REGULATIONS FOR THE ELECTRICAL EQUIPMENT OF BUILDINGS

TWELFTH EDITION - 1950

Third impression

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EDITIONS

The following editions have been published

FIRST EDITION	entitled "Rules and Regulations for the Prevention of Fire Risks arising from Electric Lighting," *Issued in* 1882.
SECOND EDITION	*Issued in* 1888.
THIRD EDITION	entitled "General Rules recommended for Wiring for the Supply of Electrical Energy," *Issued in* 1897.
FOURTH EDITION	*Issued in* 1903.
FIFTH EDITION	entitled "Wiring Rules," *Issued in* 1907.
SIXTH EDITION	*Issued in* 1911.
SEVENTH EDITION	*Issued in* 1916.
EIGHTH EDITION	entitled "Regulations for the Electrical Equipment of Buildings," *Issued in* 1924.
NINTH EDITION	*Issued in* 1927.
TENTH EDITION	*Issued in* 1934.
ELEVENTH EDITION	*Issued in* 1939.
ELEVENTH EDITION (REVISED)	*Issued in* 1943.
ELEVENTH EDITION (REVISED 1943),	*Reprinted with minor amendments* 1945.
	Supplement issued, 1946.
	Revised Section 8 *issued,* 1948.
TWELFTH EDITION	*Issued in* 1950.

FOREWORD TO THE 12TH EDITION

The 12th Edition supersedes as from its date of issue, 1st May, 1950, all previous editions of the Regulations for the Electrical Equipment of Buildings.

Since the issue of the 11th Edition in 1939, Supplements dated 22nd February, 1940, and 6th February, 1943, were issued, and these were embodied into a reprint, together with certain further amendments, in December, 1943. Recommended War Emergency Relaxations appeared on 26th June, 1942, to take account of the scarcity of certain materials under war conditions, but these Relaxations did not form part of the Regulations. In March, 1946, a Supplement to the 1943 reprint was issued to take account of recommendations first put forward by the Study Committee on Electrical Installations, who drew up Post-war Building Studies No. 11—Electrical Installations, published by H.M. Stationery Office, in 1944, and to provide for the use of p.v.c.-insulated and -sheathed cables. With the issue of this Supplement the currency of the War Emergency Relaxations ceased. Owing to the rapid development of the use of electric discharge lighting, this subject was dealt with as a matter of urgency before the issue of a new Edition, and a Revised Section 8 was accordingly issued in July, 1948.

In the 12th Edition the Regulations as a whole have been completely reviewed and recast, and the 1946 Supplement and Revised Section 8 have been incorporated with little change.

Codes of Practice

Since the appearance of the 11th Edition, the preparation of electrical Codes of Practice has been undertaken by the Codes of Practice Committee for the Electrical Equipment of Buildings, convened by the Council of The Institution on behalf of the Council for Codes of Practice for Buildings (Construction and Engineering Services). The Codes, which are published on behalf of the Council for Codes of Practice by the British Standards Institution, offer guidance on good practice in the electrical equipment of buildings and necessarily deal with many subjects referred to in the Regulations. The principle has been established from the outset that, as the Regulations set forth minimum requirements for safety (and are therefore written in mandatory terms), the Codes will in no circumstances countenance a practice less desirable on grounds of safety from fire and shock than that required by the Regulations, though

they may on occasion go further, selecting one of a number of methods approved by the Regulations and recommending it as the preferred practice.

A further series of Engineering Codes of Practice which fall outside the scope of the Council for Codes of Practice for Buildings is also in preparation under arrangements entered into between the British Standards Institution and the major Engineering Institutions; the recommendations of these Codes will also be in consonance with the Regulations.

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THE INSTITUTION OF ELECTRICAL ENGINEERS

REGULATIONS FOR THE ELECTRICAL EQUIPMENT OF BUILDINGS

TWELFTH EDITION

Introduction

These Regulations, which state the main requirements and precautions for ensuring satisfactory results, including safety from fire and shock, relate to the distribution of electrical energy in and about all types of dwelling-houses, business premises, public buildings, and factories, whether the electric supply is derived from an external source or from private generating plant. They also relate to the generation and storage of electrical energy for private purposes; but with a public supply they are applicable only to the consumer's side of the consumer's terminals. They are not applicable to telephone or radio circuits, except where such circuits are connected to a public or private supply system.

The Regulations apply equally to a.c. and d.c. installations, except where a specific reference is made to one or other type of installation, and they primarily concern installations in which the declared voltage between conductors does not normally exceed 650 volts. Some requirements for high-voltage circuits and apparatus will, however, be found in Regulation 712 (Electrode Water-Heaters and Boilers) and in Section 9 [Electric Discharge Lamps (High-Voltage)].

The Regulations are not intended either to take the place of a detailed specification or to instruct untrained persons, and they are supplementary to the following statutory Regulations wherever these are applicable:—

The Electricity Supply Regulations, 1937.*†

Electricity (Factories Act) Special Regulations, 1908 and 1944, administered by the Minister of Labour and National Service under the Factories Act, 1937.†

Cinematograph Regulations issued by the Home Office under the Cinematograph Act, 1909.†

General Regulations as to the Installation and Use of Electricity under the Coal Mines Act, 1911.†

The regulations and requirements of (*a*) the respective licensing authorities for theatres and other places of public resort, and (*b*) other local government authorities having statutory powers in respect of the installations in certain specified buildings. (Application for information concerning such regulations and requirements should be made to the authorities concerned. A "Manual of Safety Requirements in Theatres and Other Places of Public Entertainment" has been issued by the Home Office.†)

Overhead distribution installations entailing work external to buildings are not dealt with in the Regulations herewith, and attention is drawn to the Overhead Line Regulations† administered by the Ministry of Fuel and Power.

Various methods of installation are provided for, and to guard against the risk of fire and shock the method selected should be suitable for the voltage, the atmospheric conditions, the size of the installation, and the type of building.

Only proved materials, appliances, and methods, are considered, but it is not intended to discourage invention or to exclude other materials, appliances, and methods, which may be proved in the future. Where the use of a material, invention, or design, which is not contemplated in the Regulations, is proposed or adopted, thereby necessitating a departure from, or rendering unnecessary (on the grounds of safety) compliance in certain respects with, the Regulations, such departure or non-compliance should be the subject of the written specification of a competent body, or com-

* By virtue of Section 60 of the Electricity Act, 1947, these Regulations, made by the Electricity Commission, now have effect as if made by the Minister of Fuel and Power under that Section. Where compliance with the Regulations for the Electrical Equipment of Buildings issued by The Institution of Electrical Engineers, which are for the time being current and are approved by the Minister of Fuel and Power for that purpose, can be proved in relation to any consumer's installation, that installation is deemed to fulfil the requirements of Regulations 25, 27, 28, 29, 31 of the Electricity Supply Regulations, 1937.

† Copies of these publications may be obtained from H.M. Stationery Office or through any bookseller.

petent person or persons, and should result in a degree of safety from shock and fire not less than that assured by compliance with the Regulations. · Such an installation shall not, however, be described as complying with the Regulations.

The Council of The Institution of Electrical Engineers may make appropriate addition to, or modification of, these Regulations as may in their opinion be necessary to provide for the use of additional methods, materials, or appliances, which are shown to their satisfaction to be not less safe than those covered by the following Regulations, which supersede all earlier Regulations made in previous editions or in supplements thereto.

Notice of the intention to initiate or extend an electrical installation should be given by the consumer to the fire office with whom the premises are insured, and, where the supply is obtained from an external source, also to the supply authority concerned.

Where the fire risks of the premises are of an unusual character, the special requirements of the fire office insuring the risk should be ascertained and complied with.

Definitions

NOTE. The following definitions indicate the sense in which the expressions defined are used in these Regulations

Accessory. Any device, other than a lighting fitting, associated with the wiring and current-using appliances of an installation; for example, a switch, a fuse, a plug, a socket-outlet, a lampholder, or a ceiling rose.

Adaptor, Socket-outlet. An accessory for insertion into a socket-outlet and containing metal contacts to which may be fitted one or more plugs for the purpose of connecting to the supply portable lighting fittings or other current-using appliances.

Bunched. Cables are said to be "bunched" when two or more are contained within a single conduit, duct, or groove, or, if not enclosed, are not separated from each other.

Cable. A length of insulated single conductor (solid or stranded), or of two or more such conductors, each provided with its own insulation, which are laid up together. The insulated conductor or conductors may or may not be provided with an overall mechanical protective covering.

Cable, Armoured. A cable provided with a wrapping of metal (usually tapes or wires), primarily for the purpose of mechanical protection.

Cable, Flexible. A cable consisting of one or more cores, each formed of a group of wires, the diameters of the wires and the insulating material being such as to afford flexibility.

Cable, Lead-sheathed. A cable provided with a lead or lead-alloy sheath for the purpose of excluding moisture from the conductors and their insulation.

Cable, Mineral-insulated metal-sheathed. A cable in which a conductor insulated by a highly compressed refractory mineral insulating material, such as magnesia, is contained in a solid-drawn hard-metal sheath.

Cable, P.V.C.-insulated. A cable in which the insulation of the conductor or conductors is a polyvinyl-chloride compound.

Cable, P.V.C.-sheathed. A cable in which mechanical protection is provided to the core or cores by a sheath of a polyvinyl-chloride compound.

Capacitor. A piece of apparatus capable of storing electrical energy as electric stress in insulating material and generally consisting of conducting surfaces (known as "plates" or "electrodes") at a small distance apart and separated by insulating material.

NOTE.—In the past the term "condenser" was commonly used instead of "capacitor," but its use in this sense is now deprecated.

Circuit. An arrangement of conductors for the purpose of carrying current.

Circuit, Extra-low-voltage. A circuit in which the voltage between conductors and between every conductor and earth does not normally exceed extra-low-voltage and which is not metallically connected to any system operating at a voltage exceeding extra-low-voltage.

Circuit, Final Sub-. An outgoing circuit connected to one way in a distribution fuseboard and intended to supply electrical energy at one or more points to current-using appliances, without the intervention of a further distribution fuseboard other than a one-way board. It includes all branches and extensions derived from that particular way in the board.

Circuit-breaker. A mechanical device for making and breaking a circuit under normal conditions and under abnormal conditions such as those of short circuit, the operation under abnormal conditions being usually automatic.

Conductor (of a core or cable). The conducting portion, consisting of a single wire or of a group of wires.

Conductor, Bare. A conductor not covered with insulating material.

Connector (for a cable or flexible cord). A mechanical clamp shrouded in insulating material, for connecting the conductor of a cable or of a flexible cord to that of another cable or of another flexible cord.

Connector (for a portable electrical appliance or for extending a flexible cord). A combination of a plug and socket arranged for attachment to a portable electrical appliance or to a flexible cord.

Consumer's earth impedance. (*See* Earth impedance, Consumer's.)

Consumer's terminals. The ends of the electric conductors situated upon any consumer's premises and belonging to him, at which the supply of energy is delivered from the service lines.

Cord, Flexible. A flexible cable in which the cross-sectional area of each conductor does not exceed 0·007 square inch.

Core (of a cable). The conductor with its insulation but not including any mechanical-protective covering.

Damp situation. A situation in which moisture is either permanently present, or intermittently present to such an extent as to be likely to impair the effectiveness of an installation conforming to the requirements for ordinary situations.

Discharge lamp, electric. (*See* Electric discharge lamp.)

Distribution fuseboard. An assemblage of parts including one or more fuses (or other overload protective devices) arranged for the distribution of electrical energy to final sub-circuits or to other distribution fuseboards.

Earth. A correction to the general mass of earth by means of an earth electrode. An object is said to be "earthed" when it is electrically connected to an earth electrode; and a conductor is said to be "solidly earthed" when it is electrically connected to an earth electrode without a fuse, switch, circuit-breaker, resistor, or reactor, in the earth connection.

Earth-continuity conductor. The wire, clamp, or other conductor, connecting to the earthing lead or to each other those parts of an installation which are required to be earthed. It may be in whole or in part the metal conduit or the metal sheath of the cables, or the special continuity wire of a cable or flexible cord incorporating such a wire.

Earth electrode. A metal rod, water-pipe, or other conductor, electrically connected with the general mass of earth.

Earth impedance, Consumer's. The sum of the impedance (measured in accordance with the requirements of Regulation 1106) of the consumer's earth-continuity conductor and earthing lead and the resistance of the earth electrode to the general mass of earth (measured in accordance with the requirements of Regulation 1107).

Earthed concentric wiring. A system of wiring in which one of the conductors (known as the "external" conductor) is effectually earthed and completely surrounds the other (known as the "internal" conductor) throughout its length.

Earth-free situation. A situation in which there is no likelihood of an electric shock to earth from any live metal.

NOTE.—Bathrooms, sculleries, damp situations (*see* Definition), rooms with concrete floor surfaces, and similar situations, are deemed not to be earth-free.

A situation in which a radio receiver having a bare or lightly-insulated aerial or earth connection is installed is also deemed not to be earth-free.

Earthing lead. The final conductor by which the connection to the earth electrode is made.

Electric discharge lamp. An electric lamp comprising a hermetically sealed bulb or tube containing gas and/or metal intended to be vaporized during operation, and fitted with electrodes between which a discharge of electricity takes place, the useful light being emitted from, and/or excited by, the discharge through the gas or vapour.

Electrode water-heater (or electrode boiler). Apparatus for the electrical heating of water or other liquid by the passage of electric current between electrodes immersed therein or through a resistor which owing to its being in electrical contact with the water or other liquid is in this respect indistinguishable from an electrode.

Final sub-circuit. (*See* Circuit, Final Sub-.)

Fire resistance. That property by virtue of which an element of a structure functions satisfactorily while subjected to a prescribed heat influence and load for a period as specified in B.S. 476.

Fitting, Lighting. A device for supporting or containing a lamp or lamps, together with any holder, shade, or reflector; for example, a bracket, a pendant with ceiling rose, an electrolier, or a portable standard.

Fittings wire. A cable, generally of small conductor and overall diameter, suitable only for the internal wiring of fittings having small bore or aperture and when not subject to disturbance or mechanical damage.

Flameproof. A flameproof enclosure for electrical apparatus is one which will withstand without injury any explosion of prescribed inflammable gas that may occur within it under practical conditions of operation within the rating of the apparatus (and recognized overloads, if any, associated therewith) and will prevent the transmission of flame such as will ignite any

prescribed inflammable gas that may be present in the surrounding atmosphere.

NOTE.—Electrical apparatus should not be described as "flameproof" unless it complies in all respects with B.S. 229 (Flameproof enclosures).

Flexible cable. (*See* Cable, Flexible.)

Flexible cord. (*See* Cord, Flexible.)

Fuse. A device for opening a circuit by means of a conductor designed to melt when an excessive current flows. The fuse comprises all the parts that form the complete device.

NOTE.—The current rating of a fuse is a current, less than the minimum fusing-current, stated by the maker as the current that the fuse, and the fuse-link with which it is fitted, will together carry continuously without deterioration (*see* B.S. 88).

