BRITISH STANDARD

BS 7540-1:2005
Incorporating Corrigendum No. 1

Electric cables — Guide to use for cables with a rated voltage not exceeding 450/750 V —

Part 1: General guidance

(Implementation of CENELEC HD 516 S2)

ICS 29.060.20

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BSI British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee GEL/20, Electric cables, to Subcommittee GEL/20/17, Low voltage cables, upon which the following bodies were represented:

BEAMA Installation Ltd.

British Approvals Service for Cables

British Cables Association

British Plastics Federation

Chartered Institution of Building Services

Department of Trade and Industry — Consumer Safety Unit

Electricity Association

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16211 Corrigendum No. 1	26 January 2006	Correction of heading rows and values in Table 1

Contents

Foreword

This part of BS 7540 has been prepared by Subcommittee GEL/20/17. Together with BS 7540-2 and BS 7540-3 it supersedes BS 7540:1994, which is withdrawn.

BS 7540 is published in three parts:

a) Part 1: *General guidance*;

b) Part 2: *Harmonized cable types from HD 21 and HD 22*;

c) Part 3: *National standard cables not included in HD 21 or HD 22*.

BS 7540-1 and BS 7540-2 together form the UK implementation of the European Committee for Electrotechnical Standardization (CENELEC) Harmonization Document HD 516 S2.

This part of BS 7540 should be read in conjunction with either BS 7540-2 or BS 7540-3 as appropriate for the cable type. BS 7540-2 gives guidance on those cable types that are specified in Harmonized Documents HD 21 and HD 22 as implemented in BS 638-4, BS 6004, BS 6007, BS 6500, BS 7211 and BS 7919. BS 7540-3 gives guidance on cables specific to the United Kingdom that are specified in these standards but not included in HD 21 or HD 22.

NOTE BS 7540 is applicable only to cable types that are specified in British Standards, so the parts of HD 516 that cover non-BS cables are not included in the main body of BS 7540. These non-BS cables are, however, listed in BS 7540-2:2005, Annex A, with references to the relevant clauses in HD 21 and HD 22.

Attention is drawn to the Electrical Equipment (Safety) Regulations 1994 [1].

Additional information on installation practice is given in BS 7671.

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 does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 15 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Introduction

This British Standard provides guidance for equipment manufacturers, installers and end-users on the properties of low voltage electric cables, and the limitations that are deemed to be necessary in order to safeguard life, buildings and goods.

The information is given in the form of limiting values and is illustrated by examples, which are not exhaustive but which indicate ways by which safety can be obtained.

1 Scope

This part of BS 7540 provides general guidance for the safe use of electric cables with a rated voltage not exceeding 450/750 V. It is applicable to those cables that are specified in BS 638-4, BS 6004, BS 6007, BS 6500, BS 7211 and BS 7919.

NOTE 1 These British Standards specify requirements for two categories of cable type. For cable types specified in Harmonized Documents HD 21 and HD 22 as implemented in these British Standards, specific guidance is given in BS 7540-2. For cable types specific to the United Kingdom that are specified in these standards but not included in HD 21 or HD 22, specific guidance is given in BS 7540-3.

The guidance given in this part of BS 7540 can also be applicable to low-voltage cables of a similar type to those specified in BS 638-4, BS 6004, BS 6007, BS 6500, BS 7211 and BS 7919 but not specifically mentioned in those standards.

NOTE 2 In such cases it is advisable to seek additional advice from BSI or the cable manufacturer.

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 638-4:1996, *Arc welding power sources, equipment and accessories — Specification for welding cables.*

BS 4727-2:Group 08, *Glossary of Electrotechnical, power, telecommunication, electronics, lighting and colour terms — Part 2: Terms particular to power engineering — Group 08: Electric cable terminology.*

BS 6004:2000, *Electric cables — PVC insulated, non-armoured cables for voltages up to and including 450/750 V, for electric power, lighting and internal wiring.*

BS 6007:2000, *Electric cables — Single core unsheathed heat resisting cables for voltages up to and including 450/750 V, for internal wiring.*

BS 6500:2000, *Electric cables — Flexible cords rated up to 300/500 V, for use with appliances and equipment intended for domestic, office and similar environments.*

