britain

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Foreword

This Subsection of BS 5550 has been prepared under the direction of the Cinematograph Standards Committee, following a request from the Television Broadcast Industry.

Television lighting equipment, evolving from well established film studio operations, has been based in general upon the use of original or modified 110 V d.c. plant and luminaires. Since television seldom requires the use of carbon arc light sources, a.c. has been adopted at 240 V for all tungsten lights. As with the low current connectors, the original d.c. high current connectors were retained at the high voltage. It has become apparent that these high current connectors can constitute a safety hazard and that safer ones are required. This standard therefore specifies dimensional and performance requirements for two non-interchangeable connectors, one rated at 150 A and one at 400 A, for use in the film and television industry.

Attention is drawn to the other Subsections of BS 5550 dealing specifically with location lighting:

- *Subsection 7.5.1: Code of practice for distribution of electricity for location lighting;*
- *Subsection 7.5.2: Specification for lighting power distribution units;*
- *Subsection 7.5.3: Specification for plugs and socket connectors.*

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 24, 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.

1 Scope

This British Standard specifies requirements for single pole power outlets, cable sockets, cable couplers and appliance couplers (these are all referred to generally throughout the standard as accessories). The accessories are for use on a.c. supplies with a voltage to earth not exceeding 250 V and a frequency not exceeding 500 Hz and on 120 V d.c. supplies. Two sizes are specified, rated at 150 A and 400 A respectively. The accessories are intended for use in the television industry for lighting purposes “on location” either indoor or outdoors. The accessories are intended for continuous use in ambient temperatures between -20°C and $+35^{\circ}\text{C}$.

2 References

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

3 Definitions

For the purposes of this British Standard, the following definitions, together with those given in BS 4727, apply. It should be noted that definitions 3.2, 3.3 and 3.4 are not in accord with common plug and socketry definitions. This is because, as can be seen from Figure 11, a female socket of this design of connector is of such an internal diameter that, should it be powered, its live part could be accessible to the standard test finger. Accordingly it is the protected plug of the connector to which the power is supplied, and these definitions, which describe the functions of these accessories, are in accord with this physical realization (see Figure 12).

3.1

on location

electronic or motion-picture film cameras are said to be on location when they are used outdoors or indoors in any temporary or permanent building, either static, transportable or mobile, which is not specifically constructed for use as a film or television studio

NOTE A licensed theatre is not deemed to be a studio unless it has been specially adapted for regular film or television use.

3.2

power outlet and cable socket

means enabling the connection, at will, of a flexible cable to fixed wiring. It consists of a power outlet, provided with a male contact pin with insulated tip, which is the part intended to be installed with the distribution unit, and a cable socket, provided with a contact tube, which is the part integral with or attached to the flexible cable connected to the equipment or to a cable outlet

3.3

cable coupler

means enabling the connection, at will, of two flexible cables. It consists of a cable outlet, provided with a male contact pin with insulated tip, which is the part integral with or intended to be attached to the flexible cable connected to the supply, and a cable socket provided with a contact tube, which is the part integral with or intended to be attached to the flexible cable connected to equipment or to a cable outlet

3.4

appliance coupler

means enabling the connection, at will, of a flexible cable to the equipment. It consists of a cable outlet, provided with a male contact pin with insulated tip, which is the part integral with or intended to be attached to the flexible cable connected to the supply, and an appliance socket, provided with a contact tube, which is the part incorporated in or fixed to the equipment, or intended to be fixed to it

NOTE The use of accessories in 3.2, 3.3 and 3.4 above is shown in Figure 12.

3.5

retaining device

mechanical arrangement that holds a socket or outlet in position when it is in proper engagement and that prevents its accidental withdrawal

3.6

rated current

current value assigned to the accessory by the maker

3.7

maximum rated voltage

maximum voltage at which any component part may be used

NOTE Where the terms “voltage” and “current” are used they imply r.m.s. values.

3.8

functional insulation

insulation necessary for the proper functioning of the accessory and for basic protection against electric shock

3.9

solder cup

recess in the termination into which the conductor is soldered

3.10

compression terminal

arrangement whereby the conductor is placed into a recess which is subsequently distorted by mechanical means so as permanently and securely to connect the conductor to the termination

4 General requirements

Accessories shall be so designed and constructed that in normal use their performance is reliable and without danger to the user or surroundings. The accessories shall be of two non-interchangeable sizes with maximum current ratings of 150 A and 400 A respectively and they shall be of splashproof design. Apart from current-carrying parts, accessories shall be of insulating material. Cases shall not be of metal.