Fuse, Cartridge. A fuse in which the fuse-element is totally enclosed in a cartridge.

Fuse-element. That part of a fuse which is designed to melt and thus open a circuit.

Fuse-link. That part of a fuse which comprises a fuse-element and a cartridge or other container, if any, and either is capable of being attached to fuse contacts or is fitted with fuse contacts as an integral part of it.

Fuse-switch. A switch the moving part of which carries one or more fuses.

Immersion heater. An appliance containing an electrically heated resistor for raising the temperature of the liquid in which it is immersed without being itself in contact with such liquid.

Impedance. The ratio, at the frequency of the supply, of r.m.s. voltage applied to a circuit to the r.m.s. current produced thereby.

Incombustible. (*See* Non-ignitable.)

Inflammable. An inflammable material is one capable of being easily ignited.

Insulation (of a cable). That part of a cable which is relied upon to insulate the conductor.

Insulation, Double

(1) of a conductor.

A conductor is said to have double insulation when insulating material intervenes not only between the conductor

and its surrounding envelope (if a cable) or immediate support (if bare), but also between the envelope or support and earth.

(2) of a portable appliance.

A portable appliance which is partially or wholly metal-clad is said to have double insulation when adequate spacing or suitable insulating material with adequate creepage path intervenes not only between every live part and its surrounding envelope (if a cable) or immediate support (if bare), but also between the envelope or support and an external casing which so encloses the complete appliance that no internal part can be touched.

Joint box. A box forming part of a wiring installation, provided to contain joints in the conductors of the cables of the installation.

Junction box. A box connecting two or more lengths of conduit or duct.

Lampholder plug. An accessory for insertion into a lampholder for the purpose of connecting to the supply a current-using appliance.

Lead-sheathed cable. (*See* Cable, Lead-sheathed.)

Lighting fitting. (*See* Fitting, Lighting.)

Live. An object is said to be "live" when:—

(*a*) a difference of potential exists between it and earth; or

(*b*) it is connected to the "middle wire," "common return," or "neutral," of a supply system in which that conductor is not permanently and solidly earthed.

Mineral-insulated metal-sheathed cable. (*See* Cable, Mineral-insulated metal-sheathed.)

Non-ignitable (Incombustible). A non-ignitable material is one which neither burns nor gives off inflammable vapours in sufficient quantity to ignite at a pilot flame when heated in the manner specified in B.S. 476 or in B.S. 738 whichever is applicable.

Non-inflammable. A non-inflammable material is one which, when tested in the manner described in B.S. 476, does not glow or carry flame and is neither charred nor scorched in excess of the amount permitted therein.

Plug. (*See* Socket-outlet and plug.)

Plug, Lampholder. (*See* Lampholder plug.)

Point, in wiring. Any termination of the fixed wiring intended for the attachment of a lighting fitting or of a device for connecting to the supply a current-using appliance.

Polyvinyl-chloride- (p.v.c.-) insulated cable. (*See* Cable, P.V.C.-insulated.)

Polyvinyl-chloride- (p.v.c.-) sheathed cable. (*See* Cable, P.V.C.-sheathed.)

Resistance area (for an earth electrode only). The area of ground (round an earth electrode) within which a voltage gradient measurable with ordinary commercial instruments exists when the electrode is being tested.

NOTE.—Beyond the resistance area the voltage gradient is too small to be measured. When earth resistance is being measured, it is important to ensure that the resistance areas of the electrodes do not overlap. (*See* Regulation 1107.)

Resistor. A piece of apparatus used primarily because it possesses the property of electrical resistance.

Self-extinguishing. A self-extinguishing material is one which, having been ignited, does not continue to burn after the source of heat is removed (see B.S. 738).

Sign, Electric. A word, letter, model, border, outline, box, device, representation, announcement, or direction (including the framework and backing, and the means of attachment to the building or supporting structure), illuminated by means of filament lamps and/or electric discharge lamps, the means of illumination forming an integral part thereof.

Socket-outlet adaptor. (*See* Adaptor, Socket-outlet.)

Socket-outlet and plug. A device consisting of two portions for easily connecting to the supply portable lighting fittings and other current-using appliances, normally by means of flexible cords or cables. The socket-outlet is designed to be the fixed member, and the plug portion carries two or more metal contacts which connect with corresponding metal contacts in the socket portion.

Sub-Circuit, Final. (*See* Circuit, Final Sub-.)

Switch. A device, other than a fuse, circuit-breaker or thermostat, for closing and/or opening a circuit.

Switch-and-fuse. A unit comprising a switch and one or more fuses, the fuses not being carried on the moving part of the switch.

Switch, linked. A switch the blades of which are so linked mechanically as to make or break all poles simultaneously or in a definite sequence.

Switch, Single-pole. A switch suitable for closing and/or opening a circuit on one pole or phase only.

Switchboard. An assemblage of switchgear with or without instruments; but the term does not apply to a group of local switches on a final sub-circuit where each switch has its own insulating base.

NOTE.—In the Electricity (Factories Act) Special Regulations, 1908 and 1944, the term "Switchboard" includes "Distribution board."

Switchboard, Open-type. A switchboard in which the current-carrying parts of the switchgear are not provided with protecting covers.

Switchgear. Apparatus for controlling the distribution of electrical energy, or for controlling or protecting electrical circuits, machines, and current-using appliances.

Thermostat. An automatic device designed to open and/or close a circuit in response to changes of temperature.

Tough Rubber. A tough-rubber compound used as a sheathing or protection of a cable, or as both, and complying with B.S. 7.

Voltage, Extra-low / Low / Medium / High — Potential difference, between conductors, of the following values, subject to such variations as are permissible under the Electricity Supply Regulations administered by the Minister of Fuel and Power:—

Extra-low. Normally not exceeding 30 volts r.m.s. A.C. or 50 volts D.C.

Low. Normally exceeding extra-low-voltage but not exceeding 250 volts.

Medium. Normally exceeding 250 volts, but not exceeding 650 volts.

High. Normally exceeding 650 volts.

Water-heater, Electrode. (*See* Electrode water-heater.)

Weatherproof. Accessories, lighting fittings, and current-using appliances, are said to be of the "weatherproof" type if they are so constructed that, when installed, rain, snow, and splashings, are excluded.

General

Regulations 1–4

1 Good workmanship is an essential requirement for compliance with these Regulations. **Workmanship.**

2 Every installation shall comply with the specific requirements of Sections 1 to 13 of these Regulations, which are based on the following general principles:— **Specific requirements.**

(A) All electrical apparatus and conductors shall be of such construction and size as to prevent excessive temperature rise while in service, and so made and installed as to prevent danger so far as is reasonably practicable. **Construction and conditions of use.**

(B) All live conductors, including those forming part of apparatus (other than those of extra-low-voltage circuits) shall either be so insulated, and further effectively protected where necessary, or so placed and safeguarded, as to prevent danger so far as is reasonably practicable. **Insulation and protection of live conductor.**

(C) Any metalwork other than the current-carrying conductors, enclosing, supporting or otherwise associated with such conductors operating at voltage in excess of extra-low-voltage shall, where necessary to prevent danger, be connected with earth. **Precautions against metalwork becoming electrically charged.**

(D) Every circuit shall be protected against the persistence of such excess current as might cause danger, and circuit-breakers or fuses provided for this purpose shall have a breaking capacity related to the maximum fault current that can flow in the circuit concerned. **Protection against excess current.**

(E) Every circuit shall be protected against the persistence of earth-leakage currents of such a magnitude as to cause danger. **Protection against effects of earth-leakage.**

(F) Effective means, suitably placed for ready operation, shall be provided so that all voltage may be cut off from every part of a system and from all electrical apparatus, as may be necessary to prevent danger. **Isolation of systems and apparatus.**

(G) Every piece of electrical apparatus which requires operation or attention in normal use shall be so installed that adequate means of access and working space are afforded for such operation or attention. **Position of apparatus.**

Precautions for special conditions.

(H) All electrical apparatus and conductors exposed to the weather, corrosive atmospheres or other adverse conditions shall be so constructed or protected as may be necessary to prevent danger arising from such exposure. Where the conditions comprise exposure to inflammable surroundings or an explosive atmosphere, the conductor or apparatus shall be protected by a flameproof enclosure of an appropriate standard of construction, or be otherwise of such construction or intrinsically-safe characteristics, as to prevent danger.

Addition to an installation.

3 No addition, temporary or permanent, shall be made to the authorized load of an existing installation, unless it has been ascertained that the current-carrying capacity and the condition of any existing apparatus (including that of the supply authority) which will have to carry the additional load are adequate for the increased loading.

Instructions for periodical inspection and testing.

4 A notice of a size not less than 4 inches long by 2 inches high, of such durable material as to be likely to remain easily legible throughout the life of the installation, shall be fixed in a prominent position at or near the main distribution fuseboard of every installation. The notice shall be inscribed in indelible characters not smaller than those shown below (12-point) and shall read as follows:—

"IMPORTANT

This installation should be periodically inspected and tested, and a report on its condition obtained, as prescribed in the Regulations for the Electrical Equipment of Buildings issued by The Institution of Electrical Engineers."

Section 1

Regulations 101–115

THE CONTROL AND DISTRIBUTION OF THE SUPPLY

101 Every installation supplied from an external source shall, subject to the requirements of Regulations 102 and 106, be adequately controlled as a whole by the switchgear specified in Table 2 for the respective systems of supply and wiring in use. This switchgear may either **Main switchgear.**

(i) be combined in a consumer's supply control unit, or
(ii) be combined on a switchboard, or
(iii) be in the form of independent switches or fuses, or
(iv) be combined in the same case as the circuit fuses in the form of a combined distribution fuseboard and main switch.

102 Provision shall be made for disconnecting all conductors of the installation for the tests specified in Regulation 1103. **Isolation.**

103 (A) The equipment installed at the supply intake position shall be arranged in the following sequence:— **Sequence of equipment.**

(i) service cable and sealing box, if any (S.C.);
(ii) service fuses and neutral link, if any (S.F.);
(iii) watt-hour meter (M.);
(iv) linked switch (S.);
(v) consumer's main fuse, when provided (M.F.);
(vi) consumer's circuit fuses (C.F.)

(B) Where a linked circuit-breaker (C.) is used in place of a linked switch and consumer's main fuse, this shall be substituted for items (iv) and (v) in the sequence in clause (A).

NOTE 1.—The following diagrams indicate the standard sequence required by Regulation 103, (i) being the sequence where a main switch is used, (ii) being the sequence where a circuit-breaker is used:—

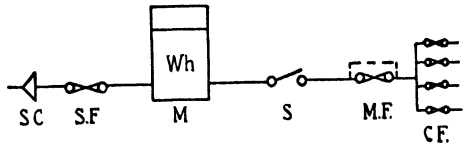


FIG. (i)

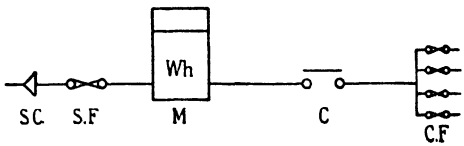


FIG. (ii)

NOTE 2.—All equipment set out in Note 1 may be combined in a single control unit (see B.S. 1454); alternatively the linked switch (S.) may be combined with the consumer's main fuse in a switch-and-fuse unit, or with the consumer's circuit fuses in a splitter unit.

NOTE 3.—Where separate metering, e.g. for lighting and heating or power circuits is required, it will be necessary to duplicate some of the equipment detailed above, and the same standard sequence will be applicable in each circuit.

Position.

104 The main switchgear referred to in Regulation 101 shall be readily accessible to the consumer and situated as near as practicable to the termination of the service line or cable.

Duplication of switchgear.

105 If the main switchgear, although supplied and installed by the supply authority, may be operated by the consumer, it need not be duplicated by him.

Omission of consumer's main fuses.

106 The consumer's main fuses, indicated by the letters M.F. in Note 1 to Regulation 103 and specified in column 7 of Table 2, may be omitted provided that:—

(i) The installation is controlled by a consumer's electricity control unit complying with B.S. 1454;

or (ii) The installation is controlled by a combined distribution fuseboard and main switch, where the distribution fuseboard comprises not more than eight fused ways each rated at not more than 30 amperes, and

the total connected load is not more than 60 amperes;

or (iii) The service fuses installed by the supply authority are used for one consumer only, and the consent of the supply authority to the omission of the consumer's main fuses has been obtained.

NOTE 1.—Where the consent of the supply authority has been obtained to the omission of the consumer's main fuses as provided in (iii), the sizes of the distribution fuseboard, the main switch and the connected load need not be limited as described in (ii).

NOTE 2.—Where, in a domestic installation having a total connected load exceeding 15 amperes, the supply authority's fuse is of the cartridge type in accordance with B.S. 1361, it is recommended that the consumer's main fuse be omitted and that the consumer's circuit fuses be in accordance with B.S. 1361. If in such circumstances the consumer's circuit fuses are not in accordance with this Specification, they should be of a type and rating capable of providing reasonable discrimination under fault conditions.

107 Where a switchboard of the ironclad type, having its busbars totally enclosed in a rigid metal case, supplies two or more circuits, means of disconnecting the busbars from the supply shall be provided, e.g. a main switch, isolating links, or fuses. **Ironclad switchgear.**

108 (A) Open-type switchboards shall be placed only in dry situations and in well-ventilated rooms, and if such switchboards are used in the vicinity of batteries, arrangements shall be made to prevent the access of acid fumes thereto. **Position of switchboards.**

(B) Every switchboard installed in a damp situation or where inflammable or explosive dust, vapour, or gas, is likely to be present, shall be of the enclosed type or of the flameproof type, as may be necessitated by the particular circumstances.

109 Every distribution fuseboard shall comply in its design and construction with Regulations 1301 and 1303, and shall be connected to one of the following:— **Distribution fuseboards.**

(A) The main switchgear controlling the supply.

(B) A separate way on a larger distribution fuseboard or switchboard.

(C) One or more other distribution fuseboards, either by looping-in to their busbars or to form a ring circuit. Fuse-links or disconnecting links may, if desired, be inserted in the connecting circuits. The circuit feeding such an arrangement of distribution fuseboards shall itself be connected to one way of a switchboard, or, through switchgear, direct to the source of supply.

Protection of circuits against excess current.

110 Throughout an installation every circuit shall be protected against the persistence of an excess-current condition by the provision of suitably rated fuses or circuit-breakers installed in accordance with the requirements of Regulations 111 and 114.

Provision of fuses and circuit-breakers.

111 In the installation of switches and in the provision of protection against excess-current conditions, the following requirements (A) to (C) shall be observed as may be appropriate for both a.c. and d.c. installations.

(A) In every installation connected to a source of supply having its neutral, middle wire or common return conductor permanently and effectively connected with earth, fuses or circuit-breakers shall be inserted in every non-earthed conductor. No fuse, non-linked switch or non-linked circuit-breaker shall be inserted in the conductor connected with earth.