BS 7211:1998, *Specification for thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire.*

BS 7540-2, *Electric cables — Guide to use for cables with a rated voltage not exceeding 450/750 V — Part 2: Harmonized cable types from HD 21 and HD 22.*

BS 7540-3, *Electric cables — Guide to use for cables with a rated voltage not exceeding 450/750 V — Part 3: National standard cables not included in HD 21 and HD 22.*

BS 7671, *Requirements for electrical installations — IEE Wiring Regulations — Sixteenth edition.*

BS 7919:2001, *Electric cables — Flexible cables rated up to 450/750 V, for use with appliances and equipment intended for industrial and similar environments.*

3 Terms and definitions

For the purposes of this part of BS 7540, the terms and definitions given in BS 7671 and BS 4727-2: Group 08 and the following apply.

3.1
internal wiring
wiring mechanically protected by being enclosed within a casing of equipment or by other equivalent means

4 Safety

4.1 General

Safety of a cable means that the product does not present an unacceptable risk of danger to life or property whilst being used in its intended manner.

The limiting conditions under which the cables can reasonably be expected to operate safely under normal circumstances are given in BS 7540-2 and BS 7540-3. Cables should be used only within these limits and in accordance with the relevant British Standard for each cable type.

NOTE 1 Annex A shows how the table numbers in the cable product standards correspond to the table numbers in BS 7540-2 and BS 7540-3.

These limiting conditions are those considered capable of ensuring a length of life in service which has been accepted as reasonable by experience of the particular type of cable and in particular conditions of use. The duration of acceptable performance of a particular type of cable depends upon the type of use, installation or electrical apparatus and on the particular combination of influences relating thereto. For example, the duration of acceptable performance considered as reasonable for a cable used in a fixed installation for the distribution of electricity in a building is more than that for flexible cord.

Cables should not be buried directly in the ground, and unless otherwise stated, should not be used for any purpose other than the transmission and distribution of electricity.

NOTE 2 The test methods and test parameters described in the British Standards referred to in Clause **1** are only for the purposes of checking design with respect to safety and quality assurance. They do not necessarily indicate that the cables are suitable for service under conditions equivalent to the test conditions.

4.2 Selection and installation

4.2.1 All conductors and cables should be selected so as to be suitable for the voltages and currents likely to occur under all conditions which are anticipated in the equipment or installations or that part thereof in which they are used.

4.2.2 Cable should be so constructed, installed, protected, used and maintained as to prevent danger so far as it is reasonably practicable.

4.2.3 Cables should be selected so that they are suitable for the intended operating conditions and equipment classification. Examples of operation conditions are:

a) voltage;

b) current;

c) protective measures;

d) grouping of cables;

e) method of installation;

f) accessibility.

4.2.4 Cables should be selected so that they are suitable for any external influences which might exist. Cables should not be installed under any of these conditions unless they are of a type specifically designed to withstand such conditions. Examples of external influences are:

a) ambient temperature;

b) presence of rain, steam or accumulation of water;

c) presence of corrosive, chemical or polluting substances;

d) mechanical stresses (such as through holes or sharp edges in metal work);

e) fauna (such as rodents);

f) flora (such as mould);

g) radiation (such as sunlight).

NOTE 1 The colour of the cable is an important factor with regard to radiation. Black gives a higher degree of protection against radiation than a light colour.

NOTE 2 Classes of external influence are shown in Annex B.

NOTE 3 Annex C gives an explanation of the different types of usage (i.e. indoor/outdoor). BS 7540-2 and BS 7540-3 give recommendations as to which types of usage are appropriate for particular cable types.

4.3 Fixed cables

4.3.1 Cables should not be installed in contact with or close to hot surfaces unless they are of a type intended for such conditions.

4.3.2 Cables should be supported adequately. The recommended maximum spacing of supports is given in Table 1. In deciding the actual spacing, the mass of the cable between the supports should be taken into account so that the limiting value of tension (see **5.6.2**) is not exceeded. The cable should not be damaged by any mechanical restraint used for its support.

NOTE Cables which have been in use can be damaged if they are disturbed. This can arise from the effect of natural ageing on the physical properties of the materials used for cable insulation and sheathing which can ultimately result in hardening of these materials.

