Contents

1. General

The basic requirements for the support of cables are given in Regulations 522.8.4 and 522.8.5 of *BS 7671*.

In particular, cables should be supported in such a way that they will not be exposed to undue mechanical strain, including any strain caused by their own weight, and that there is no appreciable mechanical strain on the terminations of the conductors.

Where a cable is supported at intervals, rather than continuously, the intervals should be appropriate to meet the above requirements for avoidance of strain.

2. Selection of the means of support

BS 7671 does not stipulate the particular means by which cables should be supported, but leaves this to be dictated by the needs of the installation concerned. However, a number of essential requirements need to be met, some examples of which are:

(i) **Surfaces in contact with a cable**. All surfaces in contact with a cable must be reasonably smooth and free from sharp corners or edges likely to damage the cable (Regulation 522.8.1). This applies to cable clips, parts of a wiring system (such as conduit and cable tray) and parts of a building (such as walls, ceilings and floors).

(ii) **Suitability for external influences**. Cable supports and their fixings, like any other parts of a wiring system, must be selected so as to be suitable for the external influences they are likely to be exposed to at their location (Section 522). For example, where vibration is likely to occur, locking arrangements such as shakeproof washers are likely to be required.

(iii) **Avoiding electrolytic corrosion**. Metallic cable clips, support systems (such as cable tray), cable sheaths and armour etc, of dissimilar metals between which electrolytic corrosion is liable to occur, should not be placed in contact with each other (Regulation 522.5.2 refers). Such corrosion is possible between, for example, zinc (as used in galvanizing) and copper, especially in the presence of moisture.

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(iv) **Safety services**. The fire resistance of cable supports and fixings for a cable of a safety service (such as a fire alarm system) must be such that the cable provides the required level of fire resistance (Regulation 560.8.1). The cable manufacturer's recommendations should be followed.

(v) **Non-sheathed cables must be enclosed in conduit etc**. Non-sheathed cables for fixed wiring are required by Regulation 521.10.1 to be enclosed in conduit, ducting or trunking. The requirement does not apply to a protective conductor complying with Section 543 of *BS 7671*. However, where the protective conductor belongs to an a.c. circuit installed in a ferrous enclosure (such as steel conduit, trunking or ducting) the protective conductor must be installed in the same enclosure in order to meet the requirements of Regulation 521.5.2 relating to electromagnetic effects.

(vi) **Cables in a vertical run of trunking or ducting exceeding 5 m in length**. For cables of any type in a vertical run of trunking or ducting exceeding 5 m in length, intermediate cable supports (such as pin racks in trunking, see Fig 1) should be provided.

Pin rack, used to give cable support in a vertical trunking run exceeding 5m in length

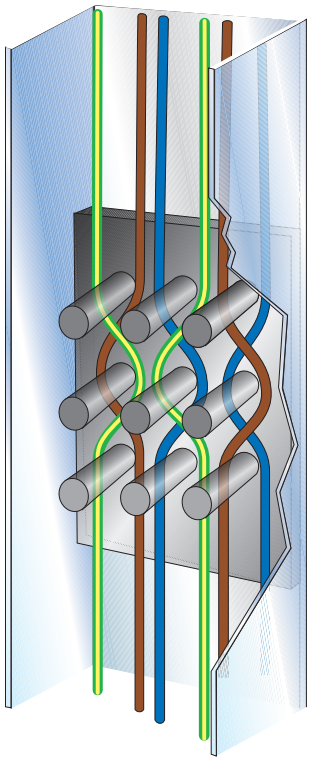

Fig 1

(vii) **Cables in a vertical run of conduit exceeding 5 m in length**. For non-sheathed cables in a vertical run of conduit exceeding 5 m in length, precautions (such as additional cable supports) should be taken to protect the cable insulation on the bend at the top of the run against undue compression.

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(viii) **Vertical run of cable supported from the top**. Where a vertical run of cable is supported from the top, such support should comprise a clip and a rounded support of radius not less than that recommended in Topic ***B29-1***. In addition, for reasons of protection against mechanical damage (Regulation Groups 522.6 and 522.8), the cable should be inaccessible and unlikely to be disturbed.

(ix) **Cables resting without fixing on part of a building**. For reasons of protection against mechanical damage (Regulation Groups 522.6 and 522.8), cables resting without fixing on part of a building (such as on the top surface of a plasterboard ceiling beneath floorboards) should be located where they are inaccessible and unlikely to be disturbed.

(x) **Cables passing through a wooden floor or ceiling joist or supports**. Cables passing through wooden floor or ceiling joists or supports are subject to the requirements of Regulation 522.6.100 for protection against mechanical damage, particularly penetration by nails, screws and the like (see Topic ***J5-1***).

