PAS 5308-2:2009

PUBLICLY AVAILABLE SPECIFICATION

Control and instrumentation cables

Part 2: Specification for PVC insulated cables

BCA British Cables Association

ECA

BSI

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Foreword

Publishing information

This Publicly Available Specification (PAS) was sponsored by the British Cables Association (BCA) with the support of the Electrical Contractors' Association (ECA). It was developed by BSI and came into effect on 31 July 2009.

Acknowledgement is given to the following organizations that were involved in the development of this specification as members of the Steering Group.

- British Cables Association
- British Approvals Service for Cables
- Electrical Contractors' Association
- ERA Technology Limited
- Ministry of Defence UK Defence Standardization

Acknowledgement is also given to the members of a wider Review Panel who were consulted in the development of this specification.

This PAS is not to be regarded as a British Standard.

The PAS process enables a specification to be rapidly developed in order to fulfil an immediate need in industry.

Relationship with other publications

This PAS is issued in two parts:

- *Part 1: Specification for polyethylene insulated cables*
- *Part 2: Specification for PVC insulated cables*

This part is based on BS 5308-2:1986, which was superseded by BS EN 50288-7:2005.

It takes into account the following recently published harmonized European standards which supersede key British Standards:

- BS EN 60228:2005, a specification for conductors of insulated cables, which superseded BS 6360:1991; and
- BS EN 62230:2007, a spark–test method, which exists alongside BS 5099:2004.

WARNING. This PAS calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

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. The word "should" is used to express recommendations, the word "may" is used to express permissibility and the word "can" is used to express possibility, e.g. a consequence of an action or an event.

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 PAS cannot confer immunity from legal obligations.

Introduction

This part of PAS 5308 has been developed to incorporate additional aspects not covered in the European standard for control and instrumentation cables, BS EN 50288-7. In particular this part of PAS 5308:

a) covers circumstances where higher voltages are encountered and as such specifies cables that are suitable for more demanding applications, for example, in petrochemical plants; and

b) gives detailed constructional tables, showing actual dimensions for the full range of cable types as previously specified in BS 5308-2:1986 and as such maintains the availability of such data, which is required by stakeholders as a tool for design, manufacture, testing and selection.

The contribution of the cables to fire hazard can pose a significant risk. The fire performance of cables is not covered. However, attention is drawn to the fact that safety systems or national and local regulations might specify requirements for either resistance to fire performance (e.g. circuit integrity under fire) and/or reaction to fire performance (e.g. low emission of smoke and corrosive and acidic gases and propagation of fire).

1 Scope

This part of PAS 5308 specifies requirements for and dimensions of PVC insulated control and instrumentation cables in multicore and multipair construction, with or without screens, and optionally incorporating single wire armour.

It categorizes cables into:

a) type 1: PVC insulated and PVC sheathed; and

NOTE These cables are not recommended for underground burial.

b) type 2: PVC insulated, PVC bedded, single wire armoured and PVC oversheathed.

The cables are suitable for operation at voltages up to and including 300 V r.m.s. core to earth and 500 V r.m.s. core to core (i.e. 300/500 V). These cables are not primarily intended for direct connection to a low impedance source, such as the public electricity supply.

NOTE 1 Guidance on the safe handling, especially at low temperatures, for PVC sheathed cables is given in Annex A.

NOTE 2 Guidance on use is given in Annex B. It includes guidance on installation.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 5099*, Electric cables – Voltage levels for spark testing*

BS 5467:1997*, Electric cables – Thermosetting insulated, armoured cables for voltages of 600/1 000 V and 1 900/3 300 V*

BS EN 10257-1, *Zinc or zinc alloy coated non-alloy steel wire for armouring either power cables or telecommunication cables – Part 1: Land cables*

BS EN 50290-2-21:2002, *Communication cables – Part 2-21: Common design rules and construction – PVC insulating compounds*

BS EN 50290-2-22:2002, *Communication cables – Part 2-22: Common design rules and construction – PVC sheathing compounds*

BS EN 50290-2-24:2002, *Communication cables – Part 2-24: Common design rules and construction – PE sheathing*

BS EN 50334, *Marking by inscription for the identification of cores of electric cables*

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

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

PD 2379, *Register of colours of manufacturers' identification threads for electric cables and cords*

IEC 60050-461, *International Electrotechnical Vocabulary – Part 461: Electric cables*

3 Terms and definitions

For the purposes of this PAS the definitions given in IEC 60050-461 apply.

4 Conductor

A conductor shall conform to Table 1.

Table 1 **Details of conductors and insulation thickness**

Conductor				**Insulation thickness**		**Maximum core diameter**
Nominal cross-sectional area	**BS EN 60228:2005 conductor class**	**Maximum resistance at 20 °C**		**Nominal**	**Minimum**	
		Multicore	**Multipair** [A)]			
mm^2		Ω/km	Ω/km	mm	mm	mm
0.50	5	39.0	39.7	0.60	0.50	2.35
0.75	5	26.0	26.5	0.60	0.50	2.55
1.50	2	12.1	12.3	0.60	0.50	3.00
2.50	2	7.4	7.6	0.60	0.50	3.25

[A)] These resistance values are 2% higher than the values in BS EN 60228:2005 to allow for cables of multipair construction.