Table 1 — Spacing of supports for non-armoured cables in accessible positions

Overall diameter of cable[a]	Maximum spacing of clips[b]			
	General		In caravans	
	Horizontal	Vertical	Horizontal	Vertical
mm	mm	mm	mm	mm
⩽9	250	400	250	400
>9 ⩽15	300	400	250	400
>15 ⩽20	350	450	250	400
>20 ⩽40[c]	400	550	250	400

[a] For flat cables this is taken as the measurement of the major axis.
[b] The spacings stated for horizontal runs may also be applied to runs at an angle of more than 30° from the vertical. For runs at an angle of 30° or less than the vertical, the vertical spacings are applicable.
[c] For the spacing of supports for cables of overall diameter exceeding 40 mm, and for single core cables having conductors of cross-sectional area 300 mm^2 and larger, the manufacturer's recommendations should be observed.

4.4 Flexible cables or cords

4.4.1 Flexible cables or cords should be used for connections to all mobile equipment. The length of such cables should not be so great as to prevent the short circuit protective device from operating correctly (see **5.3**). Such cables should also be of a minimum practical length to reduce the risk of mechanical damage.

4.4.2 Flexible cables and cords should be selected and used with due reference to the appropriate class of duty.

NOTE Annex D gives information on classes of duty.

4.4.3 Where thermoplastic flexible cables and cords are acceptable, consideration should be given to the use of extensible leads as a means of limiting the length of the connection.

4.4.4 Multicore control cables, if installed so that they are continually flexed, should be protected in a manner which minimizes the possibility of abrasion, cutting and sharp bends.

4.4.5 Flexible cables and cords should not be used as fixed wiring unless they are contained in an enclosure affording mechanical protection, with the following two exceptions:

a) final connection to fixed equipment when the duty type of the cable is at least ordinary duty or higher;

b) fixed installations in temporary buildings when the duty type of the cable is heavy duty.

4.4.6 Exposed lengths of flexible cable or flexible cord used as final connections to fixed equipment should be as short as practicably possible and should be directly connected to the fixed wiring in a manner that is appropriate to the equipment and the method of termination.

4.4.7 Flexible cables or cords should not be subject to excessive tension (see **5.6.2**), crushing, abrasion, torsion and kinking, particularly at the inlet of the appliance and at the point of connection to the fixed wiring. They should not be damaged by any strain relief or clamping device.

4.4.8 Flexible cables or cords should not be placed under carpets or other floor coverings, where there is:

a) any risk of thermal insulating effects, leading to excessive temperature rise [see **5.4.1**a)]; or

b) any risk of damage due to furniture or equipment resting on them or traffic passing over them.

4.4.9 Flexible cables or cords should be prevented from being in contact with or close to hot surfaces, unless they are of a type intended for such conditions. Because of the relative low melting temperature of thermoplastic insulated and/or sheathed cables or cords, very careful consideration of the temperatures involved should be made before using this type of cable. PVC-covered cables should not be used for welding (this includes both industrial arc welding and hobby welding). Only the cross-linked rubber cables specified in BS 638-4 should be used for such purposes, as they are designed to resist the hot particles that are commonly generated during welding.

4.4.10 When flexible cables or cords are required for use outdoors, whether for intermittent, temporary or permanent usage, their suitability for such usage should be determined in accordance with BS 7540-2 or BS 7540-3 as appropriate. Flexible thermoplastic cables or cords are unsuitable for permanent use outdoors, and should not be used for temporary or intermittent outdoor use unless the temperature is above the minimum given in BS 7540-2 and BS 7540-3 for installation and handling.

4.4.11 Non-sheathed cords should not be used for connection to any Class 2 appliance, for any extension cord or for the replacement of any sheathed cable type.

4.4.12 Flexible cables should not be used in deep mining operations, in quarrying, or on moveable equipment such as cranes with spring-loaded reeling devices.

4.4.13 Flexible thermoplastic cables and cords are not necessarily suitable for the manufacture of extensible leads.

5 Limiting conditions

5.1 General

The influence of all factors as outlined in **5.2** to **5.8** should be considered in combination, not separately.

