BS 4737-3.30:2015

BSI Standards Publication

Intruder alarm systems in buildings

Part 3: Specifications for components

Section 3.30: Specification for insulated and sheathed cables for interconnecting wiring

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Contents

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

Foreword

Publishing information

This part of BS 4737 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 28 February 2015. It was prepared by Subcommittee GW/1/1, *Alarm components*, under the authority of Technical Committee GW/1, *Electronic security systems*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 4737 supersedes BS 4737-3.30:1986, which is withdrawn.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- The scope has been expanded to include alarm systems (not just intruder alarms) and is no longer specific to PVC cable.
- It provides for three classifications of cable construction.
- It provides a more robust schedule of tests.
- It provides guidance on the application of cables.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *Rules for the structure and drafting of UK standards*, subclause **J.1.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

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

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

1 Scope

This specification gives requirements for the construction and performance of insulated and sheathed cables for interconnecting wiring used in alarm systems.

This British standard is applicable to cables intended for use with voltages up to 50 V a.c. or d.c.

This standard excludes cables for fire alarm systems.

2 Normative references

BS 4808-1, *Specification for L.F. cables and wires with PVC insulation and PVC sheath for telecommunication – Part 1: General requirements and tests*

BS 7655-3.2, *Specification for insulating and sheathing materials for cables – Part 3.2: PVC insulating compounds – Hard grade types*

BS 7655-4.2, *Specification for insulating and sheathing materials for cables – Part 4.2: PVC insulating compounds – General application*

BS 7655-6.1, *Specification for insulating and sheathing materials for cables – Thermoplastic sheathing compounds having low emission of corrosive gases, and suitable for use in cables having low emission of smoke when affected by fire – Part 6.1: General application thermoplastic types*

BS EN 50363-8, *Insulating, sheathing and covering materials for low voltage energy cables – Part 8: Halogen-free, thermoplastic sheathing compounds*

BS EN 50363-3, *Insulating, sheathing and covering materials for low voltage energy cables – Part 3: PVC insulating compounds*

BS EN 50363-4-1, *Insulating, sheathing and covering materials for low voltage energy cables – Part 4-1: PVC sheathing compounds*

BS EN 50363-7, *Insulating, sheathing and covering materials for low voltage energy cables – Part 7: Halogen-free, thermoplastic insulating compounds*

BS EN 50395, *Electrical test methods for low voltage energy cables*

BS EN 50396:2005+A1:2011, *Non electrical test methods for low voltage energy cables*

BS EN 60228:2005, *Conductors of insulated cables*

BS EN 60332-1-2:2004: *Tests on electric and optical fibre cables under fire conditions – Part 1: Test for vertical flame propagation for a single insulated wire or cable – Section 2: Procedure for 1 kW pre-mixed flame*

BS EN 61034-1, *Measurements of smoke density of cables burning under defined conditions – Part 1: Test apparatus*

BS EN 61034-2, *Measurements of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

BS EN 62230, *Electric cables – Spark-test method*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this part of BS 4737, the following terms and definitions apply.

3.1.1 alarm system

applications intended for the protection of life, property or the environment

NOTE Intruder and hold-up alarm systems, social alarm systems, access control systems, CCTV systems, etc.

3.1.2 interconnecting wiring
wired interconnection conveying information between components of an alarm system

3.1.3 values

3.1.3.1 approximate value
value which is only indicative

NOTE Values described as "approximate" do not constitute requirements to be checked by measurement.

3.1.3.2 nominal value
value by which a quantity is designated

NOTE Nominal values usually give rise to values to be checked by measurements taking into account specified tolerances.

3.1.4 cable
one or more cores enclosed in a common sheathing

3.1.5 conductor
part of a cable which has the specific function of carrying current and/or signals.