5 Insulation

Insulation shall be of a PVC insulation compound conforming to BS EN 50290-2-21:2002, grade TI51.

The thickness of the insulation shall conform to Table 1.

6 Laying up

6.1 Pairs

Two insulated conductors shall be twisted together to form a pair. The lengths of lay used shall be such that the two cores forming each pair are not dissociated by normal handling.

The length of lay of any pair shall not exceed 100 mm.

6.2 Two-pair cables without individual pair screens (quads)

Two-pair cables without individual pair screens (quads) shall have four cores laid in quad formation round a central dummy.

6.3 Core and pair identification

6.3.1 Multicore cables

Cores in muticore cables shall be identified in accordance with **C.1**.

6.3.2 Multipair cables without individual pair screens

Unscreened pairs in multipair cables shall be identified either:

a) by means of coloured insulation in the sequence specified in **C.2**, starting at the centre; or

b) by each pair in the cable having one black and one blue core. Each core shall also be identified through marking by inscription of a number on the core's insulation in accordance with BS EN 50334. Both cores in a pair shall be marked with the same number.

6.3.3 Multipair cables with individual pair screens

Screened pairs in multipair cables shall be identified either:

a) by means of coloured insulation in the sequence specified in **C.2**, starting at the centre; or

b) by each pair in the cable having one black and one blue core. Each pair shall be covered in a numbered polyester film. The numbering shall be such that each pair is distinguishable from any other pairs in the cable. The distance between each number shall not be greater than 50 mm.

NOTE The numbered polyester film may also serve as part of the pair screen.

6.4 Pair screens

When individual pair screens are used, each pair shall have a laminated screening tape applied a minimum overlap 25% with the metallic side down in electrical contact with a drain wire.

The laminated screening tape shall comprise aluminium bonded to polyester with a minimum thickness of aluminium of 0.008 mm and a minimum thickness of polyester of 0.010 mm.

The drain wire shall comprise one or more tinned annealed copper wires with a total cross-section of not less than 0.5 mm^2.

Over the screening tape, either two polyester tapes shall be applied with a minimum overlap of 25%, or one polyester tape shall be applied with a minimum overlap of 50%.

6.5 Cabling of pairs

The required number of pairs shall be assembled together using the reverse layer or reciprocating lay technique. The cable shall be so constructed that the pairs are in concentric layers.

NOTE 1 Non-hygroscopic fillers may be used to maintain a circular formation.

NOTE 2 The number of pairs should preferably be 1, 2, 5, 10, 15, 20, 30 or 50.

6.6 Binder tape

6.6.1 Cables without a collective screen

Cables without a collective screen shall be bound with a non-hygroscopic binder tape of minimum thickness 0.023 mm with a minimum overlap of 25%.

NOTE Open spiral interlayer tape may also be applied.

6.6.2 Cables with a collective screen

6.6.2.1 Collectively screened cables other than one-pair cables

Collectively screened cables other than one-pair cables shall be bound with either:

a) a non-hygroscopic binder tape of minimum thickness 0.023 mm with an overlap of 50%; or

b) two non-hygroscopic binder tapes each of minimum thickness 0.023 mm each with a minimum overlap of 25%.

NOTE Open spiral interlayer tape may also be applied.

6.6.2.2 Collectively screened one-pair cables

Collectively screened one-pair cables shall either:

a) be bound in accordance with **6.6.2.1**; or

b) no binder tape shall be applied (see **6.7.4**).

6.7 Cables with a collective screen

6.7.1 General

Where specified in **6.7.2** and **6.7.3**:

a) laminated screening tape shall comprise aluminium bonded to polyester, with a minimum thickness of aluminium of 0.008 mm and a minimum thickness of polyester of 0.010 mm; and

b) a drain wire shall comprise one or more tinned annealed copper wires with a total cross-section not less than 0.5 mm^2.

6.7.2 Cables other than one-pair cables

Laminated screening tape shall be applied with a minimum overlap of 25% and with the metallic side down in electrical contact with a drain wire run longitudinally over the non-hygroscopic binder tape or tapes.

6.7.3 One-pair cables where binder tape has been applied

Laminated screening tape shall be applied in accordance with **6.7.2**.

6.7.4 One-pair cables where no binder tape has been applied

Laminated screening tape shall be applied with a minimum overlap of 25% and with the metallic side down in electrical contact with a drain wire laid in one interstice.

7 Outer protection

7.1 Type 1 cable

An extruded sheath of a PVC compound conforming to BS EN 50290-2-22:2002, grade TM51 shall be applied over the binder tape (see **6.6**) or the collective screen (see **6.7**) in accordance with the dimensions in Annex D.

NOTE The sheath should be black unless the purchaser specifies that another colour is required.

7.2 Type 2 cable

7.2.1 An extruded bedding of a PVC compound conforming to BS EN 50290-2-22:2002, grade TM51 shall be applied over the binder tape (see **6.6**) or collective screen (see **6.7**) in accordance with the dimensions in Annex D.