5.2 Voltage

The rated voltage of a cable is the reference voltage for which the cable is designed.

The rated voltage is expressed by the combination of two values U_o/U, expressed in volts, where:

a) U_o is the r.m.s. value between any insulated conductor and "earth" (metal covering of the cable or the surrounding medium);

b) U is the r.m.s. value between any two phase conductors of a multicore cable or of a system of single core cables.

In an alternating current system, the rated voltage of a cable should be at least equal to the nominal voltage of the system for which it is intended. This condition applies to the values of both U_o and U.

In a direct current system, the nominal voltage of the system should be not higher than 1.5 times the rated voltage of the cable.

NOTE The operating voltages of a system may permanently exceed the nominal voltage of such a system by 10 %.

5.3 Current-carrying capacity

5.3.1 The cross-sectional area of every conductor should be such that its current-carrying capacity is not less than the maximum sustained current which will normally flow through it.

5.3.2 The limiting temperature to which the current-carrying capacity is related should not exceed that appropriate to the type of cable insulation or sheath concerned.

5.3.3 The current-carrying capacities for flexible cables, cords and fixed wiring should be in accordance with BS 7671.

NOTE 1 The values given in BS 7671 for the particular cable type and size have been determined such that the limiting temperatures given in BS 7540-2 and BS 7540-3 are not exceeded, under the particular installation conditions given, when the cables are continuously loaded (100 % load factor) with current having an alternating frequency of 50 Hz.

NOTE 2 For arc welding cables, the current-carrying capacities and the associated voltage drop figures are given in BS 7540-2 and BS 7540-3 according to whether they are harmonized cables or national cables.

5.3.4 In the case of soft soldered joints or terminations, the temperature for the conductor under short circuit conditions should be not more than 160 °C.

5.3.5 Tinned copper conductors should not be used at temperatures above 200 °C, even under fault conditions, because of the risk of mutual adhesion.

5.3.6 The method of installation used for the cable affects its current-carrying capacity, and due account should be taken of this. Correction factors for quoted current-carrying capacities are sometimes available for particular conditions such as:

a) ambient temperature;

b) cable grouping;

c) type of overcurrent protection;

d) presence of thermal insulation;

e) reeled/drummed cables;

f) frequency of supply (if different from 50 Hz, etc.);

g) effect of harmonics.

5.3.7 The selection of the cross-sectional area of any conductor should not be based on current-carrying capacity alone. Account should also be taken of:

a) electric shock;

b) thermal effects;

c) overload and short circuit current;

d) voltage drop;

e) mechanical strength;

taking particular account of influences such as:

1) limiting temperatures for terminals of equipment, busbars or bare conductors;

2) limiting short circuit temperatures;

3) the carrying of current by the neutral conductor, e.g. as resulting from the presence of significant harmonic current in a three-phase circuit;

4) electromagnetic effects;

5) reduction of heat dissipation;

6) size of the circuit protective conductor under fault conditions;

7) solar or infra-red radiation.

NOTE This list is not exhaustive. Other influences might arise for particular installations.

5.4 Thermal effects

5.4.1 The limiting temperatures of the individual types of cables are given in BS 7540-2 and BS 7540-3. The values given should not be exceeded by any combination of the heating effect of current in the conductors and the ambient conditions. Particular account should be taken of the following.

a) Cables in free air should be so installed that the natural air convection is not impeded. When cables are covered or embedded in thermal insulation or when the heat dissipation is impeded by other means, it is essential that the current-carrying capacity is reduced by an appropriate factor, e.g. as given in BS 7671.

b) The temperature of cable sheaths can be significantly higher than the ambient temperatures where the cables are subjected to radiation, e.g. solar or infra-red. Where these situations cannot be avoided their effect should be taken into account in assessing the current-carrying capacity or the temperature of the cable relative to the limiting temperature and its service life.

c) Account should be taken of the temperatures occurring within equipment, appliances, luminaires and at their terminals, in selecting the types of cables to be used in them and connected thereto.

d) Exposure of thermoplastic insulated cables to temperatures greater than those given in BS 7540-2 and BS 7540-3, even for short periods, can cause the insulation to soften. Account should be taken of this effect, particularly when mechanical stress is also an influence.