3.1.6 core
single conductor with its own insulation

3.1.7 filled sheathing
sheathing which also fills the interstices between the contours of the core(s)

3.1.8 insulation
layer of material applied to the conductor with the specific function of resisting current flow between the conductor and any adjacent conductive material

3.1.9 drain wire
uninsulated wire laid in contact with a screen but not including any sheathing

3.1.10 drum
cylinder with flanges on to which a cable is wound during manufacturing for storage and transportation.

3.1.11 plain conductor
conductor which is not coated with an additional metal

3.1.12 screen
metallic layer which serves to confine the electrical field within the cable and/or to protect the cable from external electrical influences

3.1.13 sheath
uniform and continuous covering of non-metallic material, giving mechanical protection and/or additional insulation to a core or cores in a cable

NOTE The sheath is generally extruded.

3.1.14 solid conductor
conductor consisting of a single wire

3.1.15 spark test
dielectric test in which a cable is subjected to a proof voltage applied by means of a surrounding electrode and through which the cable is passed

3.1.16 stranded conductor
conductor consisting of a number of parallel strands assembled, without intermediate insulation by twisting the strands together in a helical formation or by laying them straight

3.1.17 tinned conductor
metal-coated conductor in which the metal coating is of tin

3.1.18 tubed sheathing
sheathing which does not follow closely the contours of the core(s)

3.2 Abbreviations

LSHF	Low smoke halogen free
PVC	Polyvinyl chloride

4 Cable construction types

NOTE The ability of a given cable to conform to the requirements for a particular category in this standard refers only to the test condition stated, and the level of performance achieved in a particular installation can be influenced by the actual installation conditions.

Cables shall be designated by type in accordance with Table 1, using the following classification:

- Type 1: Normal electrical resistance and having insulation and sheathing with low emission of smoke and corrosive gases when affected by fire.
- Type 2: Normal electrical resistance with PVC insulation and sheathing.
- Type 3: Higher electrical resistance with PVC insulation and sheathing.

Table 1 **Cable construction types**

Cable type	Insulations/sheath	Conductor resistance Ω/km	Insulation material	Sheath material
1	LSHF	100 max.	TI 7 in accordance with BS EN 50363-7, or LTS 3 in accordance with BS 7655-6.1	TM7 in accordance with BS EN 50363-8 or LTS 3 in accordance with BS 7655-6.1
2	PVC	100 max.	TI 1 in accordance with BS EN 50363-3 or Type 2 BS 7655-3.2	TM1 in accordance with BS EN 50363-4-1 or Type 6 BS 7655-4.2
3 [A)]	PVC	155 max.	TI 1 in accordance with BS EN 50363-3 or Type 2 BS 7655-3.2	TM1 in accordance with BS EN 50363-4-1or Type 6 BS 7655-4.2

[A)] Lower grade of conductor material expectation, e.g. alloy conductor

5 Conductors

Conductors shall be plain or tinned annealed copper, plain aluminium, or composite construction using suitable metals constructed in accordance with Table 1.

Conductors shall consist of a single solid wire or multiple strands of wire of the same material. The conductor construction shall be the same for all conductors in any single cable.

Conductors shall be tested in accordance with Table 3.

NOTE Strands may either be parallel or twisted.

6 Materials of core, insulation and sheathing

6.1 Identification of cores

6.1.1 General

The cores shall be distinguishable, for example by colour or striping.

Conformity shall be checked by visual examination.

6.1.2 Clarity and durability

The identification of the cores shall be clear and durable such that it cannot be removed, when tested in accordance with BS EN 50396:2005+A1:2011, **5.1**.

6.1.3 Laying up

The cores of cables shall be laid up. Conformity shall be checked by visual examination.

Any uninsulated drain wire incorporated in the cable shall conform to **8.3.2**.

6.1.4 Screen

In cables where a screen is used, a metallic or laminated metallic tape(s) or braid shall be applied, either longitudinally or helically, or a combination of both.

If a tape is applied longitudinally or helically it shall have an overlap of not less than 10%.

6.2 Insulation

6.2.1 Type of insulation

The insulation shall be extruded in accordance with Table 1.