7.2.2 A single layer of galvanized steel wire armour conforming to BS EN 10257-1 shall be applied spirally over the PE bedding. The nominal wire diameter shall be in accordance with Annex D.

7.2.3 An extruded oversheath of a PVC compound conforming to BS EN 50290-2-22:2002, grade TM51 shall be applied over the galvanized steel wire armour in accordance with the dimensions in Annex D.

NOTE The sheath should be black unless the purchaser specifies that another colour is required.

8 Cable marking

8.1 General

8.1.1 All cables shall be marked with:

a) the PAS identifier, i.e. PAS 5308-2[1)] in accordance with **8.2**;

b) the voltage designation, i.e. 300/500 V in accordance with **8.2**;

c) the manufacturer's identification in accordance with **8.3**; and

d) the year of manufacture in accordance with **8.4**.

8.1.2 The letters and figures of embossing, indenting or printing shall consist of upright block characters with a minimum height of 3 mm.

8.2 PAS identifier and voltage designation

8.2.1 The PAS identifier and voltage designation shall be marked on the oversheath by embossing, indenting or printing.

8.2.2 The PAS identifier and voltage designation shall appear on one or more lines along the axis of the cables. If more than one line is used the marking shall be equally spaced around the circumference of the cable.

8.2.3 For both the PAS identifier and voltage designation, the distance between the end of one element of marking and the beginning of the next identical element of the marking shall be no greater than 550 mm.

8.3 Manufacturer's identification

8.3.1 The manufacturer's identification shall either be marked by:

a) the use of a printed tape immediately under the outer protection;

b) the use of a coloured thread in accordance with PD 2379 immediately under the outer protection; or

c) embossing, indenting or printing on the oversheath.

8.3.2 If the manufacturer's identification is to be embossed, indented or printed on the oversheath it shall appear on one or more lines. If more than one line is used the marking shall be equally spaced around the circumference of the cable.

8.3.3 The distance between the end of one element of the manufacturer's identification marking and the beginning of the next identical element of the marking shall be no greater than 1 100 mm.

8.4 Year of manufacture

8.4.1 The year of manufacture shall be marked by either:

a) the use of a printed tape immediately under the outer protection; or

b) by embossing, indenting or printing on the oversheath.

[1)] Marking PAS 5308-2 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the PAS. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

8.4.2 If the year of manufacture is to be embossed, indented or printed on the oversheath it shall appear on one or more lines. If more than one line is used the marking shall be equally spaced around the circumference of the cable.

8.4.3 The distance between the end of one element of the year of manufacture marking and the beginning of the next identical element of marking shall be no greater than 1 100 mm.

9 Electrical testing

9.1 Spark test

9.1.1 Cores

When tested in accordance with BS EN 62230, using a test voltage of 4 kV a.c. (r.m.s.) as a minimum, there shall be no breakdown of the insulation.

9.1.2 Sheath

When tested in accordance with BS EN 62230, the outer PVC sheath on cables with screen and/or armour shall withstand the voltages specified in BS 5099 without failure to maintain the voltage.

9.2 Voltage test

When tested in accordance with Annex E, there shall be no breakdown of the insulation.

9.3 Insulation resistance

9.3.1 Individual conductor

When a steady voltage of 500 V d.c. is applied for 1 min, the insulation resistance of each conductor measured against the remaining bunched conductors/screens and/or armour shall not be less than 5 GΩ for 1 km at 20 °C.

9.3.2 Individual screens

For cables with individual pair screens, when a steady voltage of 500 V d.c. is applied for 1 min, the insulation resistance measured between screens shall be not less than 1 MΩ for 1 km at 20 ± 5 °C.

9.4 Conductor resistance

The d.c. resistance of each conductor in the completed cable at 20 °C shall not exceed the values given in Table 1.

9.5 Capacitance

9.5.1 Mutual capacitance

The mutual capacitance of the pairs or adjacent cores shall not exceed a maximum of 250 pF/m at a frequency of 1 kHz.

9.5.2 Capacitance between any core and core screen

The capacitance between any core and all other cores connected to any other metallic elements present (e.g. screens and armour) and earth shall not exceed 450 pF/m at a frequency of 1 kHz.

9.6 Inductance (*L*) to resistance (*R*) ratio

The *L*/*R* ratio for adjacent cores shall not exceed the values in Table 2.

Table 2 **L/R ratios for adjacent cores**

Nominal cross-sectional area of conductor	**Maximum *L/R* ratio**
mm^2	$\mu H/\Omega$
0.50	25
0.75	25
1.50	40
2.50	60

9.7 End sealing

After completion of the electrical tests, the ends of the cable shall be sealed to prevent the ingress of moisture.

10 Finished cable testing

10.1 Thickness of bedding

The minimum thickness of extruded bedding measured in accordance with BS 5467:1997, Annex D shall not fall below the values in Table D.1 to Table D.12 by an amount more than (15% + 0.1 mm).