NOTE The minimum limiting temperatures given in BS 7540-2 and BS 7540-3 are minimum ambient temperatures. All insulation and sheath materials used for cables become progressively stiffer as their temperature is lowered below the normal ambient temperature to the point where they become brittle. This behaviour has been taken into account in establishing the values (see **7.3**).

5.4.2 Cables should be selected, located and installed such that their intended heat dissipation is not inhibited and they do not present a fire hazard to adjacent materials.

5.4.3 Where the limiting temperature given in BS 7540-2 and BS 7540-3 is such that the temperature of the surface of the cable is liable to exceed 50 °C, the cable should be so located or guarded as to prevent contact of persons or animals therewith.

NOTE Cable surface temperatures above this can cause involuntary reaction in the event of contact with exposed skin.

5.4.4 Account should be taken of the effect of heat generated by the passage of current through the conductor on the material of which it is made and on the material used in making joints or terminations.

5.5 Fire characteristics

5.5.1 Cables can provide a source of fuel and means of propagating a fire, and the insulation and sheath materials of burning cables can give rise to smoke and to toxic and corrosive fumes. Where this could constitute a hazard, and particularly where it is necessary to ensure safe evacuation of the premises, e.g. in public buildings, offices, hotels, hospitals etc., the guidance of the cable manufacturer should be obtained to select cables to minimize the hazard, and the cables should be installed and segregated in such a way that any emissions from the cables during a fire do not impede evacuation of premises.

5.5.2 Guidance should be sought in selecting cables required to maintain the integrity of electrical circuits when this is necessary to the safety of life and property in the case of fire.

5.5.3 When a cable is to be used in the presence of explosive or flammable atmospheres, guidance should be sought in selecting suitable cables.

NOTE Guidance is available from cable manufacturers; see also BS EN 60079.

5.6 Mechanical stress

5.6.1 *General*

In assessing the potential risk of mechanical damage to cables, account should be taken of any mechanical strains likely to be imposed during the normal process of installation of cables.

5.6.2 *Tension*

The tension applied to a cable should not exceed the following values of tensile stress per conductor, subject to a total maximum tensile force of 1 000 N unless otherwise agreed by the cable manufacturer:

a) 50 N/mm^2 for non-flexible cables during installation;

b) 15 N/mm^2 for flexible cables under static tensile stress and for non-flexible cables in service in fixed circuits.

NOTE A mass of 1 kg is approximately equal to 10 N.

In circumstances where a stress exceeding these values would result, a separate stress-bearing member or device should be used. The method of attaching such a member or device to the cable should be such that the cable is not damaged.

In circumstances where flexible cables are under dynamic stress (including those due to inertia, e.g. reeling drums) the permissible tensions or fatigue life should be agreed between the design engineer and the cable manufacturer.

Where cables are installed vertically, without intermediate support, and are inaccessible and unlikely to be moved or disturbed, they should be supported at the top of the run such that the internal radius of the resultant bend is not less than the appropriate minimum bending radius for normal use according to Table 2. The unsupported vertical length should not exceed 5 m.

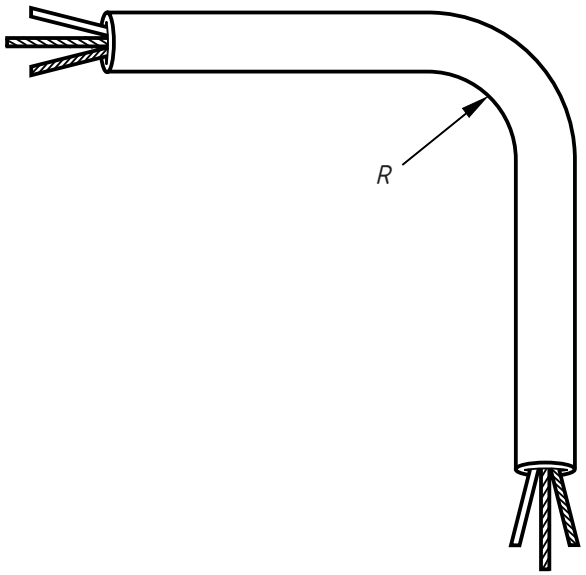
5.6.3 *Bending*

The internal bending radii (as shown in Figure 1) for different types of cable should under normal circumstances be not less than those given in Table 2.