NOTE 1.—A permanent and effective connection with earth is one in which the resistance between the earth electrode (or electrodes) and the general mass of earth does not at any time exceed one ohm, and which is not broken in any circumstances (including testing and the location of faults) while any conductor in the circuit is alive. This requirement is met in the case of all a.c. supplies given in accordance with the Electricity Supply Regulations, 1937.

NOTE 2.—The requirements of permanent and effective earthing do not preclude the provision in a consumer's installation of a means of breaking the neutral, provided that arrangements have been made whereby all non-earthed conductors must be broken either simultaneously or previously to the breaking of the neutral.

NOTE 3.—Attention is drawn to the particular importance of adopting the correct colouring of cables as specified in Regulations 309 to 311, where the neutral is unfused in accordance with the requirements of this Regulation.

(B) In every installation connected to a source of supply having no permanent and effective connection with earth as described in Note 1 above, fuses or circuit-breakers shall be inserted in every conductor, except that in a 3-wire or 4-wire installation no fuse, non-linked switch or non-linked circuit-breaker shall be inserted in any neutral, middle wire or common return conductor forming part of a medium-voltage installation.

NOTE.—For the purpose of this Regulation, a 2-wire low-voltage installation derived from a 3-wire or 4-wire medium-voltage installation shall not be deemed to form part of the medium-voltage installation.

(C) In an earthed-concentric system of wiring, installed in accordance with Regulation 410, no fuse, non-linked switch or non-linked circuit-breaker shall be inserted in the earthed external conductor.

Isolating link.

112 The requirements of Regulations 110, 111 and 1204 shall not preclude the provision, for testing purposes, of an isolating link having a current-carrying capacity at least equal to that of the conductor which it is intended to isolate. Such an isolating link shall be securely fixed to its terminals by bolts or screws, or shall be so arranged that it is in permanent contact before the switches in the other conductors can be operated; it shall only be used to disconnect the earthed conductor subsequent to the disconnection of the other conductors.

Position of single-pole switches.

113 (A) In every 2-wire installation or circuit all single-pole switches shall be fitted in the same conductor throughout, being that connected to the phase or outer conductor, or to the non-earthed conductor, of the supply.

(B) In every 3-wire or 4-wire installation every single-pole switch shall be in a conductor connected to an outer or phase conductor of the supply.

Relative sizes of conductor and fuse.

114 (A) In every circuit and sub-circuit every cable, including every flexible cord not protected by a fuse in a plug or socket-outlet adaptor, shall, except as provided in Regulation 201 (C), have a current rating not less than that of the fuse-element, nor less than one-half of the operating current of the circuit-breaker, which protects the circuit or sub-circuit, respectively. (See Regulations 611, 612, and 704.)

Reduction in cross-section of conductors.

(B) Where a reduction in cross-section is made to a conductor, e.g. at an extension or branch thereof, the smaller conductor shall, except as provided in Regulation 201 (C) and subject to clause (C) below, be protected locally either by a circuit-breaker or by a fuse, except where the rating of the fuse-element, or one-half the operating current of the circuit-breaker, protecting the larger, does not exceed the rating of the smaller conductor. This clause shall not apply to circuits where the reduction of cross-section is necessary for technical reasons of electrical design and where local protection is undesirable or unnecessary, e.g. in the shunt-coil circuit of a contactor where the entire sub-circuit wiring is contained within the case of the contactor.

(C) Where a branch conductor is in the form of a tapping from a main conductor having a current rating exceeding 150 amperes and it is impracticable for the local fuse or circuit-breaker referred to in Clause (B) above to be at the actual point of tapping or to be enclosed within the duct or housing containing the main conductor, the following requirements shall apply:—

(i) The length of the branch conductor between the point of tapping and the local fuse or circuit-breaker shall not exceed 50 feet.

(ii) The cross-sectional area of the branch conductor between the point of tapping and the local fuse or circuit-breaker shall be such that its current rating is at least one-quarter of that of the main conductor, and its area shall not be reduced except at a subsequent fuse or circuit-breaker.

(iii) The branch conductor between the point of tapping and the local fuse or circuit-breaker shall be adequately protected against mechanical damage and unauthorized interference, and its surroundings shall be fire-resisting.

(iv) If the branch conductor is insulated with vulcanized rubber or other inflammable material and the main conductor is enclosed in a duct or casing, the aperture in such duct or casing through which the branch conductor emerges shall be suitably plugged with non-ignitable material, and all inflammable insulating

material shall be removed from that portion of the branch conductor which projects more than half an inch into the main duct or casing.

(v) The breaking capacity of the fuses and/or circuit-breakers protecting the main and branch conductors shall be correctly related to the estimated short-circuit current in any such conductors.

(vi) The above requirements (i) to (v) shall also apply to a circuit or sub-circuit connected to a switchboard where a fuse or circuit-breaker is not fixed at the actual point of tapping, but are not intended to apply to internal interconnections of switchboards.

Medium-voltage between two or more low-voltage circuits.

115 (A) Where two or more low-voltage circuits between which medium-voltage may exist are installed in the same room, corridor, staircase or other location, any terminals (other than those of portable appliances) or other fixed live metal parts not permanently shrouded in insulating material, between which medium-voltage may exist, shall be installed to comply with one of the following requirements (i), (ii) or (iii).

(i) They shall be enclosed in earthed metal marked to indicate the risk of dangerous shock due to the presence of medium-voltage, and the enclosure shall be so constructed that it is possible to obtain access, in turn, to every terminal or other fixed live metal not permanently shrouded in insulating material without simultaneously exposing parts between which there may be medium-voltage;

or (ii) they shall be installed in a room accessible only to authorized persons;

or (iii) they shall be so fixed that they are not less than 6 ft. apart.

(B) In any room having a floor area less than 500 sq. ft. all low-voltage socket-outlets shall be connected to the same pair of supply conductors.

Section 2

Regulations 201–210

THE ARRANGEMENT OF FINAL SUB-CIRCUITS AND THE APPLICATION OF DIVERSITY THERETO

NOTE.—Diversity factors in general are dealt with in Section 3, but additional Regulations governing their application to final sub-circuits are contained in this Section. In the case of socket-outlets not fitted with fused plugs the assessment of their demands must be in accordance with Regulation 202 (D) and (E).

Socket-outlet circuits to which the connection of all flexible cords is by means of fused plugs are subject to special diversity considerations and may be installed as provided by Regulation 201 (C).

Connection of final sub-circuits.

201 (A) Every final sub-circuit shall be connected to a separate way in a distribution fuseboard, provided that where there is only one such sub-circuit it may be directly connected to the main switchgear.

NOTE.—The use of a fuse in a plug or in a socket-outlet adaptor does not obviate the necessity of complying with Regulation 201 (A).

Final sub-circuits not exceeding 15 amperes rated capacity.

(B) A final sub-circuit having a rated capacity not exceeding 15 amperes may supply an unlimited number of points provided that:—

(i) the aggregate rating of the points does not exceed the current rating of the cable;

(ii) in installations in private houses or residential flats there shall be at least one final sub-circuit for lighting, apart from socket-outlets, for each 1 000 sq. ft. of floor area, or part thereof; and

(iii) the protection of flexible cords connected to the circuit complies with Regulation 202.

NOTE 1.—Regulations 506 and 807 contain special requirements for final sub-circuits in temporary installations and electric-discharge-lamp installations respectively.

NOTE 2.—In the interests of good planning, undue use should not be made of the provision that an unlimited number of points may be supplied by a single final sub-circuit.

Final sub-circuits exceeding 15 amperes rated capicity.

(c) A final sub-circuit having a rated capacity exceeding 15 amperes shall not supply more than one point except as specifically permitted in the following exemptions (i) to (iv). These exemptions apply to installations in private houses or residential flats and to other installations where the application of a diversity factor can be justified, and in which all connection of appliances to the circuits is either by means of fused plugs, or in accordance with clause (D) below. The application of these exemptions is restricted to the circuits and conditions described therein.

Exemptions:—

(i) A final sub-circuit having conductors of not less than 0·0045 sq. in. cross-sectional area (7/·029 in.) (or 0·003 sq. in. in the case of mineral-insulated metal-sheathed cable) and protected by a fuse having a current rating not exceeding 20 amperes may serve two socket-outlets each of 13-ampere rating.

(ii) A final sub-circuit having conductors of not less than 0·007 sq. in. cross-sectional area (7/·036 in.) (or 0·0045 sq. in. in the case of mineral-insulated metal-sheathed cable) and protected by a fuse having a current rating not exceeding 30 amperes may serve not more than six socket-outlets each of 13-ampere rating.

(iii) A final sub-circuit having conductors of not less than 0·0045 sq. in. cross-sectional area (7/·029 in.) (or 0·003 sq. in. in the case of mineral-insulated metal-sheathed cables) in the form of a ring both ends of which are brought into the terminal of a fuse having a rating not exceeding 30 amperes may serve not more than ten socket-outlets of 13-ampere rating; provided that in small houses or residential flats having a floor area not exceeding 1 000 sq. ft. the number of such socket-outlets served by such a ring circuit shall not be restricted.

(iv) It is permissible to take spurs from such a ring circuit as is described in (iii) above to outlying socket-outlets without intermediate fusing, provided that the branch conductors are not of smaller cross-

sectional area than those forming the ring, that each spur does not serve more than two such socket-outlets, that the aggregate number of socket-outlets served by spurs from any individual ring-circuit does not exceed the number served directly by the ring-circuit and that the maximum number of socket-outlets served by any such ring-circuit and associated spurs together does not exceed that permitted in (iii) above.

(D) Fixed appliances may be fed from any of the sub-circuits permitted under the exemptions (i) to (iv) in clause (C) above, provided they are fed through fuses of appropriate current-rating mounted adjacent to the appliance, and that the sum of the ratings of all such appliances fed from a single final sub-circuit does not exceed 15 amperes. Where the number of socket-outlets permissible under the exemptions is limited, for every fixed appliance so connected the permissible number shall be diminished by one.

Protection of final sub-circuits.

202 (A) The protection by fuse or circuit-breaker of every cable, including every flexible cord not protected by a fuse in a plug, shall, except as provided in Regulation 201 (C), be such that the current rating of the fuse, or one half the operating current of the circuit-breaker, does not exceed the current rating of the cable.

Fuses in plugs

(B) Where a fuse is fitted in a plug, the current rating of the fuse shall not exceed that of the flexible cord connected to the plug.

Size of conductors.

(C) A final sub-circuit supplying only one point shall have its conductors of such cross-sectional area that their current rating is at least equal to that of the point.

(D) Where a diversity factor is applicable (see Regulation 303), a final sub-circuit supplying more than one point shall, except as otherwise permitted under clause (F) below, have its conductors of such cross-sectional area that their current rating is at least two-thirds the aggregate current rating of all the points connected to the sub-circuit and in any event is not less than that of the largest point connected to the sub-circuit.

(E) In assessing, for the purposes of clauses (C) and (D)

above, the current ratings of the points connected to a final sub-circuit, other than those installed in accordance with the exemptions to Regulation 201 (C),

Every 15-ampere socket-outlet shall be deemed to require 15 amperes.

Every 13-ampere socket-outlet shall be deemed to require 13 amperes.

Every 5-ampere socket-outlet shall be deemed to require 5 amperes.

Every 2-ampere socket-outlet shall be deemed to require at least ½ ampere.

Every lampholder shall be deemed to require a current equivalent to the maximum load likely to be connected to it, which shall be assumed to be at least 60 watts.

Special installations.

(F) In certain installations, other than those in buildings intended for use as dwellings, it is permissible to use cables smaller than those stipulated in clause (D) above, provided that the installation has been carried out to the specification of a competent electrical engineer, and also provided that the circuit-breakers and fuses protecting the final sub-circuits are in the continuous charge of a responsible qualified person.

(G) In the event of the operating current of a circuit-breaker being increased, or a fuse protecting a final sub-circuit being replaced by a fuse of larger current-rating, every flexible conductor connected to the sub-circuit under the new conditions shall, unless it is protected by a fuse in a plug, have a current rating not less than that required by Regulation 202 (A) for the new conditions.

Fittings wire.

(H) The use of fittings wire shall be restricted to the internal wiring of lighting fittings.

Pilot lamp circuits.

203 (A) Where a pilot lamp used in connection with a current-using appliance is mounted directly on or within the case of the equipment controlling the appliance, and the whole of the wiring to the pilot lamp is contained within such case, the circuit-breaker or the fuse protection of the final sub-circuit supplying the appliance shall be deemed to be appropriate for the pilot lampholder and its wiring.

(B) Where any of the wiring to a pilot lamp used in connection with a current-using appliance is external to the case of the control equipment referred to in (A) above, the pilot circuit, unless already protected by the circuit fuse, shall be connected through a local fuse or fuses to the final sub-circuit supplying the appliance and the sizes of conductors and of the lampholder shall be in accordance with Regulations 202 and 606 respectively.

Electric lift circuits.

204 (A) Cables which supply current to the motor operating an electric lift or hoist shall not be included in any twin or multicore trailing cable used for the control and safety devices of the lift or hoist; and they shall not be connected to a distribution fuseboard controlling final sub-circuits for lighting unless the maximum current, including the starting or accelerating current, of the motor is less than 20 % of the total rating of the fuse-ways on the distribution fuseboard, and unless the fuse-way of the motor circuit is clearly labelled.

(B) A twin or multicore trailing cable which is used with an electric lift or hoist, and which incorporates any conductor of any circuit operated at the supply voltage, shall not include any conductor of an electric bell or similar signalling circuit which is operated at reduced voltage from the supply system, or which is energized from another source.

Control of lighting fittings.

205 Every lighting fitting shall be controlled, but not necessarily individually, either by a switch or switches or, subject to Regulation 208, by a socket-outlet and plug. Every such switch or socket-outlet shall be so placed as to be readily accessible.

Switch-lampholders.

206 Every switch-lampholder shall be provided with further means of control, which may be either a switch or a socket-outlet, in a readily accessible position in the same room.

Single-pole switches.

207 (A) In a 2-wire installation all single-pole switches shall be fitted in the same conductor throughout, which shall be the conductor connected to an outer or phase conductor or to the non-earthed conductor of the supply.

NOTE.—For compliance with Regulation 608 (K), a switch must be double-pole on an appliance connected to the supply by means of a reversible connector.

(B) In a 3-wire or a 4-wire installation every single-pole switch shall be fitted in a conductor connected to one of the outer or phase conductors of the supply.

Control of d.c. socket-outlets.

208 Where the supply is direct current, each socket-outlet shall be controlled by a switch immediately adjacent thereto or combined therewith.

NOTE.—In situations where a socket-outlet may be misused by children or others, it is desirable to install a type in which the contact tubes cannot remain live after, or, alternatively, are automatically screened by, the withdrawal of the plug.

Control of a.c. socket-outlets.

209 Where the supply is alternating current, a socket-outlet need not be controlled by a switch in the final sub-circuit to which it is connected.

NOTE.—In situations where a socket-outlet may be misused by children or others, it is desirable to install a type in which the contact tubes cannot remain live after, or, alternatively, are automatically screened by, the withdrawal of the plug.