10.2 Thickness of sheath

10.2.1 Type 1 cable

The thickness of the PVC sheath, determined by taking the average of a number of measurements in accordance with BS 5467:1997, Annex D shall not fall below the nominal values in Table D.1 to Table D.12 by an amount more than (15%+ 0.1 mm).

10.2.2 Type 2 cable

The minimum thickness of the PVC oversheath, measured in accordance with BS 5467:1997, Annex D shall not fall below the nominal values in Table D.1 to Table D.12 by an amount more than (20% + 0.2 mm).

Annex A (informative) Handling and usage at various temperatures

Attention is drawn to the fact that as the temperature decreases PVC compounds become increasingly stiff and brittle, with the result that if the cable is bent too quickly to too small a radius or is struck sharply at temperatures in the region of 0 °C or lower, there is a risk of shattering the PVC components.

To avoid the risk of damage during handling, therefore, it is desirable that the cables specified in this PAS should be installed only when both the cable and the ambient temperatures are above 0 °C and have been so for the previous 24 h, or where special precautions have been taken to maintain the cable above this temperature. However, after installation, they will operate satisfactorily at temperatures between –15 °C and +65 °C providing that at temperatures below 0 °C they are not subject to movement and/or impact.

The manufacturer should be consulted for precise instructions if the cable is to be stored and/or used outside these temperature limits.

Annex B (informative) Guide to use

B.1 Aim

The aim of this annex is to inform users of characteristics and limitations of electric cables and thereby to minimize their misuse.

It is assumed that the design of installations and the specification, purchase and installation of cables specified in this PAS is 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.

B.2 Cable selection and design

B.2.1 General

Control and instrumentation cables are not primarily intended for direct connection to a low impedance source, such as the public electricity supply. Where this is unavoidable it is essential that the conductors and other constructional elements are adequately protected from overcurrent.

Due consideration should be given to the following, as appropriate:

a) the operating characteristics of the connected equipment;

b) the possibility of transient overvoltages as they may damage the cables;

c) the rated current of the cable conductors;

d) the need to protect the conductors, etc. from overcurrent;

e) local regulations regarding the minimum conductor size (usually 1.5 mm^2 for fixed wiring);

f) the voltage drop requirements; and/or

g) the earth loop impedance.

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

NOTE 1 Attention is drawn to The Electricity Safety, Quality and Continuity Regulations 2002 [1].

NOTE 2 Attention is drawn to the fact that in countries outside the UK, corresponding regulations might apply.

B.2.2 Minimum installation radius of bend

The cables specified in this PAS should not be bent during installation to a radius smaller than that given in Table B.1, where *D* is the overall diameter of the cable. However, wherever possible, larger installation radii should be used.

Table B.1 **Minimum installation radius of bend**

Cable type	Minimum internal radius of bend
Type 1	6*D*
Type 2	6*D*

B.2.3 Prevention of moisture ingress

Care should be exercised during installation to avoid any damage to cable coverings. This is important in wet or aggressive environments. The protective sealing should not be removed from the ends of the cable until immediately prior to termination or jointing. When the sealing has been removed the unprotected ends of the cable should not be exposed to moisture.

The possibility of damage to sealing during handling and installation or during storage of the cable should be borne in mind. Where such damage may have occurred, the seals should be inspected and remade if necessary.

B.2.4 Earthing of armour

Provision should be made for earthing the armour in type 2 cables to the main earth system at the supply end by means of a metallic bond of adequate conductance, the bonding connection being as short and straight as possible.

Special precautions may be taken to eliminate the risk of corrosion, especially the risk arising from the use of dissimilar metals.

B.2.5 Voltage test after installation

A voltage test after installation is not a requirement of this PAS, but if a test is conducted it should be performed with a d.c. test voltage conforming to Table B.2.

During the test, the voltage should be increased gradually to the full value and maintained continuously for 15 min with no failure to maintain the voltage. The test should be made between conductors and between each conductor and armour.

Sequence testing may be used to reduce overall time to prepare the cable for testing.

The test voltages given in Table B.2 are intended for cables immediately after installation and not for cables that have been in service. When testing is required after cables have been in service, regardless of service duration, the manufacturer should be consulted for the appropriate test conditions, which depend on the individual circumstances.

Table B.2 **Test voltages after installation**

Cable type	**d.c. test voltage**	
	Between conductors	**Between each conductor and armour**
	V	V
Type 1 and type 2	2 000	2 000

B.2.6 Voltage designation

All cables in this specification are designated and marked 300/500 V and are suitable for use at this voltage.

B.3 Environment and application

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

B.3.2 Type 2 can be used for the most onerous heavy duty applications particularly where mechanical damage, exposure to petrochemicals and explosive atmospheres are significant risks.

B.3.3 Special precautions for when cables are to be installed in areas classified as hazardous, e.g. explosive atmospheres, are specified in BS EN 60079-14.

B.3.4 Cables specified in this PAS are not specifically designed for use:

a) as self-supporting aerial cables;

b) as submarine cable or for laying in water-logged conditions;

c) where subsidence is likely, unless special precautions are taken to minimize damage;

d) where any exposure to excessive heat under normal operating conditions is involved; and/or

e) where the oversheath is subjected to a voltage test after installation.