Care should be taken when stripping the insulation to ensure that no damage occurs to the conductor since this will severely affect the bending radii.

The bending radii recommended are for ambient temperatures of (20 ± 10) °C. For temperatures outside these limits, the cable manufacturer's recommendations should be followed.

For flexible cables and cords, particularly at terminations and at the point of entry of moveable appliances, it can be necessary to use a device which ensures that the cable is not bent to an internal bend radius less than that recommended in Table 2. It is necessary to prevent the cable being flexed significantly too close to any internal and/or external anchorage point. If a cord guard or other device is used it should not prevent internal movement of the cores of the cable within the device.



Key

R Internal bending radius

Figure 1 — Definition of internal bending radius

Table 2 — Minimum recommended bending radii at cable temperatures of (20 ± 10) °C

Cable type	Minimum bending radius			
	Cable diameter ⩽8 mm	Cable diameter >8 ⩽12 mm	Cable diameter >12 ⩽20 mm	Cable diameter >20 mm
Cable for fixed installations:				
Normal use	4*D*	5*D*	6*D*	6*D*
Careful bending at termination	2*D*	3*D*	4*D*	4*D*
Flexible cables (thermoplastic, e.g. PVC):				
Fixed installation	3*D*	3*D*	4*D*	4*D*
Free movement	5*D*	5*D*	6*D*	6*D*
At inlet of portable appliance or mobile equipment[a]	5*D*	5*D*	6*D*	6*D*
Under mechanical load[b]	9*D*	9*D*	9*D*	10*D*
Festooned[c]	10*D*	10*D*	11*D*	12*D*
Repeated reeling[b]	7*D*	7*D*	8*D*	8*D*
Deflected by pulleys[b]	10*D*	10*D*	10*D*	10*D*
Flexible cables (thermosetting, e.g. rubber):				
Fixed installation	3*D*	3*D*	4*D*	4*D*
Free movement	4*D*	4*D*	5*D*	6*D*
At inlet of portable appliance or mobile equipment[a]	4*D*	4*D*	5*D*	6*D*
Under mechanical load[b]	6*D*	6*D*	6*D*	8*D*
Festooned[c]	6*D*	6*D*	6*D*	8*D*
Repeated reeling[b]	6*D*	6*D*	6*D*	8*D*
Deflected by pulleys[b]	6*D*	8*D*	8*D*	8*D*
D = the overall diameter of round cables or the smaller dimension of flat cables.				

[a] No mechanical load on the cable.
[b] See **5.6.2** with regard to dynamic stress.
[c] As in gantry cranes.

5.6.4 *Compression*

A cable should not be compressed to such an extent as to cause damage.

NOTE None of the cables in BS 7540-2 and BS 7540-3 are intended to be compressed.

5.6.5 *Twisting/torsion*

Flexible cables are generally not designed to be twisted about the longitudinal axis. In installations where it is not possible to avoid such twisting, the design of the flexible cable and the installation arrangements should be agreed between the designers of the installation and the manufacturers of the cable.

For design purposes the following recommendations should be followed.

a) Where the normal mode of operation requires infrequent rotation through an arc of up to 360° in either direction, the distance between the clamping supports of the cable should be not less than 50 times the largest cable diameter in the cable run.

b) Where the normal mode of operation requires frequent rotation through an arc of up to 360° in either direction, the distance between the clamping supports of the cable should be not less than 100 times the largest cable diameter in the cable run.

Where cables designed specially for these purposes are used, the above ratios may be reduced to 25 times and 50 times, respectively.

5.7 Compatibility

5.7.1 The possibility of interference, either mechanical or electrical, between adjacent circuits should be avoided.

5.7.2 Account should be taken of the effect of heat given out by cables, and the chemical/physical effect of materials used in their construction, on materials adjacent to which they are installed, e.g. construction materials, decorative materials, cable enclosures, supports.

5.7.3 The interaction of adjacent materials with the materials used in the construction of cables should be taken into account, e.g. the absorption of plasticizer from PVC cables by some materials used for thermal insulation, wiring accessories and appliances.