Electric signs with grouped lampholders.

210 Any sub-circuit supplying, in conformity with clause 201 (B), an electric sign in which lampholders are grouped in close proximity shall, in addition to complying with the requirements of that clause, be controlled by a multipole linked switch or alternatively by a multipole linked circuit-breaker.

Section 3

Regulations 301–316

THE INSTALLING OF CONDUCTORS AND CABLES (GENERAL)

Conductors of cables.

301 (A) All conductors of cables, other than those specifically exempted below, shall be of a size in accordance with Tables 4, 16, 17 or 18 as may be appropriate.

Exemptions:—

(i) The conductors of mineral-insulated metal-sheathed cables;

(ii) The conductors of switchboard panel wiring forming an integral part of the switchboard.

(iii) The outer conductors of earthed concentric wiring systems.

(iv) Bare wires used for soil-warming in accordance with Regulation 414.

(B) All cables, other than conductors installed in accordance with the Regulations for bare conductors, shall be insulated with the correct grade of insulation in accordance with the appropriate British Standard to withstand a voltage not less than the highest voltage to which they are likely to be subjected.

NOTE.—On 3-phase systems up to 440 V which have the neutral conductor permanently and effectively earthed, 250-volt grade cables are satisfactory. Such cables are rated at 250 volts to earth and are thus designed to withstand 500 volts between current-carrying conductors.

Current rating of cables.

302 (A) The size of each conductor of a cable shall be such that its current rating as given in Tables 5 to 17 inclusive is not less than the maximum current which will normally flow through it, except that where conditions of service warrant, a rating may be increased by the use of the appropriate rating factor given in Table 20.

Current rating of bare conductors.

(B) Every bare solid copper conductor shall, except where it forms part of the equipment of a switchboard [*see* clause (C) below], shall be of such a size that its current rating as given in Table 19 is not less than the maximum current which will normally flow through it.

Switchboard connections

(C) Busbars, busbar connections, and bare conductors forming part of the equipment of switchboards, shall comply, as regards current rating and limits of temperature, with the requirements of B.S. 159.

(D) For the purposes of clauses (A) to (C) above, the maximum current required by an electric motor shall be deemed to be that corresponding to its full-load rating when rated in accordance with the relevant British Standard.

303 A diversity factor may be applied to the calculation of the cross-sectional area of the conductors of all circuits, provided that the known or anticipated conditions in a particular installation (or part of an installation) are suitable for the application of diversity, and provided that in a final subcircuit the requirements of Regulations 201 and 202 are observed.

NOTE 1.—The application of a diversity factor does not permit any relaxation of the requirement of Regulation 114 in respect of the relationship of the current rating of the cable to that of the protective device for the circuit.

NOTE 2.—It is not practicable to specify the value of the diversity factor for every type of installation, but Table 1 may be taken as a guide.

Voltage drop.

304 (A) Except as specifically provided in the following Exemptions (i) and (ii), which do not apply to earthed-concentric wiring systems, the sizes of conductors of circuits shall be so selected that the drop in voltage from the consumer's terminals in an installation connected to a public supply, or from the busbars of the main switchboard controlling the various circuits in a private generating plant, to any and every point on the installation does not exceed 1 volt plus 2 % of the declared voltage at the consumer's terminals or at the busbars, as the case may be, when the conductors are carrying the maximum current under their normal conditions of service [*see* Clause (B)].

Exemptions:—

(i) Where the voltage of the consumer's installation is so regulated (preferably by automatic means) as to be approximately constant irrespective of variations of the supply voltage at the consumer's terminals, or at the busbars of the main switchboard in the case of a private generating plant, the voltage drop in

the consumer's installation under normal conditions of load shall not be greater than 5 % of the declared voltage.

(ii) In motor circuits the drop in voltage from the consumer's terminals of the supply, or from the busbars of the main switchboard controlling the various circuits in a private generating plant, to the motor terminals, shall not, under full-load conditions, be greater than 7·5 % of the declared voltage.

NOTE 1.—Tables 5 to 17 and 19 show the total length of cable run which will give a voltage drop of 1 volt when the respective maximum currents are carried.

NOTE 2.—In some cases a cable which gives a volt drop less than the above may be necessary to ensure satisfactory starting.

(B) For the purpose of determining the voltage drop referred to in (A) above, the value of the maximum current in the circuit shall, where diversity is applicable, be taken as not less than that indicated in Table 1.

Voltage drop on earthed-concentric wiring.

305 Where earthed-concentric wiring is used for a d.c. installation in accordance with the requirements of Regulation 410, the voltage between any two points on the external conductors shall not exceed:—

(i) Seven volts, if the internal conductors are connected to the positive pole of the system;

or (ii) One-and-a-half volts, if the internal conductors are connected to the negative pole of the system.

NOTE.—Regulation 305 is framed to minimize the risk of electrolytic action, and a.c. installations are therefore exempt from its provisions.

Maximum size of single wire.

306 (A) All conductors of cables having a nominal cross-sectional area exceeding 0·0015 sq. in., except earth-continuity conductors and the conductors of mineral-insulated metal-sheathed cables, shall be stranded.

Minimum size of conductor.

(B) The smallest conductor for sub-circuit fixed wiring shall have a nominal cross-sectional area not less than 0·0015 sq. in.

Insulation and protective sheath of flexible cables and flexible cords.

307 (A) Flexible cables and flexible cords, other than those protected by armour, or tough-rubber or p.v.c. sheath, shall not be used in places (e.g. workshops) where they are subject to abnormal risk of mechanical damage.

(B) Twisted flexible cords may be used only for fixed wiring as permitted in Regulation 413, and for fixed lighting fittings, including pendants; in all other positions and for all other purposes flexible cords shall be of the circular type.

(C) Flexible cords with reduced thickness of sheath or insulation, in accordance with B.S. 7, shall be used only for the purposes set out in that Standard.

Cables unsuitable for a.c.

308 The following types of cables shall not be used for a.c. except for earthed-concentric wiring in which the sheath forms one conductor:—

(i) Single-core cables armoured with wire or tape of magnetic material, or encased in a sheath of magnetic material.

(ii) Single-core cables encased in brass, copper, or other hard metal, and having a conductor of nominal cross-sectional area greater than 0·2 sq. in.

NOTE.—The use of single-core aluminium-sheathed cables having conductors of nominal cross-sectional area greater than 0·2 sq. in. is not deemed to be excluded by (ii) above provided that the guidance given in the last paragraph of the note to Section 14 on page 115 is observed.

Identification of conductors by colour.

309 (A) Throughout an installation the covering of conductors connected to the neutral, middle wire, or common return conductor of the supply shall be black.

(B) Black shall be used only for the following:—

(i) Cables specified in clause (A) above;

(ii) Cables required to be black under Regulations 310 and 311; and

(iii) Earthing leads and earth-continuity conductors, subject in the last instance to the requirement in Regulation 1311 (B) that the covering of an earth-continuity conductor in a flexible cord or flexible cable shall be green.*

(C) In installations where more than one phase or non-earthed conductor is used, the distinctive colours set out in Regulations 310 and 311 shall be used.

* The shade of green used should be easily distinguishable from black or blue.

(D) Where a scheme of colouring is used in a consumer's installation to identify switchboard busbars and/or connections to individual phases or poles, such scheme of colouring shall either conform to the requirements of Regulations 310 and 311 or, if the scheme of colouring complies with B.S. 158, any common terminals (after connection) shall be coloured in accordance with Regulations 310 and 311.

D.C. cable colours.

310 The distinctive colours for the cables of d.c. systems shall be as follows:—

(A) Two-conductor circuits of a 2-wire system—

Red for positive.
Black for negative.

(B) Two-conductor circuits connected to the middle wire and one outer conductor of a 3-wire system:—

Red for outer.
Black for middle wire.

(C) Two-conductor or three-conductor circuits of a 3-wire system except as in clause (B) above—

Red for positive.
*Black for middle wire.
White for negative.

A.C. cable colours.

311 The distinctive colours for cables of a.c. systems shall be as follows:—

(A) Two-conductor circuits of a 2-wire system of wiring connected to one phase conductor and neutral—

Red for line conductor.
Black for earthed neutral.

Alternatively, in larger installations fed from a 3-phase supply, cables of the phase colour required in (C) below may be used up to the final distribution board.

(B) Three-conductor circuits of a 3-phase supply—

Red, white and blue for the respective phases.

(C) Four-conductor circuits of a 3-phase 4-wire supply—

Red, white and blue for the respective phases.
Black for earthed neutral.

* In a three-core cable blue may be substituted for black.

Cable ends, sockets, and terminals.

312 (A) Unless substantial mechanical clamps are provided, the ends of every conductor having a nominal cross-sectional area exceeding 0.01 sq. in. shall be provided with soldering sockets of such a size as to contain all the strands of the conductor.

(B) Where cable sockets or terminals are used, each cable shall be so supported that there is no appreciable mechanical stress on any socket or terminal.

(C) All the strands at the exposed ends of the conductors of cables insulated with impregnated paper, impregnated jute, or varnished cambric, shall be soldered together where such exposed ends are not provided with cable sockets. The ends of the conductors of vulcanized-rubber-insulated cables in damp situations shall be similarly treated.

(D) When the end of a conductor is soldered or secured to a socket or terminal, the insulation shall not be removed [except as necessary to comply with Regulation 401 (I) for cables connected to bare conductors, and with Regulation 114 (C) (iv)] farther than is necessary to allow the conductor to enter the socket or terminal completely and to be properly soldered. Insulation damaged by the application of heat during the process of soldering shall be cut away and replaced by suitable insulation at least as thick as the original insulation.

(E) Soldering fluxes containing acid or other corrosive substances shall not be used.

(F) The braid, lead, or other covering over the insulation, including the tape in contact therewith, shall be cut back at least half an inch from the end of the insulation.

(G) Where vulcanized-rubber-insulated cables operate under exceptional conditions of heat or moisture, or are subject to other deleterious agents, their exposed ends shall be effectively sealed.

NOTE.—Under all conditions the life of vulcanized-rubber-insulated cables is considerably increased if means are taken to exclude air from the exposed ends of the rubber insulation and from the conductor where it emerges from the rubber insulation.

(H) In cables insulated with impregnated paper, impregnated jute, or varnished cambric, the exposed conductor and insulation shall be protected from moisture by being suitably sealed.

(I) The ends of mineral-insulated metal-sheathed cables shall be so sealed as to prevent the ingress of moisture, and all moisture shall be expelled from the dielectric before the sealing material is applied. Such sealing material, and any material used to insulate the conductors where they emerge from the dielectric, shall have adequate insulating and moisture-proofing properties, and shall retain these properties throughout the range of temperatures to which the cable is subject in service.

Joints and connections between cables

313 (A) Every connection between cables other than flexible cords (for which *see* Regulation 316) shall be made by means of a soldered joint or a mechanical connector, and shall be readily accessible and mechanically and electrically sound.

(B) Every soldered joint in the conductors of vulcanized-rubber- or p.v.c.-insulated cables shall be lapped with rubber, p.v.c., or equivalent insulating material to a thickness not less than that of the insulation of the cables, and with waterproof protective tape so as to render the joint moisture-proof; and if the cables are tough-rubber- or p.v.c.-sheathed the joint shall be enclosed in a joint box complying as regards its design and construction with B.S. 816, the protective covering of the cable being maintained up to a position within such box.

(C) Every soldered joint in the conductors of a cable insulated with impregnated paper, impregnated jute, or varnished cambric, shall be insulated with suitably impregnated tape and enclosed either in a lead sleeve wiped on to the cable sheaths or in a joint box complying as regards its design and construction with B.S. 816, such sleeve or box being filled with an insulating compound impervious to moisture.

(D) Every mechanical connector used for connecting together the conductors of cables as required by clause (A) above shall be effectively enclosed in accordance with one of the following two methods:—

(i) Shrouded in non-ignitable insulating material and contained within the recess in the wood block or base of a lighting fitting on the surface of a wall or ceiling, the ends of cables insulated with impregnated paper, impregnated jute, or varnished cambric, being protected by suitably compounded tape.

(ii) Contained in a non-ignitable box complying with B.S. 816, the protective covering of the cable being maintained up to a position within the box and, where the cable is insulated with impregnated paper, impregnated jute, or varnished cambric, the box being filled with an insulating compound impervious to moisture or the ends of the cable being protected by suitably compounded tape. If used in damp situations, such boxes shall be weatherproof and moisture-resisting.

(E) Soldering fluxes containing acid or other corrosive substances shall not be used.

Joints in earthed-concentric wiring.

314 Joints in the external conductor of earthed-concentric wiring shall be of such a nature that the resistance of the conductor is not increased.

Selection of runs.

315 (A) Cables shall be fixed in positions where they will not be exposed to rain, dripping water or condensed water or accumulations of water or oil, or to high temperature from boilers, steam pipes, or other hot objects, unless the cables and their accessories are adequately shielded or are specially designed to withstand the effects of exposure to water, oil, or heat respectively.

NOTE 1.—It is recommended that cables likely to be exposed to acids or alkalis should have an outer sheathing of tough-rubber or other suitable material having a high degree of resistance to such acids or alkalis, and to abrasion.

NOTE 2.—Non-ignitable barriers (e.g. of brickwork or concrete) as may be necessary to prevent the spread of fire from one part of a building to another should be provided when conduits, cables, or conductors, are installed in chases, channels, troughings, or shafts, and care should be taken to make good any cutting away of, or damage to, such barriers.

NOTE 3.—Services and extensions to outbuildings garages, etc., where not dealt with by these Regulations, require special consideration.

(B) Cables, other than those specially designed for high temperatures, shall not be installed in any duct or surroundings in which ambient air temperatures greater than the following are likely to be attained:—

Type of insulation	Maximum temperature of duct or cable surroundings
Vulcanized rubber	115° F. (46° C.)
P.V.C. ..	115° F. (46° C.)
Impregnated paper	150° F. (66° C.)
Varnished cambric	150° F. (66° C.)
Impregnated jute	150° F. (66° C.)

NOTE.—In a long vertical channel containing conductors it may be desirable to install suitable barriers at intervals, in order to prevent the air at the top of the channel from attaining an excessively high temperature.

(C) Cables for the distribution of power and lighting supplies shall not be installed in the same tube, groove, or section of conduit or casing systems as the cables or wires of radio, telephone, electric bell, or similar signalling circuits. Where controls for radio, telephone, electric bell, and similar signalling circuits, are mounted in or on boxes, switchplates, or blocks, carrying switches for power or lighting supplies, the wiring and connections of the lighting, heating, and power circuits shall be effectively screened from those of the former circuits by means of rigidly fixed screens or partitions.

(D) All cables other than trailing cables, installed for any purpose in a lift or hoist shaft shall, except in special instances such as in chemical works or cold stores, be armoured or enclosed in steel or other hard-metal conduits or be of the mineral-insulated metal-sheathed type. If conduits are used the control cables and power cables shall be installed in separate conduits.