6.2.2 Application of insulation

The insulation shall be applied by an extrusion process and shall form a single, compact and homogeneous layer. It shall be possible to remove the insulation easily without damage to the insulation its self or to the conductor or tin coating (if any).

6.2.3 Thickness of insulation

The minimum value of the radial thickness of the insulation, when measured in accordance with BS EN 50396:2005+A1:2011, **4.1**, shall be not less than 0.15 mm.

6.2.4 Spark testing of insulation

When tested in accordance with the a.c. or d.c. test methods at the test voltages specified in BS EN 62230, there shall be no breakdown of the insulation.

6.3 Sheath

6.3.1 Type of sheath

The sheath shall be an extruded layer in accordance with the requirements given in Table 1.

6.3.2 Application of sheath

Sheathing shall be continuous, tubed or filled, and shall fit closely over the core(s) without adhesion.

NOTE A polymeric rip cord may be included alongside the laid up cores.

When the sheath is removed, there shall be no damage to the core insulation when visually checked.

A rip cord with a breaking strength of not less than 40 N shall be provided under sheathing to facilitate its removal.

6.3.3 Thickness of sheath

When measured in accordance with BS EN 50396:2005+A1:2011, **4.2**, the smallest value of the radial thickness of sheath shall fall not below 0.4 mm.

6.3.4 Spark testing of sheath

When tested in accordance with the a.c. or d.c. test methods and the test voltages specified in BS EN 62230, there shall be no breakdown of the sheath.

7 Marking/labelling and packaging

A cable claimed to comply with the requirements of this standard shall be supplied coiled on a drum or coiled in a box, and identified with the following information:

a) the name or identification mark of the manufacturer;

b) the number and date of this standard, i.e. BS 4737-3.30:2015;

c) the cable type – 1, 2 or 3 (in accordance with Table 1);

d) the length of cable on the drum, stated in metres;

e) the number of cores in the cable;

f) the conductor construction of either solid or stranded, if stranded the number of strands;

g) the resistance value of each core detailed as maximum ohms per km;

h) the date of manufacture and batch number.

Where the cores in the cable are not all of the same resistance, the information of the resistance and number of cores of each resistance type shall be detailed.

This information shall be legible, durable and unambiguous, to enable the cable type to be identified. Permissible methods are:

1) visible labelling affixed to the outside of drum or box;

2) a colour rip cord (see Table 2 for colour scheme); or

3) details printed on the cable (see note).

NOTE Printed identification may be by means of an abbreviated manufacturers' mark and cable type number, a unique manufacturers' code (to allow a cross-reference to the documentation supplied with the cable or confirmation of cable type by the manufacturer), or the manufacturer's website.

Table 2 **Rip cord colour scheme**

Type	Materials/Resistance	Rip Cord colour [A)]
Type 1	LSHF 100 Ω max.	Green
Type 2	PVC 100 Ω max.	Red
Type 3	PVC 155 Ω max.	Yellow

[A)] The accompanying label shall contain additional information to enable the user to confirm the type of cable by referring to the colour of the rip cord.

8 Tests

8.1 Schedule of routine and sample tests

Cables shall be tested in accordance with Table 3.

NOTE Table 3, refers to the relevant clauses of the standard specifying the requirements and test methods as well as the category of each test which applies, i.e. S or R (as defined in Table 3).

Table 3 **Schedule for routine and sample tests**

Test	Clause	Test method		Test category
		Standard / Section	Clause	
Conductor construction	**5**	BS EN 60228		S
Insulation application	**6.2.2**	Visual examination		S
Insulation thickness	**6.2.3**	BS EN 50396:2005+A1:2011	**4.1**	S
Spark test of insulation	**6.2.4**	BS EN 62230		R
Core identification	**6.1.1**	Visual examination		S
Core clarity and durability	**6.1.2**	BS EN 50396:2005+A1:2011	**5.1**	S
Direction and sequence of lay	**6.1.3**	Visual examination		S
Screen application	**6.1.4**	Visual examination and measurement		S
Sheathing application	**6.3.2**	Visual examination		S
Sheathing thickness	**6.3.3**	BS EN 50396:2005+A1:2011	**4.2**	S
Spark test of sheathing	**6.3.4**	BS EN 62230		R
Conductor resistance	**8.3.2**	BS EN 60228:2005	Annex A	R
Continuity of drain wire	**8.3.2**	BS EN 60228:2005	Annex A	R
Stretch test on cores	**8.4.2**	Annex B		S