5.8 Dynamic stresses (electromechanical stress)

Account should be taken of the possibility of damage to cables and their supports due to the disruptive effects of the electromechanical forces caused by any current which the cables might have to carry in service, including short circuit currents.

6 Initial and periodic verifications

Cables liable to be touched should be inspected along their route and, if necessary, checked by measurements at the end of the installation and periodically during operation.

Cables for fixed installations or for fixed or transportable equipment should be inspected periodically, and every time there is a possibility that the cable has been damaged by internal (overvoltage, overcurrents) or external stresses. If the cable shows a visible change of external appearance it should either be repaired, through suitable devices and by skilled persons, or replaced.

Cables for portable or hand-held equipment should be inspected periodically. If the cable shows any sign of wear, damage or visible change of external appearance it should be replaced.

7 Packaging, storage and handling/transportation

7.1 Packaging

Cables are normally delivered to the user either on drums, reels, in coils or as cut lengths in non-tangle packaged units. They are normally labelled to identify the cable type and size.

7.2 Storage

7.2.1 Cables not intended for use outdoors should be stored indoors in dry locations. Some types of cords are particularly susceptible to damage due to moisture. All cables capable of being, and likely to be, stored outdoors should have their ends sealed so as to prevent the penetration of moisture.

7.2.2 During storage, the cable temperature should not exceed the recommended maximum storage temperature, or be lower than the recommended minimum installation temperature, given in BS 7540-2 and BS 7540-3.

7.3 Handling/transportation

During handling or transportation, care should be taken to minimize any mechanical stress, in particular vibration, impact, shock, bending and torsion. If the cable temperature falls below the minimum installation temperature or if it exceeds the maximum storage temperature given in BS 7540-2 and BS 7540-3 then additional precautions should be taken as the likelihood of damage to the cable is increased. Additional advice can be obtained from BSI or the cable manufacturer.

Annex A (informative)
Relationship between cable product standards and BS 7540

Table A.1 identifies, for each cable product standard covered by BS 7540, the location of specific guidance for harmonized cables (BS 7540-2) and national standard cables (BS 7540-3). For example:

— guidance for cables conforming to BS 6004:2000, Tables 7 and 8, covering the national standard flat wiring cables, is given in BS 7540-3:2005, Table 2;

— guidance for cables conforming to BS 6500:2000, Table 27, covering ordinary duty PVC flexible cords, is given in BS 7540-2:2005, Table 2 in respect of the harmonized types and BS 7540-3:2005, Table 5 for the national standard types.

Table A.1 — Cross-reference table

Cable standard	Table no. in cable standard	Table no. in BS 7540-2:2005	Table no. in BS 7540-3:2005
BS 638-4:1996	1, 2	10	1
	3, 6, 7	—	1
BS 6004:2000	4a	1	—
	4b	1	—
	5	1	2
	7, 8, 9	—	2
	10a, 10b	4	—
	11a, 11b	3	—
	12	3	2
	13	7	—
BS 6007:2000	3, 4, 5, 6, 7	11	—
	8	8	3
	9, 10	8	—
BS 6500:2000	11	—	4
	12	9	4
	13	9	—
	14	—	4
	15	15	—
	16	15	—
	24, 26	2	—
	27	2	5
	28	6	—
	29	6	—
BS 7211:1998	3a, 3b, 4a, 4b	12	—
	5, 6, 7	—	6

Table A.1 — Cross-reference table *(continued)*

Cable standard	Table no. in cable standard	Table no. in BS 7540-2:2005	Table no. in BS 7540-3:2005
BS 7919:2001	10	9	—
	11, 12	15	—
	13	14	—
	14, 15	9	—
	16, 17	15	—
	18, 19	16	—
	20, 21	18	—
	22	17	—
	23, 24	13	—
	40	2	—
	41	6	—
	42	7	—
	43	7	—
	44	—	7

Annex B (informative)
Classes of external influence (environmental conditions)

A coding system for cables classifying external influences according to degree of risk is given in Table B.1.