(E) Vulcanized-rubber- or p.v.c.-insulated cables shall not be so bent that the radius of the inside of the bend is less than four times the overall diameter of the cable if unarmoured, or less than six times the overall diameter of the cable if (i) lead-sheathed and/or armoured or (ii) hard-metal-sheathed.

(F) A cable, whether armoured or not, insulated with impregnated paper, impregnated jute, or varnished cambric, shall not be so bent that the radius of the inside of the bend is less than twelve times the overall diameter of the cable.

(G) Where p.v.c.-insulated cables are used, precautions must be taken against the deformation liable to occur to such insulation from the combined effects of high temperature and compressive stresses due to the weight of the conductors or other cables, and p.v.c.-insulated cables shall not be brought into lighting or other fittings unless it is ensured that the temperature of the insulation is not liable to exceed 135° F. (57° C.) under working conditions.

(H) Where flexible cords are used and the temperature is liable to exceed 135° F., the type of flexible cord selected shall be one of the types specified in Regulation 1309.

(I) Cables shall not be installed in ventilating ducts unless the ducts are specially designed for the accommodation of cables.

Joints in flexible cords.

316 (A) Where a flexible cord has to be directly connected to another flexible cord or to a cable the connection shall, except as provided for in clause (B) below, be effected by means of a mechanical connector shrouded in incombustible insulating material contained within a suitable receptacle, which may form part of a lighting fitting and which, if not on the surface of the wall or ceiling, shall be of incombustible material. If on the surface of the wall or ceiling such receptacle may be the recess in a wood block or the base of the fitting.

(B) The attachment of a flexible cable or a flexible cord to an appliance, and the extension of a length of flexible cable or flexible cord, shall, if the connection be made by contact-tubes and pins, be so arranged that separation of the pins from the contact-tubes disconnects the pins from the supply.

Section 4

Regulations 401–414

THE INSTALLING OF CONDUCTORS AND CABLES (METHODS OF WIRING)

Bare conductors.

401 Bare and lightly insulated (e.g. taped and/or painted) conductors, other than earthing connections or the external conductors of earthed-concentric wiring systems or wires for soil-warming (see Regulation 414), shall be installed in accordance with the following clauses (A) to (I):—

(A) The conductors shall be so installed that they are not accessible to unauthorized persons.

(B) The conductors shall be supported on effective insulators which shall be so spaced as to prevent the conductors coming into contact with each other or with any part of the structure of the building or other object other than:—

(i) The supporting insulators.

(ii) Fittings provided for tappings to or from the conductor.

(iii) Insulating barriers provided to sectionalize the channel or ducting containing the conductors.

(C) The conductors shall be free to expand and contract, as the temperature changes, without detriment to themselves or to any other part of the installation.

(D) At each straining position suitable straining gear fitted with double insulation shall be provided.

(E) In damp situations the supports and fixings of the insulators shall be of non-rusting material.

(F) No conductors shall be installed in a situation where inflammable or explosive dust, vapour, or gas, is likely to be present or where explosive materials are handled or stored.

NOTE.—Adequately-ventilated battery rooms are not deemed to be situations such as are referred to in clause (F) [*see* Regulation 1208].

(G) Conductors passing through floors, walls, partitions, or ceilings, shall pass through directly and shall be protected by enclosure in non-absorbent, incombustible, insulating material, and no space through which fire might spread shall be left around the conductors or insulating material.

(H) If installed in buildings complying with the Rules for Fire-Resisting Construction issued by the Fire Offices Committee,* and not used as collector wires of travelling cranes or trolleys, or for similar purposes, the conductors shall either be totally enclosed in earthed metal or fixed in a chase, channel, troughing, or shaft specially provided for the purpose, suitable barriers being provided to prevent the spreading of fire where the chase, channel, troughing, or shaft passes through floors, walls, partitions, or ceilings [*see* Note 2 to Regulation 315 (A)].

(I) Where vulcanized-rubber- or p.v.c.-insulated cables are connected to bare conductors rated in accordance with Regulation 302 (C), the insulation of the cables shall be removed for 18 inches or more from the connection, as may be necessary to prevent deterioration of the insulation; and, where under these Regulations the lengths of conductors so exposed are required to be insulated, heat-resisting insulating materials shall be used.

Cleated wiring.

402 Vulcanized-rubber-insulated and braided, or p.v.c.-insulated cables, which comply with the requirements of Regulation 1306, may be installed on insulators without further protection of casing, duct or conduit, provided that the requirements of the following clauses (A) to (F) are complied with:—

(A) The cables shall be supported on suitable insulators having smooth or rounded edges which will not indent or damage the braiding or sheath, and the insulators shall be so spaced as to prevent the cables coming into contact with each other or with any part of the structure of the building or other object other than—

(i) The supporting insulators;

(ii) Fittings provided for tappings to or from the cable;

(iii) Insulating barriers or conduits provided where cables pass through walls, floors, ceilings, etc.

(B) The cables shall be open to view throughout their length except where additional protection is provided in accordance with clause (D) and shall nowhere be buried in

* Copies are obtainable from the Fire Offices Committee, 65 Watling Street London, E.C.4.

plaster or installed under floors or within partitions or similar closed spaces.

NOTE.—Where it is necessary to install cables under floors or within walls, partitions, etc., additional protection is necessary, and Regulations 405, 406, 407 or 409 will be applicable according to the type of protection adopted.

(C) In damp situations the supports and fixings shall be of non-rusting material.

(D) Where the cables are liable to mechanical damage and in all places where they are less than 6 ft. above floor level, they shall be adequately protected.

(E) The cables shall pass directly through floors, walls, partitions, ceilings, etc., and shall be protected by being enclosed in metal or other non-absorbent incombustible conduits, and the holes through which the conduits pass shall be made good with cement or similar incombustible material to the full thickness of the material of the wall or floor, no space through which fire might spread being left around or inside the conduits. The protective conduits, if of metal and if isolated and exposed, shall be earthed by efficient means, but not necessarily near the point of entry of the supply.

(F) Where cables are taken into a conduit in accordance with clause (E) or into any enclosure (e.g. terminal box of a lighting fitting or accessory), the conduit or entry to the enclosure shall be bushed or so finished as to prevent abrasion of the cables.

Metal-sheathed and/or armoured cables.

403 Metal-sheathed and/or armoured cables, other than mineral-insulated metal-sheathed cables (for which see Regulation 408), which comply with the requirements of Regulation 1306, may be used without the further protection of casing or conduit, provided that the requirements of the following clauses (A) to (J) are complied with:—

(A) The metallic sheath and/or armour shall, where practicable, be prevented by spacing, insulation or other means from coming into contact with, (i) the wires, cables or sheath of any wiring system operating at extra-low-voltage or of any wiring system not installed in accordance with the requirements of these Regulations; (ii) the metal pipes of other services (e.g. gas or water). Where the separation called for above is not practicable, the metallic sheath and/or armour

shall be bonded to the metal sheath and/or pipework of other services with which it may come into contact in such a manner as to prevent the occurrence of a voltage difference at such points of contact.

NOTE 1.—The bonding of the sheath of cables to other services may require the permission of the authorities responsible for those services.

NOTE 2.—Attention is drawn to the Factories (Testing of Aircraft Engines, Carburettors and Other Accessories) Order, 1944.*

(B) Where the cables are liable to suffer mechanical damage, they shall be adequately protected, in relation to the nature of their sheath and/or armour.

(C) The cables shall be secured by cleats, saddles, or clamps but not by driven staples, or, subject to compliance with clause (B) above, shall be embedded in plaster. In damp situations and wherever they are exposed to the weather, the cleats, saddles or clamps and their fixings shall be of material that will not be likely to set up electrolytic action with the sheath or armour (if any) and, for aluminium-sheathed cables, the cleats, saddles, or clamps shall in all situations be of aluminium or aluminium-alloy.

NOTE 1.—Metal-sheathed and/or armoured cables embedded in plaster are not ordinarily deemed to be liable to suffer mechanical damage, but protection may be necessary in particular instances.

NOTE 2.—Attention is drawn to the possibility of corrosion, in damp situations, of:—

(i) Metal sheathing and armouring of cables, and other metal parts, by certain materials containing magnesium chloride which are used in the construction of flooring and dadoes.

(ii) Steel armour of cables where plaster undercoats are contaminated with corrosive salts.

(iii) Lead or aluminium sheath of cables as a result of contact with lime, certain cements, oak, and other woods.

(iv) Aluminium sheath in contact with certain other metals particularly copper and alloys having a high copper content. (See British Standard Code of Practice CP 211 "Internal Plastering," pp. 43 and 97.)

NOTE 3. Applications of bitumen or bituminized paint before erection, or prevention of contact by separation with bitumen felt, are recognized precautions against the corrosion referred to in Note 2.

* Obtainable from H.M. Stationery Office under reference S.R. and O. 1944 No. 495.

(D) The spacings of cleats, saddles, or clamps for metal-sheathed cables, other than hard-metal-sheathed cables and armoured cables, installed in such positions that they are liable to be disturbed, shall not exceed those set out in the following Schedule for the respective conductor sizes:—

Nominal cross-sectional area of conductor	Standard number and diameter (in.) of wires forming conductor	Maximum spacing of cleats, saddles or clamps	
		Horizontal runs	Vertical runs
sq. in.		in.	in.
0·0015	1/·044	9	15
0·002	3/·029	9	15
0·003	3/·036	9	15
0·0045	7/·029	9	15
0·007	7/·036	12	15
0·01	7/·044	12	15
0·0145	7/·052	15	18
0·0225	7/·064	15	18
0·03	19/·044	15	21
0·04	19/·052	18	21
0·06	19/·064	18	21

NOTE.—The spacings in the above Schedule are recommended for armoured cables, though their observance is not a requirement of the Regulations for such cables.

(E) Where metal-sheathed and/or armoured cables are installed in such positions that they are unlikely to be disturbed (e.g. under floors or within partitions), greater distances between the points of support are permissible than those set out in clause (D) above, but no such distance shall exceed 3 ft. In addition, the cables, where vertical, shall be gripped firmly at the supports; and where, owing to a change of direction, there is likely to be excessive pressure on any part of the cable, the cable shall be brought over a rounded support of a radius not less than six times the overall diameter of the cable if vulcanized-rubber- or p.v.c.-insulated, or less

than twelve times the overall diameter of the cable if impregnated-paper-insulated, impregnated-jute-insulated, or varnished-cambric-insulated, and whether armoured or not. [*See* Regulation 315 (E) and (F) for the bending of cables.] Cables run parallel to joists shall be attached to the sides of the joists.

(F) Where the cable passes through a floor, wall, partition, or ceiling, etc., the hole shall be made good with cement or similar incombustible material to the full thickness of the material of the floor, wall, etc., and space through which fire might spread shall not be left around the cable; and where the cable, other than an armoured cable, passes through structural steelwork or ironwork, every hole shall be so bushed as to prevent abrasion of the cable. In addition, where cables are installed under floors they shall be mounted on the sides of joists or in such other positions as are not liable to damage due to contact with the floorboards or floorboard fixings. Where the cables are sunk into the floor joists, the floorboard shall be fixed with removable screws.

(G) Every connection between the conductors of cables shall be made in a joint box of ample capacity complying with B.S. 816.

(H) Joint boxes for aluminium-sheathed cables shall, if of metal, be of aluminium or aluminium alloy.

(I) Except as specifically exempted below, where cables terminate at, or are looped into, an accessory or lighting fitting, a box shall be provided into which the metallic sheath and/or armour shall be brought in such a manner that those parts of the cable from which the metallic sheath and/or armour have been removed are enclosed within the box, accessory or lighting fitting.

Exemption.—Where a cable which is run on the surface terminates at an accessory or lighting fitting, the box called for above may be omitted provided that the metallic sheath and/or armour are brought into the accessory or lighting fitting or into a recess lined with incombustible material, or, where the surroundings are of incombustible material, into a recess formed of or lined with hard wood such as beech, oak (English), teak or mahogany.

(J) The sheaths and metal fittings and accessories shall be earthed in accordance with the requirements of Section 10,

and where the sheath forms the earth-continuity conductor, clamps or soldered joints shall be provided at every break in the sheath to ensure the continuity of the earthing conductor throughout the installation, and where non-metallic joint boxes are used, means shall be provided to maintain the continuity, such as an integral metal strip having a resistance not greater than that of the sheath of the largest cable entering the box. The electrical impedance of the sheath and/or armour, together with the impedance of the earthing lead, measured from the connection with the earth electrode to any other position in the completed installation shall not exceed 1 ohm.

NOTE.—For the purpose of estimating the resistance of the metal strip, it may be assumed that the resistivities of lead and steel are respectively twelve and eight times that of copper.

Tough-rubber- or p.v.c.-sheathed cables.

404 Vulcanized-rubber- or p.v.c.-insulated cables with tough-rubber or p.v.c. sheathing complying with the requirements of Regulation 1306 may be used without further protection of casing or conduit, provided that the requirements of the following clauses (A) to (J) are complied with:—

(A) Where the cables are installed in a situation in which they may be exposed to direct sunlight they shall, if tough-rubber-sheathed, be provided with a special protective covering. If this protective covering is incorporated in the cable during manufacture it shall be in the form of a braid, but if applied subsequently it shall be a treated tape.

NOTE.—For the purposes of clause (A), sunlight which has passed through ordinary window-glass is deemed not to be direct sunlight.

(B) The cables shall be prevented by spacing, insulation, or other means, from coming into contact, under any conditions of service, with gas pipes or non-earthed metalwork other than metal cleats, saddles, etc., used to support the cable.

(C) Where the cables are liable to suffer mechanical damage they shall be adequately protected in relation to the nature of their sheath.

(D) The cables shall be secured by cleats, saddles or clamps (other than driven staples) or, subject to compliance with clause (C) above, may be embedded in plaster or alternatively may incorporate or be continuously bound up with a properly-

suspended catenary wire. The insulators, cleats, saddles, and clamps, shall have smooth or rounded edges that will not indent or damage the cables, and they shall be so designed and arranged as to prevent the fixing screws or nails from damaging the insulation and protective coverings of the cables.

NOTE.—Tough-rubber-sheathed cables embedded in plaster are ordinarily deemed not to be subject to mechanical damage, but protection may be necessary in particular instances. Attention is drawn to the possibility of deleterious action on the tough-rubber sheath as a result of contact, in damp situations, with lime and certain cements and sprays.

(E) The spacings of the insulators, cleats, saddles, or clamps, where the cables are installed in such positions that they are likely to be disturbed, shall not exceed those specified in Regulation 403 (D) for metal-sheathed cables, unless the cables are supported throughout their length by properly-suspended catenary wires.

(F) Where the cables are installed in such positions that they are unlikely to be disturbed (e.g. under floors or within partitions), greater distances between the points of support are permissible than those specified in clause (E) above, but such distances shall not exceed 3 ft. In addition, the cables, where vertical, shall be gripped firmly at the supports, and where, owing to a change of direction, there is likely to be excessive pressure on any part of the cable, the cable shall be brought over a rounded support of a radius not less than six times the overall diameter of the cable [*see* Regulation 315 (E) for the bending of cables]. Cables run parallel to joists shall be attached to the sides of the joists.

