**BS7671 522. External Influences.**

**522 SELECTION AND ERECTION OF WIRING SYSTEMS IN RELATION TO EXTERNAL**

**INFLUENCES**

The installation method selected shall be such that protection against the expected external influences is provided in all appropriate parts of the wiring system. Particular care shall be taken at changes in direction and where wiring enters into equipment.

**NOTE:** The external influences categorized in Appendix 5 which are of significance to wiring systems are included in this section.

**522.1 Ambient temperature (AA)**

**522.1.1** A wiring system shall be selected and erected so as to be suitable for the highest and lowest local ambient temperatures and so that the limiting temperature in normal operation (see Table 52.1) and the limiting temperature in case of a fault (see Table 43.1) will not be exceeded.

**522.1.2** Wiring system components, including cables and wiring accessories, shall only be installed or handled at temperatures within the limits stated in the relevant product specification or as given by the manufacturer.

**522.2 External heat sources**

**522.2.1** In order to avoid the effects of heat from external sources, one or more of the following methods or an equally effective method shall be used to protect a wiring system:

(i) Shielding

(ii) Placing sufficiently far from the source of heat

(iii) Selecting a system with due regard for the additional temperature rise which may occur

(iv) Local reinforcement or substitution of insulating material.

**NOTE:** Heat from external sources may be radiated, conducted or convected, e.g.:

- from hot water systems

- from plant, appliances and luminaires

- from a manufacturing process

- through heat conducting materials

- from solar gain of the wiring system or its surrounding medium.

**522.2.201** Parts of a cable within an accessory, appliance or luminaire shall be suitable for the temperatures likely to be encountered, as determined in accordance with Regulation 522.1.1, or shall be provided with additional insulation suitable for those temperatures.

**522.3 Presence of water (AD) or high humidity (AB)**

**522.3.1** A wiring system shall be selected and erected so that no damage is caused by condensation or ingress

of water during installation, use and maintenance. The completed wiring system shall comply with the IP degree of

protection (see BS EN 60529) relevant to the particular location.

**NOTE:** Special considerations apply to wiring systems liable to frequent splashing, immersion or submersion.

**522.3.2** Where water may collect or condensation may form in a wiring system, provision shall be made for

its escape.

**522.3.3** Where a wiring system may be subjected to waves (AD6), protection against mechanical damage

shall be afforded by one or more of the methods of Regulations 522.6 to 8.

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**522.4 Presence of solid foreign bodies (AE)**

**522.4.1** A wiring system shall be selected and erected so as to minimize the danger arising from the ingress of

solid foreign bodies. The completed wiring system shall comply with the IP degree of protection (see BS EN 60529)

relevant to the particular location.

**522.4.2** In a location where dust in significant quantity is present (AE4), additional precautions shall be taken

to prevent the accumulation of dust or other substances in quantities which could adversely affect heat dissipation

from the wiring system.

**NOTE:** A wiring system which facilitates the removal of dust may be necessary (see Section 529).

**522.5 Presence of corrosive or polluting substances (AF)**

**522.5.1** Where the presence of corrosive or polluting substances, including water, is likely to give rise to corrosion or deterioration, parts of the wiring system likely to be affected shall be suitably protected or manufactured from a material resistant to such substances.

**NOTE:** Suitable protection for application during erection may include protective tapes, paints or grease.

**522.5.2** Dissimilar metals liable to initiate electrolytic action shall not be placed in contact with each other,

unless special arrangements are made to avoid the consequences of such contact.

**522.5.3** Materials liable to cause mutual or individual deterioration or hazardous degradation shall not be placed in contact with each other.

**522.6 Impact (AG)**

**522.6.1** Wiring systems shall be selected and erected so as to minimize the damage arising from mechanical stress, e.g. by impact, abrasion, penetration, tension or compression during installation, use or maintenance.

**522.6.2** In a fixed installation where impacts of medium severity (AG2) or high severity (AG3) can occur protection shall be afforded by:

(i) the mechanical characteristics of the wiring system, or

(ii) the location selected, or

(iii) the provision of additional local or general protection against mechanical damage, or

(iv) any combination of the above.