(xi) **Cables concealed in a wall or partition**. Cables concealed in a wall or partition are subject to the requirements of Regulations 522.6.101, 522.6.102 and 522.6.103 for protection against mechanical damage, particularly penetration by nails, screws and the like. The requirements apply not only where a cable passes though a wooden support, such as a 'stud' (where applicable), but throughout the cable length (see Topic ***C5-43***).

3. Spacing between supports

As explained in item 1, *BS 7671* requires the intervals between cable supports (as well as the means of support) to be such that cables do not suffer mechanical damage or strain. Table 1 of this topic gives suggested maximum spacings between supports for both horizontal and vertical runs of accessible and inaccessible cable. The maximum spacing dimensions in Table 1 relate to the overall diameter of the cable. For 'flat' cables, the diameter relates to the major axis (Fig 2 refers).

As *BS 7671* is principally concerned with the safety aspects of support systems, supports additional to those indicated in Table 1 are often needed to make the finished installation visually acceptable. Additional supports may also be needed in an installation subjected to vibration of medium or high severity, or where there is an increased risk of mechanical damage, such as by accidental snagging of the cable.

Special considerations sometimes apply to the spacing and arrangement of supports for distribution cables installed in free air. See item 4 of this topic.

For the maximum lengths of span and minimum heights for overhead wiring linking buildings etc, see item 5 of this topic.

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Table 1 Maximum cable support spacings for non-armoured, armoured and MICS cables

Cable overall diameter[a] mm	Maximum[b] support spacing			
	Horizontal[c] mm		Vertical[d] mm	
Non-armoured:	**Generally**	**In caravans**	**Generally**	**In caravans**
Up to 9	250	250 (all sizes)	400	400 (all sizes)
Exceeding 9 but not exceeding 15	300		400	
Exceeding 15 but not exceeding 20	350		450	
Exceeding 20 but not exceeding 40	400		550	
Armoured:				
Exceeding 9 but not exceeding 15	350		450	
Exceeding 15 but not exceeding 20	400		550	
Exceeding 20 but not exceeding 40	450		600	
Mineral insulated copper sheathed (MICS):				
Up to 9	600		800	
Exceeding 9 but not exceeding 15	900		1 200	
Exceeding 15 but not exceeding 20	1 500		2 000	

a For flat type cables, the diameter refers to the major axis (see Fig 2).

b Spacings smaller than given in the table will often be necessary for good workmanship/visual appearance.

c Horizontal spacings include for runs at an angle of up to 60° from the horizontal.

d Vertical spacings include for runs at an angle of up to 30° from the vertical.

Cross-section through a flat type cable, indicating the major axis

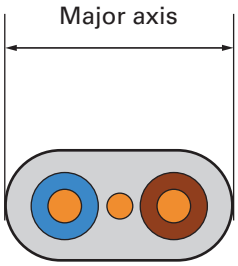

Fig 2

4. Catering for expansion and contraction of distribution cables installed in free air

Where distribution cables are installed in free air, the effect of thermal expansion and contraction should be considered when deciding upon the spacing of supports. This is particularly important for longer cable runs of lead-sheathed cables where there are operating cycles in which the load reaches the maximum current-carrying capacity of the cable. Cables are described as being in free air when they are installed in accordance with Reference Methods E, F or G (on cleats, brackets or a ladder) of Table 4A2 of Appendix 4 of *BS 7671* - see Fig 3.

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Cables supported on brackets – an example of cables installed in free air

Fig 3

Note: For full details of the method of support shown in Fig 3, see Table 4A2 of Appendix 4 of *BS 7671*, Method E or F.

Expansion in a cable can cause it to move bodily across or through its supports such that slack builds up at a bend or other position in the route. A short span of cable may then have to accommodate the expansion and contraction of a long section and repeated flexing can result in cable failure. The likelihood of cable failure is greater with lead-sheathed than with other types of cable, due to the possibility of the sheath buckling.

With polymeric cables such as thermoplastic (PVC) cables to *BS 6346*, or thermosetting (XLPE) cables to *BS 5467*, neither of which have lead sheaths, there is not the same problem with potential cable failure due to thermal movement, although bodily movement can still occur, particularly with a cable having solid aluminium conductors.

To avoid problems of build up of slack and consequent cable failure, as described above, measures such as having greater spacings between cable supports than those given in Table 1, and arranging for a slight sag to be provided between supports, may be necessary. The specific recommendations of the cable manufacturer should be followed.

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5. Overhead cables between buildings

Table 2 gives suggested maximum lengths of span and minimum heights for overhead wiring linking buildings etc in order to meet the requirements of *BS 7671* referred to in item 1 of this topic.

The minimum height dimensions in Table 2 apply only to the general case. They do not apply to special cases, such as yacht marinas, construction sites and agricultural and horticultural locations, for which special consideration is required and considerably increased minimum cable heights may be necessary.