5 General notes on tests

5.1 Tests according to this specification are type tests.

5.2 Unless otherwise specified elsewhere in this standard, the samples are tested as delivered and under normal conditions of use, at an ambient temperature of 20 ± 5 °C. The tests are made at rated frequency.

5.3 Unless otherwise specified elsewhere in this standard, the tests are carried out in the order of the clauses.

5.4 Three samples are subjected to all the tests.

5.5 Accessories do not comply with the requirements of this standard if there are more failures than that of one sample in one of the tests. If one sample fails in a test, that test, and all preceding tests that may have influenced the results of that test, are repeated on another set of three samples. If any of these samples fails in any of the repeated tests, the accessory shall be deemed not to comply with the requirements of this British Standard.

NOTE In general, it will only be necessary to repeat the test which caused the failure.

6 Standard rating

6.1 Maximum rated voltages to earth are 250 V a.c. up to 500 Hz and 120 V d.c.

6.2 Maximum rated currents are 150 A and 400 A.

7 Classification

Accessories shall be classified according to their purpose as follows (see Figure 12):

- a) power outlets and cable sockets;
- b) cable couplers, comprising a cable outlet and a cable socket;
- c) appliance coupler, comprising a cable outlet and an appliance socket.

8 Marking

8.1 Accessories shall be marked with the following:

- a) rated current in amperes;
- b) maximum rated voltage in volts;
- c) symbol for splashproof construction;
- d) the number of this British Standard, i.e. BS 5550-7.5.4¹⁾;
- e) maker's name or trade mark;
- f) type reference, which may be a catalogue number.

8.2 When symbols are used, they shall be as follows:

A	amperes
V	volts
	alternating current
	direct current
	splashproof construction

8.3 For cable outlets and cable sockets, the marking specified in 8.1 shall be easily discernible when the accessory is wired ready for use.

NOTE The term "ready for use" does not imply the socket or outlet is in engagement with its complementary accessory.

8.4 Marking shall be indelible and easily legible.

TEST. Compliance with the requirements of 8.1 to 8.4 shall be checked by inspection. In addition, after the humidity treatment given in clause 15, the marking shall be rubbed vigorously by hand for 15 s with a piece of cloth soaked with petroleum spirit, and then checked by inspection. The marking shall again be checked by inspection after the test given in 20.2.

9 Dimensions

9.1 The essential dimensions of accessories shall be as shown in Figure 1 to Figure 10.

TEST. Compliance shall be checked by measurement.

9.2 It shall not be possible to engage accessories having different current ratings.

¹⁾ Marking BS 5550-7.5.4 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, British Standards Institution, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

10 Protection against electric shock

The insulated bodies of accessories shall be of rubber of suitable composition. Accessories shall be so designed that:

- a) when they are wired as in normal use live parts are not accessible;
- b) when they are in partial or complete, engagement, live parts are not accessible.

TEST. Compliance shall be checked by inspection and, if necessary, for the sample wired as in normal use, by applying the standard test finger (see Figure 13) in every possible position, an electrical indicator with a voltage not less than 40 V being used to show contact with the relevant parts. The test finger shall not make contact with any live part.

11 Terminals and terminations

11.1 The terminations shall be of the adaptor thread type to accept a ferrule connector or of the solder cup type complying with the requirements of Figure 5 and Figure 10.

These terminations shall be an integral part of the accessory.

A ferrule connector used for connecting a conductor to an adaptor thread shall be so designed that:

- a) it can be securely fixed and locked to the accessory by means which are electrically and mechanically efficient;
- b) it does not increase the overall diameters or interfere with the basic interchangeability of the accessory;
- c) the requirements of BS 4579-1 can be met.

TEST. Compliance shall be checked by inspection.

11.2 The cable/accessory joint shall be sealed against the ingress of moisture and relieved of bending stress by the use of heat-shrink tubing. The tubing shall be of the type and size specified by the material manufacturer as being suitable for the duty indicated and shall be fitted in accordance with the manufacturer's instructions.

11.3 Contacts that are subjected to a sliding action in normal use shall be of a metal resistant to corrosion. Springs ensuring the resiliency of male contacts shall be resistant to corrosion.

TEST. Compliance shall be checked by inspection and, if necessary, by chemical analysis or, if applicable, by the test given in clause 21.

12 Retaining device

The retaining device shall be of the bayonet type complying with the requirements of Figure 1, Figure 3, Figure 6 and Figure 8.