B.3.5 If cables conforming to this PAS are exposed to localized heat, solar radiation or high temperature ambient conditions, the current carrying capacity will be reduced.

B.3.6 The sheathing compounds supplied on these cables do not provide protection against damage by pests, e.g. rodents and termites.

B.3.7 The contribution of the cables to fire hazard can pose a significant risk. Safety systems or national and local regulations might dictate either resistance to fire performance (e.g. circuit integrity under fire) and/or reaction to fire performance (e.g. low emission of smoke and corrosive and acidic gases and propagation of fire). Any such requirements should be identified between the manufacturer and the customer at the earliest possible stage of enquiry.

B.4 Installation

B.4.1 Precautions should be taken to avoid mechanical damage to the cables before and during installation.

B.4.2 Exceeding the manufacturer's recommended maximum pulling tensions can result in damage to the cable.

B.4.3 If cables are to be installed in ducts, the size of duct should be in accordance with the ERA Current Ratings Standard 69.30, Part V [2].

B.4.4 The type of jointing and filling compounds employed should be chemically compatible with the cable materials.

B.4.5 The cable support system (e.g. ladder racks, trays, cleats and brackets) should be designed to limit the possibility of damage or danger under normal or fault conditions, and should be made of a material that can also support the cable during a fire (e.g. steel).

B.4.6 Cables specified in this PAS are designed for fixed installations only; for example they are not for use as trailing or reeling cables.

B.4.7 Repeated overvoltage testing can lead to premature failure of the cable.

B.4.8 The selection of cable glands, accessories and any associated tools should take account of all aspects of intended use.

B.5 Storage and handling of drums

B.5.1 Cable drums should be regularly inspected during storage to assess their physical condition.

B.5.2 Battens, where applied, should not be removed from drums until the cable is about to be installed.

B.5.3 When handling drums, reasonable precautions should be taken to avoid injury. Due regard should be paid to the weight, method and direction of rolling, lifting, protruding nails and splinters.

B.5.4 Reference should be made to BS 8512 which gives recommendations on the storage, handling, installation and disposal of cables on wooden drums.

B.6 Incineration of scrap cable

Incineration of scrap cable should only be undertaken by a licensed contractor. The Environment Agency, the Northern Ireland Environment Agency (NIEA) or the Scottish Environment Protection Agency (SEPA) should be contacted for further information.

Annex C (normative) Core and pair identification

C.1 Core identification

C.1.1 Up to 40 cores

All cores shall be yellow and numbered 1 to 40 with both printed numbers and written word, in black, e.g. core 10 would be yellow and identified by number "10, TEN" in black.

C.1.2 41 to 80 cores

All cores shall be black and numbered 1 to 40 with both printed numbers and written word, in a contrasting colour, e.g. core 50 would be coloured black and identified by number "10, TEN" in yellow or white.

C.2 Pair identification

Two-pair cables without individual pair screens (quads) shall be colour coded in clockwise order of rotation: black, blue, green, brown. All other cables up to 50 pairs shall be colour coded in accordance with Table C.1.

Table C.1 **Identification of cable pairs other than two-pair cables without individual pair screens (quads)**

Pair no.	a-wire	b-wire	Pair no.	a-wire	b-wire
1	White	Blue	26	Red-Blue	Blue
2	White	Orange	27	Red-Blue	Orange
3	White	Green	28	Red-Blue	Green
4	White	Brown	29	Red-Blue	Brown
5	White	Grey	30	Red-Blue	Grey
6	Red	Blue	31	Blue-Black	Blue
7	Red	Orange	32	Blue-Black	Orange
8	Red	Green	33	Blue-Black	Green
9	Red	Brown	34	Blue-Black	Brown
10	Red	Grey	35	Blue-Black	Grey
11	Black	Blue	36	Yellow-Blue	Blue
12	Black	Orange	37	Yellow-Blue	Orange
13	Black	Green	38	Yellow-Blue	Green
14	Black	Brown	39	Yellow-Blue	Brown
15	Black	Grey	40	Yellow-Blue	Grey
16	Yellow	Blue	41	White-Orange	Blue
17	Yellow	Orange	42	White-Orange	Orange
18	Yellow	Green	43	White-Orange	Green
19	Yellow	Brown	44	White-Orange	Brown
20	Yellow	Grey	45	White-Orange	Grey
21	White-Blue	Blue	46	Orange-Red	Blue
22	White-Blue	Orange	47	Orange-Red	Orange
23	White-Blue	Green	48	Orange-Red	Green
24	White-Blue	Brown	49	Orange-Red	Brown
25	White-Blue	Grey	50	Orange-Red	Grey

NOTE Except in the case of bi-colour extrusion, the colour indicated first is known as the base colour, and is:

a) the extruded colour; and

b) the colour with the greater area of exposure on the finished wire.