Table 2 Maximum lengths of span and minimum heights for overhead wiring linking buildings etc

Wiring system	Maximum span m	Minimum height above ground[ab] m		
		Inaccessible to traffic[c]	Accessible to traffic	
			Generally	At road crossings
Plastics or hofr[d] sheathed cables:				
– Without intermediate support	3.0	3.5	5.8	5.8
– In galvanized conduit[e]	3.0	3.0	5.8	5.8
– Supported by a catenary wire	No limit	3.5	5.8	5.8
Overhead cable incorporating a catenary wire:				
– All	As stated by manufacturer	3.5	5.8	5.8
Covered overhead lines:				
– Supported by insulators	30.0	3.5	5.8	5.8
Bare overhead lines:				
– Supported by insulators	30.0	5.2	5.8	5.8
Bare or overhead lines for distribution between buildings and structures:				
– Meeting the requirements of *The Electricity Safety, Quality and Continuity Regulations 2002*	No limit	4.3[f]	5.8[g]	5.8

a Suspension point heights must be chosen to allow for the sag between supports.

b Greater heights than given in the table will be necessary in certain cases, such as where cranes may be present.

c The 'inaccessible to traffic' column does not apply at agricultural premises.

d 'hofr' means heat and oil resisting, flame retardant.

e The conduit should be of not less than 20 mm in diameter and not jointed in its span.

f Regulation 17 ESQCR.

g A minimum height of 5.2 m is permitted for an existing overhead line (but not where refurbished or rebuilt).

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A suspended cable or catenary must be allowed to sag, as shown in Fig 4, in order that the tension (or pulling force) in it should not be unacceptably great. The tension depends on the weight per metre of the cable or catenary and the distance between suspension points, and is greater the smaller the maximum sag.

To allow for the sag, the heights of cable suspensions need to be greater than the minimum height required for the cable above the ground. Where the suspension points are at the same height, the point at which the maximum sag occurs will be midway between suspensions. With suspension points at different heights, the point of maximum sag will be off centre towards the lower suspension.

Cable sag

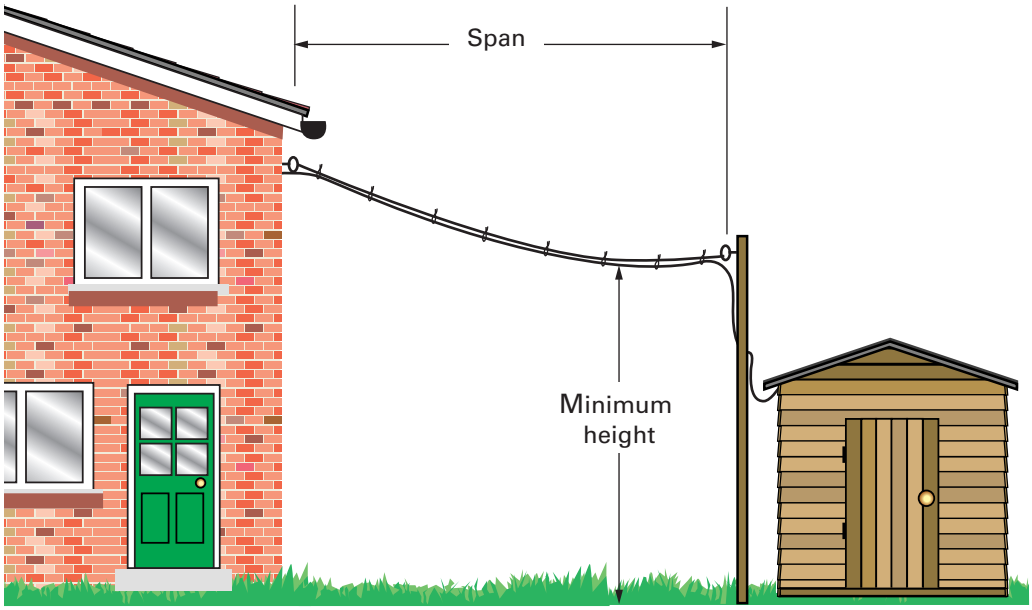

Fig 4

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Topics referred to in this text:

B29-1	BENDING RADII: Of cables: General
C5-43	CABLES: In walls or partitions, protection against penetration
J5-1	JOISTS, CABLES PASSING THROUGH OR OVER: General

Topics not referred to in this text, which are related and may be of interest:

C157-1	CONDUIT: Capacity of, to accommodate cable, space factor method
S309-5	SUPPORTS: For conduit
T113-1	TRUNKING: Capacity of, to accommodate cable, space factor method

***BS 7671* (Requirements for electrical installations)**

Some of the most important requirements are found in:

Selection and erection of wiring systems in relation to external influences	Section 522
Safety services	Chapter 56

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