The full engagement of the retaining device when two accessories are coupled shall be indicated on the insulated bodies of the accessories by the alignment of two pairs elevated indicators diametrically opposite each other. The indicators and the axis of the locking pin shall lie on the same plane.

TEST. Compliance shall be checked by inspection and by manual operation.

13 Resistance to ageing of rubber

The rubber enclosures of the accessories and parts made of rubber, such as sealing ring and gaskets, shall be sufficiently resistant to ageing.

TEST. Compliance shall be checked by an accelerated ageing test by suspending the samples freely in a heating cabinet at a temperature of $70 \pm 2^\circ\text{C}$ for a duration of 10 days (240 h).

After the samples have been allowed to attain approximate room temperature, they are examined and shall show no crack visible to the naked eye, nor shall the material have become sticky or greasy.

After the test the samples shall show no damage which would lead to non-compliance with this standard.

If there is a doubt as to whether the material has become sticky, the sample is placed on one of the pans of a balance and the other pan is loaded with a weight equal to the mass of the sample plus 500 g. Equilibrium is then restored by pressing the sample with the forefinger wrapped in a piece of dry flannelette²⁾.

No traces of the flannelette shall remain on the sample of the material and samples shall not stick to the flannelette.

NOTE The use of an electrically heated cabinet is recommended. Natural circulation may be provided by holes in the walls of the cabinet.

14 Construction

14.1 General design and interchangeability.

Accessories shall be of a splashproof design. Sockets and outlets of similar rating shall be freely interchangeable.

TEST. Compliance shall be checked by inspection of the marking and by the relevant tests given in 15.1.

14.2 Finish. Accessible surfaces of accessories shall be free from burrs, flash and similar sharp edges.

TEST. Compliance shall be checked by inspection.

²⁾ Flannelette complying with the requirements of BS 1945 is suitable.

14.3 Male contact pins. The male pin of a power outlet or a cable outlet shall be self-adjusting so as to ensure adequate contact pressure with the rigid contact tube of a cable socket or an appliance socket. The pin shall be fitted with an insulated protective tip.

TEST. Compliance shall be checked by inspection and by the voltage drop tests given in clauses 17 and 18.

14.4 Strength and security. Parts of accessories providing protection against electric shock shall have adequate mechanical strength. They shall be securely fixed in such a way that they will not work loose in normal use. It shall not be possible to remove these parts or dismantle the accessory without the aid of a tool.

TEST. Compliance shall be checked by inspection and by the mechanical strength tests given in clause 19 as applicable.

14.5 Cable sheaths. The construction of cable outlets and cable sockets shall be such that a cable sheath can be properly secured to the accessory and the insulation integrity ensured by means of a heat-shrink sleeve.

TEST. Compliance shall be checked by inspection.

14.6 Shrouds. The pin assembly of a power outlet and a cable outlet shall be completely protected by the surrounding shroud. The tube of a cable socket or an appliance socket shall be protected by a surrounding shroud.

TEST. Compliance shall be checked by inspection.

14.7 Moisture penetration. The accessories shall be so designed that they provide an adequate degree of protection against moisture penetration when in complete engagement with their complementary accessory.

TEST. Compliance shall be checked by inspection and by the tests given in clause 15.

15 Moisture resistance

15.1 The enclosures of the accessories and cable terminations shall provide an adequate degree of protection against moisture.

TEST. Compliance shall be checked by the appropriate treatment specified below, which is made on accessories fitted with the cables for which they are designed and heat-shrink tubing as specified in clause 11. Power outlets are mounted with the axis of the connector horizontal and with the drain hole, if any, in the lowest position. Cable outlets are placed in the most unfavourable position.

Power outlets and cable outlets are tested with, and also without, the complementary accessory in engagement, the means for ensuring the required degree of protection against moisture being positioned as in normal use. Cable sockets and appliance sockets are only tested when in engagement with the complementary accessory. The accessories are sprayed with water for 10 min by means of the spray apparatus shown in Figure 14, which comprises a tube formed into a semicircle. The radius of the circle is 200 mm or a multiple of 200 mm and is as small as is compatible with the size and position of the sample. The tube is perforated so that jets of water are directed towards the centre of the circle, and the water pressure at the inlet to the apparatus is equivalent to a head of about 10 m. The tube is caused to oscillate through an angle of 120°, 60° on either side of the vertical. The time for once complete oscillation ($2 \times 120^\circ$) is about 4 s.

The sample is mounted at the centre of the semicircle formed by the tube, so that its lowest part is level with the axis of oscillation. The sample is turned about its vertical axis during the test.

Immediately after the spray test, the sample is subjected for 5 min to splashing in all directions by means of the splash apparatus shown in Figure 15.