Annex D (normative) Constructional dimensions

Table D.1 **Dimensions of 0.5 mm^2 class 5 conductor multicore PVC insulated cables**
Dimensions in mm

Dimension	No. of cores															
	2		3		4		6		10		20		40		80	
	Cable type															
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Thickness of sheath/bedding (nominal)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.2	1.2	1.4	1.4
Diameter over sheath/bedding	–	6.0	–	6.3	–	6.9	–	8.1	–	10.4	–	13.5	–	18.2	–	25.1
Diameter of armour wire	–	0.9	–	0.9	–	0.9	–	0.9	–	1.25	–	1.25	–	1.6	–	2.0
Diameter over armour	–	7.8	–	8.1	–	8.7	–	9.9	–	12.9	–	16.0	–	21.4	–	29.1
Thickness of oversheath (nominal)	–	1.3	–	1.3	–	1.3	–	1.4	–	1.5	–	1.5	–	1.7	–	1.9
Overall diameter (nominal)	6.0	10.4	6.3	10.7	6.9	11.3	8.1	12.7	10.4	15.9	13.5	19.0	18.2	24.8	25.1	32.9

NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.

Table D.2 **Dimensions of 0.5 mm^2 class 5 conductor multipair PVC insulated cables without individual pair screens**
Dimensions in mm

Dimension	No. of pairs															
	1		2 (quad)		5		10		15		20		30		50	
	Cable type															
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Thickness of sheath/bedding (nominal)	0.8	0.8	0.8	0.8	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.5	1.5	1.7	1.7
Diameter over sheath/bedding	–	6.0	–	6.9	–	11.9	–	16.4	–	19.0	–	21.5	–	25.7	–	32.9
Diameter of armour wire	–	0.9	–	0.9	–	0.9	–	1.25	–	1.6	–	1.6	–	1.6	–	2.0
Diameter over armour	–	7.8	–	8.7	–	13.7	–	18.9	–	22.2	–	24.7	–	28.9	–	36.9
Thickness of oversheath (nominal)	–	1.3	–	1.3	–	1.5	–	1.6	–	1.7	–	1.8	–	1.9	–	2.1
Overall diameter (nominal)	6.0	10.4	6.9	11.3	11.9	16.7	16.4	22.1	19.0	25.6	21.5	28.3	25.7	32.7	32.9	41.1

NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.

Table D.3 **Dimensions of 0.5 mm^2 class 5 conductor multipair PVC insulated cables with individual pair screens**
Dimensions in mm

Dimension	No. of pairs													
	2		5		10		15		20		30		50	
	Cable type													
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Thickness of sheath/bedding (nominal)	0.9	0.9	1.0	1.0	1.2	1.2	1.3	1.3	1.4	1.4	1.6	1.6	1.8	1.8
Diameter over sheath/bedding	–	9.7	–	12.8	–	18.0	–	20.9	–	23.6	–	28.2	–	36.1
Diameter of armour wire	–	0.9	–	1.25	–	1.6	–	1.6	–	1.6	–	1.6	–	2.0
Diameter over armour	–	11.5	–	15.1	–	21.2	–	24.1	–	26.8	–	31.4	–	40.1
Thickness of oversheath (nominal)	–	1.4	–	1.5	–	1.7	–	1.8	–	1.9	–	2.0	–	2.2
Overall diameter (nominal)	9.7	14.3	12.6	18.1	18.0	24.6	20.9	27.7	23.6	30.6	28.2	35.4	36.1	44.5

NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.

Table D.4 **Dimensions of 0.75 mm^2 class 5 conductor multicore PVC insulated cables**
Dimensions in mm

Dimension	No. of cores													
	2		3		4		6		10		20		40		80	
	Cable type															
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Thickness of sheath/bedding (nominal)	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.3	1.3	1.5	1.5
Diameter over sheath/bedding	–	6.4	–	6.8	–	7.4	–	8.9	–	11.5	–	14.8	–	19.9	–	27.5
Diameter of armour wire	–	0.9	–	0.9	–	0.9	–	0.9	–	1.25	–	1.25	–	1.6	–	2.0
Diameter over armour	–	8.2	–	8.6	–	9.2	–	10.7	–	14.0	–	17.3	–	23.1	–	31.5
Thickness of oversheath (nominal)	–	1.3	–	1.3	–	1.4	–	1.4	–	1.5	–	1.6	–	1.7	–	2.0
Overall diameter (nominal)	6.4	10.8	6.8	11.2	7.4	12.0	8.9	13.5	11.5	17.0	14.8	20.5	19.9	26.5	27.5	35.5

NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.