(G) In damp situations and wherever exposed to the weather the cleats, saddles, and clamps, referred to in clause (D) above, together with the screws or nails used for fixing, shall be of non-rusting material.

(H) Where the cable passes through floors, walls, partitions, ceilings, etc., the holes shall be made good with suitable cement or similar incombustible material to the full thickness of the material of the floors, walls, etc., and space through which fire might spread shall not be left around the cable; and where the cable passes through structural steelwork or ironwork every hole shall be so bushed as to prevent abrasion of the

cable. Where cables are installed under floors, they shall be mounted on the sides of joists or in such other positions as are not liable to damage due to contact with the floorboards or floorboard fixings. Where the cables are sunk into the floor joists, the floorboards shall be fixed with removable screws.

(I) Every connection between the conductors of cables shall be made in a joint box of ample capacity and complying with B.S. 816, and the box shall contain all parts of the cable from which the protective sheath has been removed.

(J) Except as specifically exempted below, where cables terminate at, or are looped into, an accessory or lighting fitting, a box shall be provided into which the protective sheath shall be brought in such a manner that all parts of the cable from which the protective sheath has been removed are enclosed within the box, accessory or lighting fitting.

Exemption.—Where a cable is run on the surface, the box called for above may be omitted provided that the protective sheath is brought into the accessory or lighting fitting or into a recess lined with incombustible material, or, where the surroundings are of incombustible material, into a recess formed of or lined with hard wood such as beech, oak (English), teak or mahogany.

Conduits.

405 Any type of cable which complies with Regulation 1306 (i), (ii), (iii), or (iv), other than the high-voltage cables specified in Regulation 907 for high-voltage electric discharge lamps, may be enclosed in conduit, provided that the requirements of the following clauses (A) to (P) are complied with:

(A) The conduits for each circuit shall be erected complete before any cable is drawn in.

NOTE.—Attention is drawn to the desirability of inspection boxes, draw boxes, etc., being accessible throughout the life of the installation for such purposes as the withdrawal of existing cables or the installing of additional cables.

(B) Metallic conduit shall be prevented by spacing, insulation or other means from coming into contact with, (i) the wires, cables or sheath of any wiring system operating at extra-low voltage or of any system not installed in accordance

with the requirements of these Regulations; (ii) the metal pipes of other services, e.g. gas or water. Where the separation called for above is not practicable, the conduit shall be bonded to the metal sheath and/or pipework of other services, with which it may come into contact, in such a manner as to prevent the occurrence of a voltage difference at such point of contact.

NOTE 1. The bonding of the sheath of cables or conduit to other services may require the permission of the authorities responsible for those services.

NOTE 2.—Attention is drawn to the requirements of the Factories (Testing of Aircraft Engines, Carburettors and Other Accessories) Order, 1944.*

(C) Where conduits are liable to mechanical damage they shall be adequately protected.

(D) The maximum number of 250-volt-grade, vulcanized-rubber-insulated braided cables, or p.v.c.-insulated, braided or unbraided cables, run in one conduit shall be such that it permits of easy drawing-in, and in no circumstances shall be greater than the maximum set out in Table 22 for the particular size of conduit. For types of cables having larger overall diameters than those shown in column 3 of Table 22, appropriate reduction shall be made in the number of cables drawn into the conduits (*see* Table 23 for 660-volt grade, vulcanized-rubber-insulated, braided cables). Where necessary, arrangements shall be made to obviate the drawing of cables round more than two 90° bends, of a radius not less than that of the British Standard factory-made normal bend, or their equivalent.

(E) The radius of any conduit bend shall be such as to fulfil the requirements of Regulation 315 (E) and (F) for the bending of cables and, furthermore, the inner radius of the bend shall not be less than 2½ times the outside diameter of the conduit; and elbows or tees other than those of the inspection type shall not be used, except at the ends of conduits immediately behind accessories or lighting fittings.

(F) Except as specifically exempted below, boxes shall be provided at every outlet position and such boxes shall be of metal where metal conduits are used.

* Obtainable from H.M. Stationery Office under reference S.R. and O. 1944, No. 495.

Exemption.—Where a conduit is run on the surface, a box need not be provided at any terminal position provided that the conduit is brought into an accessory or lighting fitting, or into a recess lined with incombustible material, or, where the surroundings are of incombustible material, into a recess formed of or lined with hard wood such as beech, oak (English), teak or mahogany.

(G) Every outlet for a cable from a conduit shall be bushed or so finished as to prevent abrasion of the cables emerging therefrom.

(H) Where the conduit passes through floors, walls, partitions, ceilings, etc., the hole shall be made good with cement or similar incombustible material to the full thickness of the material of the floor, wall, partition, or ceiling, and space through which fire might spread shall not be left around the conduit. Where conduits are sunk into the floor joists, the floorboards shall be fixed with removable screws.

(I) Substantial boxes of ample capacity complying with the appropriate British Standard shall be provided at every point where cable connections have to be made. These boxes shall be of metal except that, where non-metallic conduits are used, the boxes may, if desired, be of non-absorbent, non-inflammable material other than metal.

(J) In damp situations and wherever exposed to the weather, the saddles and fixings used for securing the conduits shall be of non-rusting material or finish; and the conduits shall be watertight and, if of steel, shall be of heavy gauge and screw-jointed.

NOTE.—Conduit buried in plaster is in ordinary circumstances deemed not to be in a damp situation.

Attention is drawn to the possibility of corrosion, in damp situations, of:—

(i) Metal conduits and ducts, and other metal parts, by certain materials containing magnesium chloride which are used in the construction of floorings and dadoes.

(ii) Steel conduits and ducts where plaster undercoats are contaminated with corrosive salts. (See British Standard Code of Practice CP 211 "Internal Plastering," pp. 43 and 97.)

(K) If of metal, the conduits shall be earthed in accordance with the requirements of Section 10, and shall be mechanically and electrically continuous across all joints, so that the electrical impedance of the conduit, together with the impedance of the earthing lead, measured from the connection with the earth electrode to any other position in the completed installation, shall not exceed 1 ohm.

NOTE.—Plain slip sockets do not comply with this condition, and some form of screwed or grip joint which will give ample and permanent electrical conductance and mechanical rigidity throughout is necessary.

(L) Inspection and draw-in boxes for use with metal conduits shall be in rigid electrical and mechanical connection with the conduits.

NOTE.—Plain slip sockets do not comply with this condition, and some form of screwed or grip joint which will give ample and permanent electrical conductance and mechanical rigidity throughout is necessary.

(M) Vulcanized-rubber-insulated cables shall not be used without suitable protection in situations where they are likely to be permanently exposed to the risk of deterioration due to contact with rust.

(N) Cables installed in metal conduits shall always be so bunched that the outgoing and return cables are drawn into the same conduit.

(O) In the absence of statutory or other special regulations requiring the separation of the wiring of a.c. and d.c. systems, cables connected to one system may be run in a conduit with cables connected to the other system.

(P) Where flexible metallic tubing is connected to metal conduit, the adaptors attaching the tubing to the conduit shall be of a type suitable for connection to the separate earth-continuity conductor required by Regulation 1003.

406 (A) Where cables are installed in duct systems (metallic or non-metallic), such systems shall comply with Regulation 315 (C) and such parts of Regulation 405 as are applicable to the duct system used. Cable duct systems.

(B) All metal junction boxes, including inspection covers, duct outlets, and other accessories shall be effectively earthed in accordance with the requirements of Section 10, and where earthing is effected by means of a separate earth-continuity conductor, bonding clamps or soldered joints shall be provided for all such boxes, outlets or accessories.

NOTE.—Requirements for the installation of bare conductors and lightly insulated conductors in chases, channels, troughings or shafts are contained in Regulation 401.

Fire barriers.

407 Where ducts, chases, channels, or shafts, through which fire might spread, pass through floors, walls, partitions, or ceilings, suitable barriers having a fire resistance equal to that of the surrounding structure shall be provided to prevent the spread of fire. Such barriers shall be made good immediately after any removal or disturbance for any purpose [*see* Note 2 to Regulation 315 (A)].

Mineral-insulated metal-sheathed cables.

408 Mineral-insulated metal-sheathed cables shall be installed in accordance with the requirements of the following clauses (A) to (E):

(A) The sheath shall, where practicable, be prevented by spacing, insulation, or other means from coming into contact with, (i) the wires, cables or sheath of any wiring systems operating at extra-low-voltage or of any wiring system not installed in accordance with the requirements of these Regulations; (ii) the metal pipes of other services (e.g. gas or water). Where the separation called for above is not practicable, the sheath shall be bonded to the metal sheath or conduit and/or pipe-work of other services with which it may come into contact in such a manner as to prevent the occurrence of a voltage difference at such point of contact.

NOTE 1.—The bonding of the sheath of cables to other services may require the permission of the authorities responsible for those services.
NOTE 2.—Attention is drawn to the requirements of the Factories (Testing of Aircraft Engines, Carburettors and Other Accessories) Order, 1944.*

(B) If liable to mechanical damage they shall be adequately protected, having regard to the nature of their sheath.

* Obtainable from H.M. Stationery Office under reference S.R. and O. 1944, No. 495.

(C) Where the cables pass through floors, walls, partitions, ceilings, etc., the holes shall be made good with cement or similar incombustible material to the full thickness of the material of the floors, walls, etc., and space through which fire might spread shall not be left around the cable; and where the cable passes through structural steelwork or ironwork, every hole shall be so bushed as to prevent abrasion of the cable.

(D) The sheath, together with all joint boxes and similar receptacles for the sealing compound, shall be earthed in accordance with the requirements of Section 10, and, where the sheath forms the earth-continuity conductor, means shall be provided at every break in the sheath to ensure the permanent and effective continuity of the earthing conductor throughout the installation. The electrical impedance of the sheath, together with the impedance of the earthing lead, measured from the connection with the earth electrode to any other position on the completed installation, shall not exceed 1 ohm.

(E) Where the cable terminates at or is looped into a lighting fitting or accessory, suitable means shall be provided on or in the lighting fitting or accessory for sealing the ends of the cables in accordance with the requirements of Regulation 312 (I).

Wood casing.

409 Any type of cable which complies with Regulation 1306, other than type (v), may be enclosed in wood casing provided that the requirements of the following clauses (A) to (F) are complied with:—

(A) The casing shall be used only in dry situations, it shall not be buried in plaster or cement, it shall not be fixed in contact with gas pipes or water pipes or immediately below the latter, and it shall not be exposed to drip due to condensation or other cause.

(B) The capping shall be secured by screws.

(C) If the casing forms part of ornamental woodwork, ready access shall be provided to the cables contained therein.

(D) The number of cables bunched in one groove shall not exceed that shown in the following Schedule:—

Nominal cross-sectional area and size of cables	Maximum number of cables
Not exceeding 0·007 sq. in. (7/·036 in.)	10
Exceeding 0·007 sq. in. (7/·036 in.) Not exceeding 0·0225 sq. in. (7/·064 in.)	6
Exceeding 0·0225 sq. in. (7/·064 in.) Not exceeding 0·1 sq. in. (19/·083 in.)	4
Exceeding 0·1 sq. in. (19/·083 in.)	3

(E) The size of the casing shall not exceed that necessary to accommodate the maximum permissible number of cables.

(F) In the absence of statutory or other special regulations requiring the separation of the wiring of a.c. and d.c. systems, cables connected to one system may be run in a groove with cables connected to the other system.

Earthed concentric wiring.

410 (A) Earthed concentric wiring shall only be used where:—

(i) It is supplied by a transformer or convertor in such a manner that there is no metallic connection with a public supply system;

or (ii) It is connected to an a.c. supply system on which multiple earthing of the neutral has been authorized by the Minister of Fuel and Power;

or (iii) the supply is obtained from a private generating plant;

and the following clauses (B) to (D) shall be complied with.

(B) No fuse, non-linked switch, or non-linked circuit-breaker, shall be inserted in the earthed external conductor.

(C) The external conductor shall be earthed and, on d.c. installations, it shall, where possible, be negative to the internal conductor.

(D) From the position or positions at which the installation is earthed, concentric wiring shall be employed throughout up to all fixed positions for accessories or lighting fittings. Wherever the external conductor ceases to surround it, the internal conductor shall be separated from the surface upon which the accessory or lighting fitting is mounted, by an incorrodible metal plate or terminal box to which the external conductor is electrically connected. This requirement does not preclude the insertion of a wood block between the metal plate and the accessory or lighting fitting mounted thereon, provided that this metal plate covers the principal recess in the wood block.

NOTE 1.—Regulation 410 does not preclude:—

(i) A lighting fitting being wired with two separate conductors, one being insulated and connected to the internal conductor, and the other being connected to the metalwork of the fitting [*see* Regulation 606 (C)].

(ii) A twin flexible cord being used for a pendant and between a fixed point and a portable lighting fitting or other current-using appliance.

NOTE 2.—The voltage drop requirements for d.c. installations are given in Regulation 305.

Medium-voltage circuits.

411 All medium-voltage circuits shall be completely enclosed in heavy-gauge screwed conduit, strong metal casing, or armouring, which is electrically continuous; or, alternatively, the cables and other conductors shall be so constructed, installed, and protected, as to prevent danger so far as is reasonably practicable.

Electric bell and similar signalling circuits.

412 Except as specifically exempted below, all wiring of electric bells or similar signalling circuits shall be installed in accordance with the requirements of these Regulations:—

Exemption.—The requirements of these regulations, other than Regulations 615 and 715, are not intended to apply to wiring operating at a voltage not exceeding 15 volts, provided that it is not metallically connected to a supply operating in excess of that voltage.

Flexible-cord wiring.

413 Flexible cords shall not be used for fixed wiring except as temporary extensions to the fixed wiring for purposes such as the temporary display of lighting fittings, etc., in shops and showrooms open to the public. When cords are used for this

purpose the requirements of the following clauses (A) to (E) shall be complied with:—

(A) The cords shall conform to the requirements of B.S. 7.

(B) The cords shall be used only for final sub-circuits carrying currents not exceeding 6 amperes and for voltages not normally exceeding 250 volts.

(C) The cords shall be open to view throughout their length, except where protected in accordance with Regulation 605 (A).

(D) The cords shall be prevented by spacing, insulation, or other means, from coming into contact, under any conditions of service, with any other conductor or with non-earthed metal gas-pipes, water-pipes, or other metal pipes, or with the wires or cables of any other wiring system in the same building; and they shall not be installed immediately below water-pipes or exposed to drip due to condensation or other cause.

(E) Care shall be taken that any hooks, clips, cleats, or insulators used as supports for the flexible cord do not compress the rubber insulation of any core against any other core or against walls, ceilings, etc. Every part of such hooks, clips, and cleats, which is likely to come into contact with the flexible cord shall be of insulating material.

Soil-warming.