During this test, the water pressure is so regulated that the water splashes up to 150 mm above the bottom of the bowl. The apparatus is placed on a horizontal support 50 mm to 100 mm below the lowest edge of the sample; the apparatus is moved around so as to splash the sample from all directions. Care is taken that the sample is not hit by the direct jet.

Immediately after this treatment, the samples shall withstand an electric strength test as specified in 16.2.

15.2 Accessories shall be proof against humid conditions which may occur in normal use.

TEST. Compliance shall be checked by the humidity treatment given below followed immediately by measurement of the insulation resistance and by the electric strength test given in 16.

Cable entries, if any, are left open. The humidity treatment is carried out in a humidity cabinet containing air with a relative humidity maintained between 91 % and 95 %. The temperature of the air, at all places where samples can be located, is maintained within 1 °C of any convenient value T between 20 °C and 30 °C. The samples are kept in the cabinet for 7 days (168 h). Before being placed in the humidity cabinet, the samples are brought up to a temperature differing from T by not more than 2 °C.

NOTE In most cases, the samples may be brought to the specified temperature of $T \pm 2^{\circ}\text{C}$ by keeping them at this temperature for at least 4 h before the humidity treatment. A relative humidity between 91 % and 95 % can be obtained by placing in the humidity cabinet a saturated aqueous solution of sodium sulphate (Na_2SO_4) or potassium nitrate (KNO_3) having a sufficiently large contact surface with the air. In order to achieve the specified conditions within the cabinet, it is necessary to ensure constant circulation of the air within and, in general, to use a cabinet which is thermally insulated.

The samples shall show no damage resulting from this treatment.

16 Insulation resistance and electric strength

16.1 Insulation resistance. The insulation resistance of accessories shall be adequate.

TEST. The insulation resistance is measured by applying a d.c. voltage of approximately 500 V, the measurement being made 1 min after application of the voltage.

For all accessories, the insulation resistance is measured between the pin or the tube and metal foil wrapped round the body of the accessory and so fixed or attached as to be in intimate contact with the exposed external body area of the accessory.

The insulation resistance shall be not less than 5 M Ω .

16.2 Electric strength. The electric strength of accessories shall be adequate.

TEST. A voltage of substantially sine-wave form, having a frequency of 50 Hz and a value of 2 000 V, is applied for 1 min between the parts indicated in 16.1. Initially, not more than half the prescribed voltage is applied; it is then raised rapidly to the full value.

No flashover or breakdown, other than glow discharges without drop in voltage, shall occur during the test.

NOTE to 16.1 and 16.2 The tests given in 16.1 and 16.2 are to be carried out immediately after the test given in clause 15, in the humidity cabinet or in the room in which the samples were brought to the prescribed temperature.

17 Normal wear and tear

Accessories shall withstand, without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses occurring in normal use.

TEST. Compliance shall be checked for all power outlets and cable outlets as follows.

A cable socket is inserted into and withdrawn from the power outlet or cable outlet at a rate of 7.5 strokes, by means of the apparatus illustrated in Figure 16. The socket is inserted and withdrawn 500 times without current flowing. After the test, the sample shall show

- no wear impairing the further use of the accessory;
- no deterioration of enclosures or barriers;
- no damage to the entry holes for the contacts that might impair proper working; and
- no loosening of electrical or mechanical connections.

The sample shall then withstand an electric strength test made in accordance with 16.2 but with a test voltage of 1 500 V. After this test the sample shall not exhibit a voltage drop greater than 15 mV with rated current flowing.

NOTE For the purposes of this clause the humidity treatment is not repeated before the electric strength test.

18 Temperature rise

Accessories shall be so constructed that the temperature rise in normal use is not excessive.

TEST. Compliance shall be checked by the following test, which is made on power outlets and cable outlets.

Accessories are fitted with conductors of the following cross-sectional areas:

<i>Accessory rating</i>	<i>Nominal cross-sectional area of conductor</i>
150 A	50 mm ²
400 A	240 mm ²

A cable socket is inserted into the power outlet or cable outlet and an alternating current of the value shown below is passed through the accessories.

<i>Rated current of the accessory</i>	<i>Test current</i>
150 A	188 A
400 A	500 A

The duration of the test is 2 h.

The temperature is determined by means of particles of known melting point, colour changing indicators or thermocouples, which are so chosen and positioned that they have negligible effect on the temperature being determined.

The temperature rise of terminals and contacts shall not exceed 45 K. The voltage drop across the assembly shall not exceed 15 mV.