Table D.5 **Dimensions of 0.75 mm^2 class 5 conductor multipair PVC insulated cables without individual pair screens**
Dimensions in mm

Dimension	No. of pairs															
	1		2 (quad)		5		10		15		20		30		50	
	Cable type															
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Thickness of sheath/bedding (nominal)	0.8	0.8	0.8	0.8	1.0	1.0	1.2	1.2	1.3	1.3	1.4	1.4	1.5	1.5	1.8	1.8
Diameter over sheath/bedding	–	6.4	–	7.4	–	12.8	–	17.9	–	20.9	–	23.6	–	27.9	–	35.9
Diameter of armour wire	–	0.9	–	0.9	–	1.25	–	1.6	–	1.6	–	1.6	–	1.6	–	2.0
Diameter over armour	–	8.2	–	9.2	–	15.3	–	21.1	–	24.1	–	26.8	–	31.1	–	39.9
Thickness of oversheath (nominal)	–	1.3	–	1.4	–	1.5	–	1.7	–	1.8	–	1.9	–	2.0	–	2.2
Overall diameter (nominal)	6.4	10.8	7.4	12.0	12.8	18.3	17.9	24.5	20.9	27.7	23.6	30.6	27.9	35.1	35.9	44.3

NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.

Table D.6 **Dimensions of 0.75 mm^2 class 5 conductor multipair PVC insulated cables with individual pair screens**
Dimensions in mm

Dimension	No. of pairs													
	2		5		10		15		20		30		50	
	Cable type													
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Thickness of sheath/bedding (nominal)	0.9	0.9	1.0	1.0	1.2	1.2	1.4	1.4	1.5	1.5	1.6	1.6	1.9	1.9
Diameter over sheath/bedding	–	10.4	–	13.5	–	19.4	–	22.8	–	25.8	–	30.5	–	39.3
Diameter of armour wire	–	0.9	–	1.25	–	1.6	–	1.6	–	1.6	–	2.0	–	2.5
Diameter over armour	–	12.2	–	16.0	–	22.6	–	26.0	–	29.0	–	34.5	–	44.3
Thickness of oversheath (nominal)	–	1.4	–	1.5	–	1.7	–	1.8	–	1.9	–	2.1	–	2.3
Overall diameter (nominal)	10.4	15.0	13.5	19.0	19.4	26.0	22.8	29.6	25.8	32.8	30.5	38.7	39.3	48.9

NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.

Table D.7 **Dimensions of 1.5 mm^2 class 2 conductor multicore PVC insulated cables**
Dimensions in mm

Dimension	No. of cores															
	2		3		4		6		10		20		40		80	
	Cable type															
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Thickness of sheath/bedding (nominal)	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.2	1.2	1.4	1.4	1.7	1.7
Diameter over sheath/bedding	–	7.3	–	7.7	–	8.7	–	10.3	–	13.3	–	17.4	–	23.4	–	32.6
Diameter of armour wire	–	0.9	–	0.9	–	0.9	–	1.25	–	1.25	–	1.6	–	1.6	–	2.0
Diameter over armour	–	9.1	–	9.5	–	10.5	–	12.8	–	15.8	–	20.6	–	26.6	–	36.6
Thickness of oversheath (nominal)	–	1.4	–	1.4	–	1.4	–	1.5	–	1.5	–	1.7	–	1.8	–	2.1
Overall diameter (nominal)	7.3	11.9	7.7	12.3	8.7	13.3	10.3	15.8	13.3	18.8	17.4	24.0	23.4	30.2	32.6	40.8

NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.

Table D.8 **Dimensions of 1.5 mm^2 class 2 conductor multipair PVC insulated cables without individual pair screens**
Dimensions in mm

Dimension	No. of pairs															
	1		2 (quad)		5		10		15		20		30		50	
	Cable type															
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Thickness of sheath/bedding (nominal)	0.8	0.8	0.9	0.9	1.1	1.1	1.3	1.3	1.4	1.4	1.5	1.5	1.7	1.7	2.1	2.1
Diameter over sheath/bedding	–	7.3	–	8.7	–	15.1	–	21.1	–	24.6	–	27.7	–	33.0	–	42.7
Diameter of armour wire	–	0.9	–	0.9	–	1.25	–	1.6	–	1.6	–	1.6	–	2.0	–	2.5
Diameter over armour	–	9.1	–	10.5	–	17.6	–	24.3	–	27.8	–	30.9	–	37.0	–	47.7
Thickness of oversheath (nominal)	–	1.4	–	1.4	–	1.6	–	1.8	–	1.9	–	2.0	–	2.1	–	2.4
Overall diameter (nominal)	7.3	11.9	8.7	13.3	15.1	20.8	21.1	27.9	24.6	31.6	27.7	34.9	33.0	41.2	42.7	52.5

NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.

Table D.9 **Dimensions of 1.5 mm^2 class 2 conductor multipair PVC insulated cables with individual pair screens**
Dimensions in mm

Dimension	**No. of pairs**													
	2		**5**		**10**		**15**		**20**		**30**		**50**	
	Cable type													
	1	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Thickness of sheath/bedding (nominal)	1.0	1.0	1.1	1.1	1.4	1.4	1.5	1.5	1.6	1.6	1.8	1.8	2.2	2.2
Diameter over sheath/bedding	–	12.1	–	15.8	–	22.9	–	26.6	–	30.1	–	35.8	–	46.2
Diameter of armour wire	–	1.25	–	1.25	–	1.6	–	1.6	–	2.0	–	2.0	–	2.5
Diameter over armour	–	14.6	–	18.3	–	26.1	–	29.8	–	34.1	–	39.8	–	51.2
Thickness of oversheath (nominal)	–	1.5	–	1.6	–	1.8	–	1.9	–	2.1	–	2.2	–	2.5
Overall diameter (nominal)	12.1	17.6	15.8	21.5	22.9	29.7	26.6	33.6	30.1	38.3	35.8	44.2	46.2	56.2
NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.														