414 Bare wires used for soil-warming in and about buildings shall be supplied from the secondary winding of a double-wound transformer. One point on the secondary winding shall be earthed at the transformer and the maximum voltage to earth of any part of the secondary circuit shall not exceed extra-low voltage. Flexible cables or cords connecting busbars of soil-warming grids to the secondary terminals of transformers shall be suitably insulated and sheathed and have the appropriate current rating.

Section 5

Regulations 501–510

TEMPORARY INSTALLATIONS

NOTE.—The requirements contained in this Section do not apply to work which has been carried out in full compliance with the remainder of the Regulations.

501 Every installation which is to be in service for more than three months shall comply in all respects with the requirements for a permanent installation as set out in the remainder of the Regulations. **Duration of installation.**

502 Every temporary installation shall comply with the requirements of Regulations 503 to 510 below.

503 Where a temporary installation has to be kept in service for a longer period than three months, it shall be completely overhauled at least every three months.

NOTE.—A temporary installation should be disconnected from the supply and dismantled as soon as it is no longer required.

504 Every temporary installation shall be in accordance with any special requirements of the insurance company, the supply authority and the local authority concerned, and it shall be so maintained as to avoid risk of fire or shock.

505 Every temporary installation shall be adequately protected against excess current and shall be effectively controlled by a conveniently situated switch or other means, whereby all phases or poles of the supply, including the neutral, middle wire, or common return can be disconnected when the installation is not in use. Where a temporary installation is to be supplied from a permanent installation the current-carrying capacity of the permanent installation must be adequate for the load to be imposed upon it. **Protection and control.**

506 In any temporary installation the total load on a final sub-circuit to which bayonet-socket lampholders are connected shall not exceed 1 000 watts. **Sub-circuit loading.**

NOTE.—Attention is drawn to the necessity, except in earth-

free situations, of using in temporary installations the all-insulated type of lampholder (which should preferably be fitted with a skirt).

Responsibility for installation.

507 Every temporary installation shall be in the charge of a competent person, who shall accept full responsibility for the installation, for its use, and for any alteration or extension, provided that this shall not apply to a temporary addition to a permanent installation in a private dwelling-house. The name and designation of such person shall be prominently displayed close to the main switch or circuit-breaker.

Cables.

508 All cables in a temporary installation shall be vulcanized-rubber-insulated, taped and braided or p.v.c.-insulated and braided, or sheathed with tough-rubber or p.v.c., or steel-armoured. Where the cables are run in conduit, the conduit installation shall conform to Regulation 405. The insulation of the cables shall be in good condition, and metal-sheathed cables shall not be used unless armoured. Joints shall be as few as practicable and shall be mechanically and electrically sound.

Flexible cords.

509 Flexible cords in a temporary installation shall be in accordance with B.S. 7 and shall be used only where essential. Wherever exposed to the risk of mechanical damage they shall be tough-rubber- or p.v.c.-sheathed. (*See* Regulation 413.)

Testing

510 A temporary installation shall be tested before it is put into service, and shall comply as regards its insulation resistance and earth-continuity with the requirements of Section 11.

Section 6

Regulations 601–615

THE INSTALLING OF ACCESSORIES AND LIGHTING FITTINGS

Current-carrying capacity.

601 Every accessory shall be of such a size that its current rating is not less than the maximum current which will normally flow through it. For this purpose the maximum current of an electric motor shall be deemed to be that corresponding to its full-load rating, when rated in accordance with the relevant British Standard.

Ceiling roses.

602 (A) No ceiling rose shall be used on a circuit having a voltage normally exceeding 250 volts.

(B) Unless the ceiling rose be specially designed for multiple pendants, not more than two flexible cords, each of which shall comprise not more than three cores, shall be attached to one ceiling rose.

Lighting fittings.

603 (A) Lighting fittings shall be controlled in compliance with Regulation 205, and shall be of a type suitable for the conditions in which they are to be used (*see* Regulations 614 and 615).

(B) No fitting composed wholly or partly of nitrated celluloid shall be used in any situation near a lamp.

Portable lighting fittings.

604 Where a portable lighting fitting is supplied by a metal-armoured flexible cord or cable, the armour, in addition to an earth-continuity conductor in the cord or cable [*see* Regulation 1001 (B)], shall be in effective electrical connection at one end with the metal frame, if any, of the fitting and at the other end with the earthed metal of the plug connection.

NOTE.—A metal lampholder in a portable lighting fitting may, as an alternative to being earthed, be insulated from the fitting and so shielded by means of insulating material that it cannot inadvertently be touched by a person handling the fitting or replacing a lamp. Where a portable lighting fitting has a frame of non-conducting material, the guard surrounding the lamp or lamps, even if such guard be of metal, need not be earthed provided that it cannot come into contact with any metal part of the lampholder. [*See* Exemptions to Regulation 1001 (A).]

Enclosure of flexible cords.

605 (A) Where a flexible cord unavoidably passes through a ceiling for connection to a lighting fitting, it shall be enclosed in a non-inflammable tube terminating in a non-inflammable junction box, subject to the exception that a tough-rubber- or p.v.c.-sheathed flexible cord connected to a plug for the supply of current to a lighting fitting may be carried through a clearance hole to a socket-outlet in the space above the ceiling, such clearance hole being plugged where necessary to prevent the spread of fire.

Weight supported by flexible cords.

(B) Where a lighting fitting is supported by one or more flexible cords, the maximum weight to which any of the following twin flexible cords shall be subjected shall be:—

Number and diameter of wires forming conductor	Maximum permissible weight
14/·0076 in.	3 lb.
23/·0076 in.	5 lb.
40/·0076 in.	10 lb.

Where a weight greater than 10 lb. has to be supported, other means of support shall be provided; or, alternatively, two or more flexible cords shall be used so that the maximum weight to which any cord is subjected does not exceed the above values.

Supports for flexible cords.

(C) Where a length of flexible cord is connected to a ceiling rose or lighting fitting, care shall be taken that any hooks, clips, cleats, or insulators, used as supports for the flexible cord, do not compress the rubber insulation of any core against any other core or against walls, ceilings, etc. Every part of such hooks, clips, and cleats, which is likely to come into contact with the flexible cord, shall be made of insulating material.

Lampholders.

606 (A) Lampholders, other than those for suitably fused pilot lamps in connection with switchgear or suitable types used in discharge-lamp circuits, shall be used on low-voltage circuits only.

(B) Every circuit supplying a switch-lampholder shall, in accordance with Regulation 206, be provided with further means of control in the same room.

(C) Where centre-contact bayonet or Edison-type screw lampholders are used, the outer or screwed contact shall be

connected to the middle wire or the neutral or to the earthed conductor of the circuit.

(D) No small bayonet type (B.15) or small Edison-type screw (E.14) lampholders shall be connected to a final sub-circuit where the current rating of the fuse protecting the circuit exceeds 3 amperes, or where the tripping current of the circuit-breaker protecting the circuit exceeds 4 amperes, and small Edison-type screw (E.14) lampholders shall only be used on circuits feeding apparatus having a loading not exceeding 40 watts and operating at a voltage not exceeding 130 volts.

(E) No ordinary-size bayonet type (B.22) lampholder shall be connected to a final sub-circuit where the current rating of the fuse protecting the circuit exceeds 15 amperes, or, where the tripping current of the circuit-breaker protecting the circuit exceeds 30 amperes.

Lampholder plugs.

607 (A) Where it is anticipated that a lampholder plug will be used, a readily accessible, suitable switch shall be provided for breaking the circuit.

(B) A lampholder plug shall not be used (i) in connection with any appliance taking more than 1 ampere, nor (ii) where exposed metal is required to be earthed in compliance with Regulation 1001.

NOTE.—The use of lampholder plugs, even in earth-free situations, is deprecated.

Socket-outlet and plugs.

608 (A) A socket-outlet and plug shall not be used to carry a current greater than that for which they are rated in the applicable British Standard.

(B) Every plug containing a fuse shall be non-reversible and shall be so arranged and connected that the fuse controls an outer or phase conductor, or the non-earthed conductor of the circuit.

(C) Where a socket-outlet, sunk or otherwise, is mounted in a floor, means shall be provided to ensure that the floor may be washed without detriment to the insulation of the installation, and that there can be no risk of live metal coming into contact with any floor covering that may be used.

(D) Every socket-outlet shall be mounted in accordance with the requirements of Section 4 in relation to the system of wiring in use.

NOTE.—As by definition a socket-outlet is an accessory, a box or specially lined recess may be required. [*See* Regulations 403 (H) and (I), 404 (I) and (J), and 405 (F) and (I).]

(E) A socket-outlet in a d.c. circuit shall be controlled by a switch immediately adjacent thereto or combined therewith.

(F) Where a socket-outlet is controlled by a single-pole switch, this shall be fitted in the conductor connected to an outer or pha e conductor, or the non-earthed conductor, of the circuit.

(G) In earthed-concentric wiring, where portable appliances and lighting fittings are used in conditions in which earthing is necessary under Regulation 1001, the flexible cords shall terminate in non-reversible plug and socket-outlet connections.

(H) The terminals marked "L" and "N" of a socket-outlet for use with a 2-pole and earthing-pin plug or with a non-reversible 2-pin plug shall be connected to the conductors of the final sub-circuit as follows:—

(*a*) The terminal marked "L" shall be connected to an outer or phase conductor or the non-earthed conductor.

(*b*) The terminal marked "N" shall be connected to the middle wire, common return, or neutral, irrespective of whether such conductor is permanently and solidly earthed at the source of supply.

(I) The terminal marked "E" of a socket-outlet for use with a 2-pole and earthing-pin plug shall be connected to the earth-continuity conductor, except in earth-free situations [where it is permissible under *Exemption* (i) to Regulation 1001 (A) to omit, in fixed wiring, the connection of an earth-continuity conductor to the earth contact-tube of a socket-outlet].

(J) In a 2-pole and earthing-pin plug the flexible conductors shall be so connected to the terminals marked "E," "L," and "N," and in a non-reversible 2-pin plug to the terminals marked "L" and "N," of the plug as to correspond respectively to the conductors specified in clauses (H) and (I) above for a

socket-outlet; and, in addition, a single-pole switch (if any) on the current-using appliance connected to the plug shall control an outer or phase conductor or the non-earthed conductor of the circuit.

NOTE.—The terminals referred to above as being marked "E," "L," and "N" may be indicated by the colours, "green" "red," and "black" respectively.

(K) Reversible plugs or connectors shall not be used to connect switched electrical appliances to the supply, unless every switch on the appliance is of the double-pole type..

609 (A) A socket-outlet adaptor shall not be sunk below the surface of the wall to which the main socket-outlet is fixed. Socket-outlet adaptors.

(B) Where a socket-outlet adaptor is to be used to supply one or more current-using appliances of smaller current rating than that of the socket-outlet supplying the adaptor, it shall contain a fuse or fuses.

(C) A socket-outlet adaptor containing a fuse shall be non-reversible and shall be so arranged and connected that the fuse controls a phase or outer conductor or the non-earthed conductor of the circuit.

610 Every switch shall be installed in compliance with the following clauses (A) to (C):— Switches.

(A) If installed in a room containing a fixed bath it shall comply with Regulation 1002.

(B) It shall be mounted in accordance with the requirements of Section 4 in relation to the system of wiring in use.

NOTE.—As by definition a switch is an accessory, a box or specially-lined recess may be required [see Regulations 403 (H) and (I), 404 (I) and (J), and 405 (F) and (I)].

(C) In positions in which a switch is liable to mechanical injury, the cover, unless of rigid metal, shall be protected by a suitable guard.

NOTE.—Where inductive apparatus is used, special switches may be necessary.

611 Every circuit-breaker shall be so adjusted that it will open the circuit when a current flows equal to twice, or less than twice, the rating of the smallest cable or bare conductor it is installed to protect, provided that this requirement shall Circuit-breakers

not apply to a motor circuit installed in accordance with Regulation 704 (C).

Fuses.

612 (A) Every fuse shall be installed in accordance with one of the following three methods (i) to (iii), provided that in no circumstances is it fitted in a ceiling rose or in a socket-outlet:—

(i) fixed on the front of a switchboard or on a distribution fuseboard, provided that if the fuse protects an instrument or a pilot lamp it may, if desired, be fixed on the back of the switchboard;

or (ii) fitted in a socket-outlet adaptor or in a plug complying with Regulation 1312;

or (iii) fixed in a readily accessible position, and be either contained within a protecting case conforming in all respects to the requirements for the case of a distribution fuseboard (*see* Regulation 1303) or completely shielded in accordance with the requirements of B.S. 88.

(B) A fuse shall not be fitted with a fuse-element larger than that for which the fuse is designed.

(C) Except as specifically exempted in exemptions (i), (ii) and (iii) below, the current rating of a fuse shall not exce d the current rating of the smallest cable in the circuit protected by the fuse.

Exemptions.

(i) A fuse of lower current rating than 3 amperes need not be inserted in any final sub-circuit.

(ii) The fuse or fuses protecting an electric motor may, where the starting or accelerating current of the motor considerably exceeds the rated full-load current, be of the size permitted under Regulation 704 (C).

(iii) Fuses installed in accordance with the exemptions permitted under Regulation 201 (C) may be of the current rating indicated therein.

NOTE.—In view of the fact that the current which will flow in the event of a short-circuit on the consumer's installation depends to some extent on the supply system, it is recommended that the supply authority be consulted as to the grade of consumer's main fuses to be installed.

(D) Every fuse shall have on its case or cover, or in an adjacent conspicuous position, an indelible indication of its appropriate current rating for the protection of the circuit which it controls.

(E) Every fuse shall be of a type suitable for the system of supply in use, and its voltage rating shall not be less than the maximum voltage difference which can normally develop at any point where a fault may occur in the circuit to be protected.

NOTE.—Where two or more low-voltage circuits between which medium-voltage may exist are installed in the same conduit or terminated in the same enclosure, it will normally be necessary to install fuses rated for medium-voltage in order to comply with the requirements of the above Regulation.

Situations where the voltage exceeds 250 volts.

613 (A) Where the voltage between two or more low-voltage circuits in the same room, corridor, staircase or other location may exceed 250 volts, the requirements set out in Regulation 115 must be observed.

(B) The use of portable appliances requiring supplies at voltages exceeding 250 volts shall be avoided as far as practicable, but where this practice is unavoidable every flexible cord or flexible cable operating at a voltage exceeding 250 volts shall be effectively protected against mechanical damage. If a metal covering is used for this purpose, such covering shall be connected at each end to the earth-continuity conductor of the cord or cable; this earth-continuity conductor must be provided in addition to the metallic covering, which shall not itself form the only means of connecting the metal framework of the appliance to the earthing lead.

NOTE.—Requirements for the wiring of medium-voltage circuits are contained in Regulation 411.

Damp situations.

614 (A) In damp situations, every accessory and lighting fitting shall be of the weatherproof type, and every switch shall, in addition, be provided with cable glands or bushings, or be adapted to receive screwed conduit, according to the system of wiring in use.

Bathrooms.

(B) In kitchens and sculleries, and in every room containing a fixed bath, all flexible cords shall be of the tough-rubber-sheathed or an equally waterproof type.