**NOTE:** Examples are areas where the floor is likely to be penetrated and areas used by forklift trucks.

**522.6.4** The degree of protection of electrical equipment shall be maintained after installation of the cables and conductors.

**522.6.201** A cable installed under a floor or above a ceiling shall be run in such a position that it is not liable to be damaged by contact with the floor or ceiling or their fixings.

A cable passing through a joist within a floor or ceiling construction or through a ceiling support (e.g. under floorboards), shall:

(i) be installed at least 50 mm measured vertically from the top, or bottom as appropriate, of the joist or batten, or

(ii) comply with Regulation 522.6.204.

**522.6.202** A cable installed in a wall or partition at a depth of less than 50 mm from a surface of the wall or partition shall:

(i) be installed in a zone within 150 mm from the top of the wall or partition or within 150 mm of an angle formed by two adjoining walls or partitions. Where the cable is connected to a point, accessory or switchgear on any surface of the wall or partition, the cable may be installed in a zone either horizontally or vertically, to the point, accessory or switchgear. Where the location of the accessory, point or switchgear can be determined from the reverse side, a zone formed on one side of a wall of 100 mm thickness or less or partition of 100 mm thickness or less extends to the reverse side, or

(ii) comply with Regulation 522.6.204.

Where indent (i) but not indent (ii) applies, the cable shall be provided with additional protection by means of an RCD having the characteristics specified in Regulation 415.1.1.

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**522.6.203** Irrespective of its buried depth, a cable concealed in a wall or partition, the internal construction of which includes metallic parts, other than metallic fixings such as nails, screws and the like, shall:

(i) be provided with additional protection by means of an RCD having the characteristics specified in Regulation 415.1.1, or

(ii) comply with Regulation 522.6.204.

For a cable installed at a depth of less than 50 mm from the surface of a wall or partition the requirements of Regulation 522.6.202(i) shall also apply.

**522.6.204** For the purposes of Regulation 522.6.201(ii), Regulation 522.6.202(ii) and Regulation 522.6.203(ii), a cable shall:

(i) incorporate an earthed metallic covering which complies with the requirements of these Regulations for a protective conductor of the circuit concerned, the cable complying with BS 5467, BS 6724, BS 7846, BS 8436 or BS EN 60702-1, or

(ii) be installed in earthed conduit complying with BS EN 61386-21 and satisfying the requirements of these Regulations for a protective conductor, or

(iii) be enclosed in earthed trunking or ducting complying with BS EN 50085-2-1 and satisfying the requirements of these Regulations for a protective conductor, or

(iv) be provided with mechanical protection against damage sufficient to prevent penetration of the cable by nails, screws and the like, or

(v) form part of a SELV or PELV circuit meeting the requirements of Regulation 414.4.

**522.7 Vibration (AH)**

**522.7.1** A wiring system supported by or fixed to a structure or equipment subject to vibration of medium severity (AH2) or high severity (AH3) shall be suitable for such conditions, particularly where cables and cable connections are concerned.

**522.7.2** For the fixed installation of suspended current-using equipment, e.g. luminaires, connection shall be made by cable with flexible cores. Where no vibration or movement can be expected, cable with non-flexible cores may be used.

**522.8 Other mechanical stresses (AJ)**

**522.8.1** A wiring system shall be selected and erected to avoid during installation, use or maintenance, damage to the sheath or insulation of cables and their terminations. The use of any lubricants that can have a detrimental effect on the cable or wiring system are not permitted.

**522.8.2** Where buried in the structure, a conduit system or cable ducting system, other than a pre-wired conduit assembly specifically designed for the installation, shall be completely erected between access points before any cable is drawn in.

**522.8.3** The radius of every bend in a wiring system shall be such that conductors or cables do not suffer damage and terminations are not stressed.

**522.8.4** Where conductors or cables are not supported continuously due to the method of installation, they shall be supported by suitable means at appropriate intervals in such a manner that the conductors or cables do not suffer damage by their own weight.