Table D.10 **Dimensions of 2.5 mm^2 class 2 conductor multicore PVC insulated cables**
Dimensions in mm

Dimension	**No. of cores**															
	2		**3**		**4**		**6**		**10**		**20**		**40**		**80**	
	Cable type															
	1	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Thickness of sheath/bedding (nominal)	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.3	1.3	1.5	1.5	1.9	1.9
Diameter over sheath/bedding	–	8.1	–	8.8	–	9.7	–	11.7	–	15.1	–	19.9	–	26.7	–	37.3
Diameter of armour wire	–	0.9	–	0.9	–	0.9	–	1.25	–	1.6	–	1.6	–	2.0	–	2.5
Diameter over armour	–	9.9	–	10.6	–	11.5	–	14.2	–	18.3	–	23.1	–	30.7	–	42.3
Thickness of oversheath (nominal)	–	1.4	–	1.4	–	1.4	–	1.5	–	1.6	–	1.7	–	2.0	–	2.3
Overall diameter (nominal)	8.1	12.7	8.8	13.4	9.7	14.3	11.7	17.2	15.1	21.5	19.9	26.5	26.7	34.7	37.3	46.9
NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.																

Table D.11 **Dimensions of 2.5 mm^2 class 2 conductor multipair PVC insulated cables without individual pair screens**
Dimensions in mm

Dimension	**No. of pairs**															
	1		**2 (quad)**		**5**		**10**		**15**		**20**		**30**		**50**	
	Cable type															
	1	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Thickness of sheath/bedding (nominal)	0.8	0.8	0.9	0.9	1.2	1.2	1.4	1.4	1.6	1.6	1.7	1.7	1.9	1.9	2.3	2.3
Diameter over sheath/bedding	8.1	8.1	9.7	9.7	17.2	17.2	24.1	24.1	28.2	28.2	31.8	31.8	37.9	37.9	48.9	48.9
Diameter of armour wire		0.9		0.9		1.25		1.6		1.6		2.0		2.0		2.5
Diameter over armour		9.9		11.5		19.7		27.3		31.4		35.8		41.9		53.9
Thickness of oversheath (nominal)		1.4		1.4		1.7		1.9		2.0		2.1		2.3		2.6
Overall diameter (nominal)	8.1	12.7	9.7	14.3	17.2	23.1	24.1	31.1	28.2	35.4	31.8	40.0	37.9	46.5	48.9	59.1
NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.																

Table D.12 **Dimensions of 2.5 mm^2 class 2 conductor multipair PVC insulated cables with individual pair screens**
Dimensions in mm

Dimension	**No. of pairs**													
	2		**5**		**10**		**15**		**20**		**30**		**50**	
	Cable type													
	1	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Thickness of sheath/bedding (nominal)	1.0	1.0	1.2	1.2	1.5	1.5	1.6	1.6	1.8	1.8	2.0	2.0	2.4	2.4
Diameter over sheath/bedding	13.5	13.5	17.9	17.9	25.9	25.9	30.1	30.1	34.3	34.3	40.8	40.8	52.6	52.6
Diameter of armour wire		1.25		1.6		1.6		2.0		2.0		2.5		2.5
Diameter over armour		16.0		21.1		29.1		34.1		38.3		45.8		57.6
Thickness of oversheath (nominal)		1.5		1.7		1.9		2.1		2.2		2.4		2.7
Overall diameter (nominal)	13.5	19.0	17.9	24.5	25.9	32.9	30.1	38.3	34.3	42.7	40.8	50.6	52.6	63.0
NOTE 1.0 mm can be added to the nominal overall diameter to obtain the nominal overall diameter of these cables with a collective screen.														

Annex E (normative)

Voltage test

Apply a voltage of 2 000 V and of sine-wave form with a frequency in the range 40 Hz to 62 Hz, for 1 min.

Apply the voltage to the completed cable (i.e. after the final sheath is applied) at room temperature without immersion in water.

For cables without screen or armour, apply the voltage between conductors. For cables with screen or armour, apply the voltage between conductors, and between conductors and screen and armour which is earthed.

Increase the applied voltage gradually and maintain at full value for 1 min.

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Standards publication

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BS 6360:1991, *Specification for conductors in insulated cables and cords*[3)]

BS 7671, *Requirements for electrical installations – IEE Wiring Regulations*

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Other publications

[1] GREAT BRITAIN. The Electricity Safety, Quality and Continuity Regulations 2002. Statutory Instrument 2002 No. 2665. London: The Stationery Office.

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2) Withdrawn and superseded by BS EN 50288-7:2005.

3) Withdrawn and superseded by BS EN 60228:2005.

4) Available from http://shop.era.co.uk.

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