8.2 Temperature

Tests shall be performed at a temperature of (20 ±15) °C unless otherwise specified in the details for the particular test.

8.3 Routine tests

*COMMENTARY ON Clause **8.3***

In some tests, the preparation and presentation of the test sample can have a critical effect on the result of the tests, so test samples should always be prepared carefully.

8.3.1 General

Routine tests shall be performed in accordance with Table 3 as indicated by the symbol R in Column 5.

*NOTE The requirements for routine testing which are not fully covered by earlier clauses are detailed in **8.3.2** and **8.3.3**.*

8.3.2 Conductor and drain wire resistance

The d.c. resistance of each conductor shall conform to Clause **5** when measured in accordance with BS EN 60228 and corrected to 20 °C. The measurement of the resistance shall be made on a complete drum length or on a 1 m sample taken from the drum.

Conductor resistance shall be tested in accordance with Annex B.

The continuity of each drain wire shall conform to Clause **5** when measured in accordance with BS EN 60228 and corrected to 20 °C. The measurement shall be made on a complete drum length or on a 1 m sample taken from the drum.

8.3.3 Voltage test on completed cable

The completed cables shall be tested in accordance with BS EN 50395:2005+A1:2011,**10.3**. The test shall be carried out at a voltage of 500 V a.c. RMS, or with direct current of 500 V, between each insulated conductor, for 1 min. The other insulated conductors shall be bound together. There shall be no breakdown of the insulation.

8.4 Sample tests

*COMMENTARY ON Clause **8.4***

In some tests, the preparation and presentation of the test sample can have a critical effect on the result of the tests, so test samples should always be prepared carefully.

8.4.1 General

Sample tests shall be performed in accordance with Table 3, as indicated by the symbol S in Column 5.

NOTE The requirements for sample testing which are not fully covered by earlier clauses are detailed in 8.4.2.

8.4.2 Stretching test on cores

When a suitable length of core taken from the complete cable is loaded with a force of 20 N for 24 h, the d.c. resistance of the conductor shall not exceed the requirement in Table 3 by more than 1%.

A minimum of four cores from each cable shall be tested.

8.5 Type tests

*COMMENTARY ON Clause **8.5***

In some tests, the preparation and presentation of the test sample can have a critical effect on the result of the tests, so test samples should always be prepared carefully.

8.5.1 General

Type tests shall be carried out using the methods as described in the standards listed for the insulation and sheathing materials as mentioned in Table 1. It shall also include the Routine and Sample tests in Table 3.

8.5.2 Smoke emission

NOTE Only applicable to Type 1 cable.

When tested in accordance with BS EN 61034-2, using the apparatus specified in BS EN 61034-1, the smoke generated shall result in transmittance values of not less than 60%.

8.5.3 Flame propagation on single cable

NOTE Only applicable to Type 1 cable.

When tested in accordance with BS EN 60332-1-2, the sample of completed cable shall conform to BS EN 60332-1-2:2004, Annex A.

8.5.4 Shrinkage of insulation

When a 200 mm sample of core is tested at (150 ±2) °C for at least 15 min in accordance with BS 4808-1, the shrinkage of the insulation shall not exceed 3%.

Every core in a cable shall be tested.

Annex A (informative) Guide to use

NOTE The details given in this Annex are intended only as general technical guidance and not as interpretation of any UK statutory regulations.

A.1 General

The aim of this Annex is to inform users of good practice in alarm system design and the installation of electrical cables as specified in this Standard.