**522.8.5** Every cable or conductor shall be supported in such a way that it is not exposed to undue mechanical strain and so that there is no appreciable mechanical strain on the terminations of the conductors, account being taken of mechanical strain imposed by the supported weight of the cable or conductor itself.

**NOTE:** Consumer unit meter tails are included in the requirements of this regulation.

**522.8.6** A wiring system intended for the drawing in or out of conductors or cables shall have adequate means of access to allow this operation.

**522.8.7** A wiring system buried in a floor shall be sufficiently protected to prevent damage caused by the intended use of the floor.

***522.8.8*** *Not used*

***522.8.9*** *Not used*

**522.8.10** Except where installed in a conduit or duct which provides equivalent protection against mechanical damage, a cable buried in the ground shall incorporate an earthed armour or metal sheath or both, suitable for use as a protective conductor. The location of buried cables shall be marked by cable covers or a suitable marker tape.

Buried conduits and ducts shall be suitably identified. Buried cables, conduits and ducts shall be at a sufficient depth to avoid being damaged by any reasonably foreseeable disturbance of the ground.

**NOTE:** BS EN 61386-24 is the standard for underground conduits.

**522.8.11** Cable supports and enclosures shall not have sharp edges liable to damage the wiring system.

**522.8.12** A cable or conductors shall not be damaged by the means of fixing.

**522.8.13** Cables, busbars and other electrical conductors which pass across expansion joints shall be so selected or erected that anticipated movement does not cause damage to the electrical equipment.

**522.8.14** No wiring system shall penetrate an element of building construction which is intended to be load bearing unless the integrity of the load-bearing element can be assured after such penetration.

**522.9 Presence of flora and/or mould growth (AK)**

**522.9.1** Where the conditions experienced or expected constitute a hazard (AK2), the wiring system shall be selected accordingly or special protective measures shall be adopted.

**NOTE 1:** An installation method which facilitates the removal of such growths may be necessary (see Section 529).

**NOTE 2:** Possible preventive measures are closed types of installation (conduit or channel), maintaining distances to plants and regular cleaning of the relevant wiring system.

**522.10 Presence of fauna (AL)**

**522.10.1** Where conditions experienced or expected constitute a hazard (AL2), the wiring system shall be selected accordingly or special protective measures shall be adopted, for example, by:

(i) the mechanical characteristics of the wiring system, or

(ii) the location selected, or

(iii) the provision of additional local or general protection against mechanical damage, or

(iv) any combination of the above.

**522.11 Solar radiation (AN) and ultraviolet radiation**

**522.11.1** Where significant solar radiation (AN2) or ultraviolet radiation is experienced or expected, a wiring

system suitable for the conditions shall be selected and erected or adequate shielding shall be provided. Special precautions may need to be taken for equipment subject to ionising radiation.

**NOTE:** See also Regulation 522.2.1 dealing with temperature rise.

**522.12 Seismic effects (AP)**

**522.12.1** The wiring system shall be selected and erected with due regard to the seismic hazards of the location of the installation.

**522.12.2** Where the seismic hazards experienced are low severity (AP2) or higher, particular attention shall be paid to the following:

(i) The fixing of wiring systems to the building structure

(ii) The connections between the fixed wiring and all items of essential equipment, e.g. safety services, shall be selected for their flexible quality.

**522.13 Movement of air (AR)**

**522.13.1** See Regulation 522.7, Vibration (AH), and Regulation 522.8, Other mechanical stresses (AJ).

**522.14 Nature of processed or stored materials (BE)**

**522.14.1** See Section 527, Selection and erection of wiring systems to minimize the spread of fire and

Section 422, Precautions where particular risks of fire exist.

**522.15 Building design (CB)**

**522.15.1** Where risks due to structural movement exist (CB3), the cable support and protection system

employed shall be capable of permitting relative movement so that conductors and cables are not subjected to excessive mechanical stress.

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**522.15.2** For a flexible structure or a structure intended to move (CB4), a flexible wiring system shall be used.