Table B.1 — Classes of external influence (environmental conditions)

Environmental condition	Code	Classification	Characteristics
Water	AD1	Negligible	Probability of presence of water is negligible
	AD2	Free falling drops	Probability of vertically falling drops
	AD6	Waves	Possibility of water waves
	AD7	Immersion	Possibility of intermittent partial or total covering of water
	AD8	Submersion	Possibility of permanent and total covering by water
Corrosive or polluting substances	AF3	Intermittent or accidental	Intermittent or accidental subjection to corrosive or polluting substances being used or produced
Impact	AG2	Medium severity	Under consideration but assumed to cover industrial conditions
Vibrations	AH3	High severity	Industrial installations subject to severe conditions
Flora	AK2	Hazard	Harmful hazard of flora and/or mould growth
Fauna	AL2	Hazard	Harmful hazard from fauna (insects, birds, small animals)
Solar-radiation	AN2	Intensity >500 W/m^2 and $\leqslant$700 W/m^2	Solar radiation of harmful intensity and/or duration

Annex C (informative)
Types of usage

C.1 Indoor use

The cable is installed or connected to an apparatus and is permanently located inside the building within "the intended environment". The building may be used for residential, commercial or industrial purposes.

C.2 Temporary outdoor use

The cable can be used outdoors in "the intended environment" for short periods.

Examples could include the connection of small domestic appliances such as electric drills or lawnmowers, etc.

C.3 Permanent outdoor use

The cable is designed to resist the various stresses (including weather) which can be met outdoors in "the intended environment".

Annex D (informative)
Classes of duty

D.1 General

When flexible cables and cords are attached to appliances or to industrial equipment, they are subjected to a combination of external influences that depend upon the nature of the appliance or equipment and the environment within which it operates. The relevant standard for the appliance or equipment refers therefore to a "duty" level applicable to the cable. These duty levels range from "extra light" for the least demanding applications through to "heavy" for the toughest.

There are four basic categories of duty (**D.2** to **D.5**) and a special one for heavy-duty multi-core cables (**D.6**). The categories are largely based on mechanical influences.

D.2 Extra light duty

Extra light duty cables or cords are used where the risk of mechanical damage and mechanical stresses is negligible, i.e. under external influences to be expected in the normal use of small light-weight appliances in domestic premises and offices where a cord with greater mechanical protection would restrict the movement of the appliance or otherwise result in serious constraint of its intended use.

Examples of appliances that need extra light duty cables include electric shavers, electric clocks, etc.

D.3 Light duty

Light duty cables or cords are used where the risk of mechanical damage and mechanical stresses is low, i.e. under external influences to be expected in the normal use of light, hand-held appliances and light portable equipment in domestic premises, offices and shops.

Examples of appliances that need light duty cables include domestic hair dryers and hair styling appliances, radio sets, table and standard lamps and small desktop office machines.

D.4 Ordinary duty

Ordinary duty cables or cords are used in situations where they are likely to be subjected to low mechanical stresses and where the risk of mechanical damage is low, i.e. under external influences to be expected in the normal use of small to medium size appliances in domestic, commercial and light industrial premises.

Examples of appliances that need ordinary duty cables include toasters, small cooking appliances, vacuum cleaners, spin dryers, washing machines, sewing machines and refrigerators.

D.5 Heavy duty

Heavy duty cables are used where the risk of mechanical damage and mechanical stresses is of medium severity, i.e. under external influences to be expected in the normal use of appliances in average industrial and agricultural workshops and in temporary use on building sites.

Examples of appliances that need heavy duty cables include inspection lamps, heating plates, large boiling installations, medium size transportable motors or machines on building sites or agricultural working, lifting equipment and fixed installation in temporary buildings.

D.6 Heavy duty (multicore cables only)

Heavy duty multicore cables are used in the same situations as normal heavy duty cables (**D.5**), but primarily for the interconnection of parts of machines used for manufacturing purposes, including machine tools and mechanical handling equipment. They can be used inside or outside buildings where the ambient temperatures remain within the range –25 °C to +50 °C, and the stabilized conductor temperatures do not exceed 60 °C.

Examples of situations where heavy duty multicore cables are needed include the connection of a control unit to a machine such as a crane or hoist, or the interconnection of a control console with a manufacturing machine where the length of cable is not normally greater than 10 m. Longer lengths are acceptable where cables are used in fixed interconnections.

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