It is assumed that the design of installations and the specification, purchase and installation of cables specified in this Standard are entrusted to suitably skilled and competent people.

In cases of doubt as to the suitability of cables for a particular use, further specific information should be obtained from the manufacturer.

Cables should be installed and used in association with other equipment in accordance with BS 7671 as appropriate.

NOTE Attention is also drawn to any nationally applicable regulations, which in the UK are those referenced in BS 7671 and/or the Electricity Safety, Quality and Continuity Regulations [1], as appropriate.

A.2 Cable selection and system design

A.2.1 Cables supplied in accordance with this standard are intended for use in fixed wired installations in intruder and hold-up alarm systems, however, they may be used in other applications, for example access control, social care, and CCTV systems.

A.2.2 Cables supplied in accordance with this standard should be used for the supply of electrical energy up to the rated voltage specified by the manufacturer. The maximum supplied voltage in this standard is 50 volts.

A.2.3 For current ratings of cables installed in and around buildings, reference should be made to BS 7671.

A.2.4 In addition to the current ratings, to the following should be noted:

a) the operating characteristics of the connected equipment, such as detection, control and warning devices;

b) that the voltage delivered to any system component is not less than the minimum specified operating voltage, when measured in the maximum current condition, with the minimum power supply voltage;

c) any limitations and/or recommendations made by the cable manufacturer.

WARNING. Cables can be damaged when being pulled in large runs and/or the use of excessive force when pulling through walls, floors and other restricted access points. Particular care may be required with Type 3 cables.

A.3 Environment

A.3.1 Reasonable protection against mechanical damage, appropriate to the choice of cable and the installation conditions, should be provided.

CAUTION. Cables could be harmed by exposure to corrosive products or solvent substances, especially petroleum-based chemicals or their vapours.

NOTE Special precautions might be required when cables are installed in areas classified as hazardous, e.g. potentially explosive gas atmospheres.

A.3.2 If cables in accordance with this Standard are exposed to localized heat, solar radiation or high temperature ambient conditions, the current carrying capacity is reduced.

A.3.3 Electrical interference can cause unwanted alarms. This can be overcome by filtering the mains input to the I&HAS, separating cables from higher rated voltage and by screening of the cable.

A.3.4 Installation

A.3.4.1 None of the cables specified in this standard should be bent during installation to a radius smaller than 6 times the diameter of the cable.

Wherever possible, larger installation radii should be used.

A.3.4.2 Precautions should be taken to avoid mechanical damage to the cables before and during installation.

A.3.4.3 Cables should be run inside the supervised premises. When it is impractical for cables to be routed inside the supervised area they should be provided with suitable mechanical protection, e.g. enclosed in conduit.

A.3.4.4 All cables should be adequately supported and its installation should be in accordance with established good working practices. Care should be taken when affixing clips and staples, which could result in possible damage to the cable or its insulation.

A.3.4.5 Cables should be run in positions where there is the least risk of physical damage. If risk of physical damage exists the cable should be mechanically protected, e.g. by ducting, trunking or conduit. When these are made of conductive material they should be earthed and grounded correctly.

NOTE Physical damage might include damage caused by other persons or vermin.

A.3.4.6 Cables should be run so as not to be in the same conduit or trunking as cables carrying higher voltage, e.g. mains supplies, or cables carrying high frequency signals unless they are physically separated and/or suitably screened so as to prevent cross interference.

A.3.4.7 Any cable containment should be sufficient in size e.g. conduit, trunking etc. Guidance on containment selection should be taken from BS 7671.

A.3.4.8 All cable wiring joints should be mechanically and electrically secure.

Annex B (normative) Test method for stretching of cores

B.1 Principle

This test is to establish the maximum resistance of the unsheathed insulated conductor under both normal and stretch test conditions to ensure that it meets the requirements of the cable type.

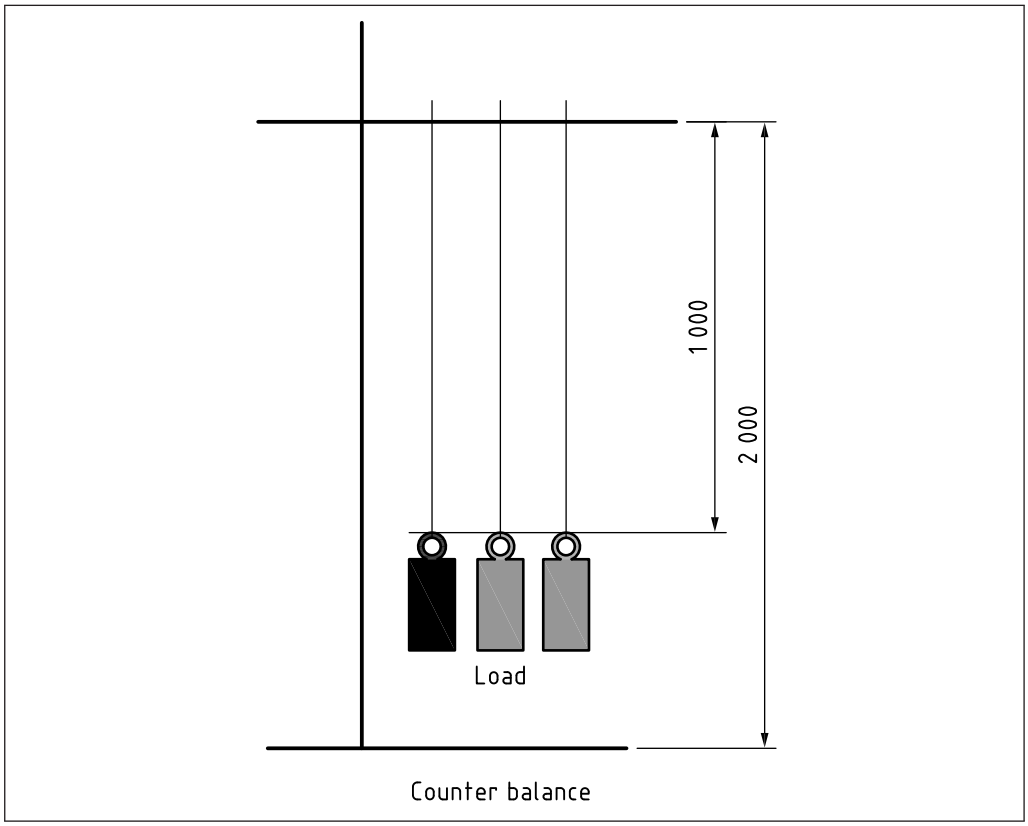
B.2 Materials

B.2.1 *cores*

B.3 Apparatus

Test apparatus (for example, see Figure B.1).

Figure B.1 **Example of suitable test apparatus**



B.4 Preparation and preservation

Take two 1600 mm samples from the same continuous length of core, remove sufficient insulation from the ends to enable a resistance reading of the conductor to be taken.

Take a resistance reading of the first sample of each conductor core in accordance with BS EN 60228:2005, Annex A and record the reading in ohms/km.

B.5 Procedure

Securely attach the load to one end of the insulated core of the second sample and attach the other end insulated core to the apparatus, ensuring that there is one metre between the load and the apparatus. Gradually apply the load to the core sample, allowing it to hang freely.

Leave the sample for 24 h, after 24 h remove the sample from the test apparatus.

Take a resistance reading of the first sample of each conductor core in accordance with BS EN 60228:2005, Annex A and record the reading in ohms/km.

B.6 Expression of results

a) The maximum allowable difference between the resistance readings for the first (un-stretched) and second (stretched) samples shall be no more than 1%.

b) The resistance shall meet the requirements for the designated cable type, as referenced in Table 1.

B.7 Test report

Measure the resistance in accordance with BS EN 60228:2005, Annex A and record the reading in ohms/km.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7671, *Requirements for electrical installations. IET Wiring Regulations.*

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