NOTE.—It is, however, recommended that flexible cords be not used for any purpose in bathrooms.

Exceptional fire and/or explosion risks

615 (A) In places where inflammable or explosive dust, vapour, or gas, is likely to be present under normal conditions, every accessory and lighting fitting irrespective of the voltage used, shall be protected by a flameproof enclosure of an appropriate standard of construction or be otherwise of such construction or intrinsically-safe characteristics as to prevent danger.

Lamps

(B) In positions in which a lamp is either near to, or might swing into contact with, inflammable material, it shall be enclosed or protected by a robust shade or guard of non-inflammable material.

Garages, etc.

(C) In places where petrol-driven vehicles are stored or repaired, every accessory and lighting fitting, other than those of the portable type, shall, unless of a totally-enclosed or flameproof type, be fixed at a height of at least 4 ft. above the general floor-level of the room or compartment.

NOTE.—It is strongly recommended that particular care be taken in connection with the introduction of portable accessories and lighting fittings into any position in which inflammable or explosive dust, vapour, or gas, is likely to be present under normal conditions.

Section 7

Regulations 701–716

THE INSTALLING OF CURRENT-USING APPLIANCES

Control of heating and cooking appliances.

701 (A) Every portable heating or cooking appliance having a loading not exceeding 3 kW shall be fed from a socket-outlet in an adjacent conveniently accessible position.

(B) Every electric heating or cooking appliance other than those referred in clause (A) above shall either be fed from an adjacent socket-outlet or be controlled by a switch or push-button, which shall be additional to any associated thermostatic control device, arranged to disconnect the appliance from all live supply conductors and installed in accordance with the requirements of clause (C) below.

NOTE.—Where a supply system has one conductor in permanent and effective connection with earth, as defined in Note 1 to Regulation 111 (A), that conductor is not deemed to be a live conductor for purposes of the above requirement.

(C) Except as specifically permitted in the following exemptions (i) to (iii) the switch or push-button required in clause (B) above shall be in the same room as the appliance but mounted apart from it in a position preferably within easy reach of a person standing beside the appliance.

(i) Where a fixed heating or cooking appliance is not fed by a flexible cord or cable the switch or push-button may be mounted on the appliance, but the connections shall be so arranged that the appliance can be dismantled for maintenance purposes without necessarily exposing any parts which remain live when the switch is in the "off" position. Any conductors and insulated cables which remain live shall be as short as possible, separated by screens of earthed metal or suitable insulating barriers from other conductors or cables, and so installed that they shall not be adversely affected by the heat from the appliance.

(ii) Where an appliance is installed in non-domestic premises and is in the form of a non-luminous heater

in which no part of the heating element can be touched (e.g. a tubular or panel heater) the switch or push-button need not be in the same room as the appliance.

NOTE.—The addition of a pilot lamp to a non-luminous appliance is deemed not to render the appliance subject to the requirements for a luminous appliance.

(iii) In a room containing a fixed bath, any switch or push-button required under clause (B) above may be located outside the room in an accessible position immediately adjacent to the normal access door to the room.

NOTE.—The requirements of Regulation 1002 may render it impracticable to locate the switch inside a room containing a fixed bath.

(D) Where thermostatic control devices are installed to control the temperature automatically by interrupting the current in a heating circuit, these devices may be so connected that the interrupting contacts are in the neutral conductor.

Generators, motors, etc.

702 (A) Every electric generator, motor, convertor, or other rotating electrical machine fixed in a situation in which the surrounding air exceeds the limit of temperature permitted for the cooling air in the appropriate British Standard, shall be of special construction or reduced rating, or, alternatively, of the pipe-ventilated, forced-draught, or induced-draught type, connected by ventilating ducts to a cool air supply.

(B) Every electric generator, motor, convertor, or other rotating electrical machine, shall be placed in a space so situated or so ventilated as to prevent the accumulation of inflammable or explosive dust, vapour, or gas, unless it is of a suitable pipe-ventilated, or duct-ventilated, or totally-enclosed, or flameproof type, as specified in the appropriate British Standard.

(C) Every electric generator, motor, convertor, or other rotating electrical machine, which has a rating of one-third horse-power or more, shall be placed in a position in which it is not exposed to risk of mechanical injury, or of damage from water, steam, or oil, and it shall be not less than 12 in. measured horizontally from, and not less than 4 ft. measured

vertically below, any unprotected woodwork or unprotected readily combustible material, unless it is of a suitably protected, ventilated, or totally-enclosed type, as specified in the appropriate British Standard.

(D) Every electric generator, motor, convertor, or other rotating electrical machine, having a rating of less than one-third horse-power shall be so guarded as to avoid risk of the transmission of fire to readily combustible materials.

(E) Where an open-type or protected-type electric generator, motor, convertor, or other rotating electrical machine, having a rating of one-third horse-power or more is mounted on a floor of wood or readily combustible material, provision shall be made to prevent oil from dripping from the machine to the floor.

703 (A) Every electric motor shall be provided with efficient means for starting and stopping, so placed as to be easily operated by the person controlling the motor; and every electric motor having a rating exceeding one-half horse-power shall be provided with the control apparatus specified in the following items (i), (ii) and (iii):—

NOTE.—The "Electricity (Factories Act) Special Regulations, 1908 and 1944," administered under the Factories Act, 1937, require that in every place in which a machine is driven by a motor there shall be means at hand for either switching off the motor or stopping the machine, if necessary to prevent danger.

(i) Means to prevent automatic restarting after a stoppage due to a drop in voltage or complete failure of supply, where unexpected restarting of the motor might cause injury to an operator.

NOTE.—It is recognized that some applications require the automatic starting of a motor at irregular intervals in response to an initial impetus produced by control devices which are governed, for example, by thermostatic, pneumatic, or hydraulic devices. In such applications it is intended that the motor should start automatically on or after the restoration of the supply after a failure.

(ii) A starter or switch for limiting the starting and accelerating currents to the extent, if any, required by the supply authority.

(iii) Efficient means of isolation suitably placed and so connected that all voltage may thereby be cut off from the motor and all apparatus, including any automatic circuit-breaker, used therewith.

NOTE.—A single means of isolation may be provided for a group of motors and associated control apparatus where for the purpose of carrying out inspection or other work on any individual motor in the group, or on the control apparatus directly associated with such a motor, simultaneous isolation of the whole group is not liable to cause inconvenience.

(B) Where the means of isolation called for in clause (A) (iii) above is remote from a motor, an additional means of isolation adjacent to the motor shall be installed, or, alternatively, provision shall be made for the primary means of isolation to be locked off.

Protection of motor circuits.

704 (A) The maximum current which can flow under normal conditions of service in cables which carry the starting, accelerating, or load current of a motor shall be deemed to be at least that corresponding to its full-load rating when rated in accordance with the relevant British Standard.

(B) The sizes of the cables for the rotor circuits of slip-ring induction motors shall be suitable for the starting, accelerating, and load conditions.

(C) Where the starting or accelerating current of a motor considerably exceeds the rated full-load current, excess-current protection must be so arranged that, although it permits excess current to pass during the normal accelerating period of the motor, it will nevertheless provide satisfactory protection for the motor and motor cables when the motor has run up to speed.

Transformers, inductors, resistors, etc.

705 Every resistor used for control or starting purposes, rated at 60 watts or above, and every inductor, capacitor, transformer, and rectifier, except where such equipment is intended for use with electric bell and similar signalling circuits (*see* Regulation 709 and 710) or with discharge-lamp installations (*see* Sections 8 and 9), shall comply with the following clauses (A) and (B):—

(A) If not suitably enclosed, it shall be placed in a position

in which it is not exposed to water, oil, steam, or vapour, or to risk of mechanical damage.

(B) If it is oil-filled and has a total oil capacity exceeding 50 gallons in any unit or group of adjacent units, means shall be provided for draining away any surplus or escaping oil, and arrangements shall be made to prevent such oil from gaining access to any other part of the building not specially designed to receive it.

NOTE.—It is recommended that an oil-filled transformer installed within a building and having an oil capacity exceeding 50 gallons be placed in a chamber of fire-resisting construction ventilated to the outside of the building only.

Separation of resistors from woodwork, etc.

706 (A) Woodwork and readily combustible material shall be protected with incombustible material when it is within a distance of 24 in. measured vertically above, or 12 in. measured vertically below, or 6 in. measured in any other direction from, frames or cases containing resistors used for control purposes and rated at 60 watts or above.

Guarding of resistors.

(B) Where the temperature of any part of the case of a resistor is liable to exceed 176° F. (80° C.) the case shall be so located or guarded as to prevent accidental contact therewith.

Control of step-up transformers.

707 Where a step-up transformer, other than an auto-transformer, forms part of a consumer's installation, a multi-pole (linked) switch shall be provided for isolating the transformer from the supply.

Auto-transformers.

708 (A) An auto-transformer shall not be connected on either its primary or secondary side to a circuit operating at a voltage normally exceeding 250 volts to earth, except where such transformer is used (i) in motor-starting or control gear, or (ii) in conjunction with, and installed adjacent to, a capacitor which is employed for improving the power factor, or (iii) in conjunction with electric discharge lamps.

(B) An auto-transformer shall not be used to supply:—

(i) a portable appliance operating at a voltage of less than 110 volts, or

(ii) earthed-concentric wiring at low voltage, except

where the supply is derived from private generating plant.

NOTE.—The term "portable appliance" is deemed to include model electric railways and other electric toys.

(C) A step-up auto-transformer shall not be connected to an installation obtaining its supply from a system in which none of the poles of the supply mains is connected to earth.

Electric bells.

709 Except as specifically exempted below, electric bells and/or similar signalling apparatus shall be installed in accordance with the requirements of these Regulations:—

Exemption.—The general requirements of these Regulations, other than Regulations 615 and 715, are not intended to apply to apparatus operating at a voltage not exceeding 15 volts, provided that the circuit supplying the apparatus is not metallically connected to a supply operating in excess of that voltage.

NOTE.—Requirements for the installing of the wiring of electric bell and similar signalling circuits are contained in Regulation 412, and requirements for the protection and earthing of certain such circuits in Regulation 1001 (C).

Bell transformers, etc.

710 Every transformer, convertor, resistor, or similar device, furnishing energy to an electric bell and/or similar signalling circuit, shall comply with the following clauses (A) and (B):—

(A) Its case, if of metal, its core or frame, and its screen, if any, shall be earthed as may be necessary for compliance with the requirements of Section 10 (Earthing).

(B) It shall be mounted on a base of non-inflammable material, and shall, if not suitably enclosed, be placed in a position where it is not exposed to water, oil, steam, or vapour, or to risk of mechanical damage.

Electrode water-heaters and boilers: general.

711 Electrode water-heaters and electrode boilers shall be connected to a.c. systems only, and shall be installed in compliance with Regulations 712, 713 or 714 according to the type of equipment in use, and with the following clauses (A), (B) and (C).

(A) The supply to the apparatus shall be controlled by a circuit-breaker constructed and installed as follows:—

(i) The circuit-breaker shall be of the multi-pole linked

type arranged to disconnect the supply to all electrodes simultaneously.

(ii) The circuit-breaker shall be provided with over-current protective devices in each conductor feeding an electrode.

(iii) The circuit-breaker shall be so placed that it may easily be operated by the person in charge and, where it is not adjacent to the heating apparatus, there shall be a means at hand at the apparatus to open the circuit-breaker instantaneously.

(B) Adequate means, such as the provision of an isolator adjacent to the apparatus, or of a locking device on the circuit-breaker, shall be provided to prevent the equipment being made live while persons are working thereon.

(C) Where the circuit-breaker is remote from the heating apparatus, indicating lamps shall be provided adjacent to or mounted on the boiler, to indicate whether the circuit-breaker is in the "ON" or "OFF" position.

NOTE.—The general earthing requirements of Section 10 are applicable to electrode water-heater and electrode boiler installations.

712 Where the electrodes are directly connected to a high-voltage supply, the installation shall, in addition to complying with the general requirements of Regulation 711, comply with the following clauses (A) and (B). **High-voltage electrode water-heaters and boilers.**

(A) A balanced-current-type earth-leakage device shall be installed to disconnect all supplies to the heating apparatus in the event of the occurrence of a sustained earth current in excess of 10 % of the rated current of the apparatus under normal conditions of operation, except that if in any case a higher value is essential to ensure stability of operation of the apparatus, the value may be increased to a maximum of 15 %. A time delay may be incorporated in the above device to prevent unnecessary operation on the occurrence of unbalanced conditions of short duration.

(B) The metalwork of the apparatus shall be permanently and effectively connected with earth and to the metal sheath and metal armour, if any, of the high-voltage cable which supplies the apparatus. The continuous-current-carrying

capacity of the earthing lead shall not be less than the current setting of the earth-leakage protective device required in clause (A) above.

Three-phase medium- and low-voltage water-heaters and boilers.

713 Where the electrodes are connected to a three-phase medium-voltage or low-voltage supply, the installation shall in addition to complying with the general requirements of Regulation 711 comply with the following clause (A) and with clauses (B), (C) and (D), if appropriate:—

(A) The metalwork of the heating apparatus shall be permanently and effectively connected with earth and to the metal conduit or sheath and armour, if any, of the supply cable. There shall be an earthing lead directly connected to the shell of the apparatus and this shall have a current-carrying capacity not less than that of the largest supply conductor connected to the apparatus, except that, where a relay is installed to limit the earth-leakage current, the cross-sectional area of the lead need not exceed that specified in Regulation 1008.

(B) An electrode water-heater or boiler having a full-load rating in excess of 200 amperes per phase, which is installed in a building which is not immediately adjacent to the system neutral earth-electrode, shall not have its shell connected to the neutral conductor of the supply.

(C) Where, in compliance with clause (B) above or for any other reason, the shell of the heating apparatus is not connected to the neutral conductor, a balanced-current type protective device shall be installed to disconnect all voltage from the apparatus in the event of the earth-leakage current exceeding 10 % of the full-load current.

NOTE.—Compliance with Regulation 1006 may require the provision of an additional protective device to limit the voltage rise on exposed metalwork to 40 volts or to limit the leakage current to 15% of the rated current for the circuit or 5 amperes whichever is the greater.

(D) Where it is permissible to connect the neutral conductor to the shell of the apparatus and where the neutral conductor is so connected, the current-carrying capacity of this conductor must not be less than that of the largest supply conductor connected to the apparatus.

Single-phase electrode water-heaters and boilers.

714 Where the supply to an electrode water-heater or boiler is single-phase and one electrode is connected to an earthed neutral conductor, the installation shall, in addition to complying with the general requirements of Regulation 711, comply with the requirements of clause (A) below.

(A) Except as exempted below, a balanced-current type protective device shall be provided to disconnect both poles of the boiler when an unbalance exceeding 15 % of the rated full-load current of the apparatus exists between the current in the phase and neutral conductors.

Exemption.—Where there is no connection between the electrodes and any piped water-supply or earthed metal, and where the electrodes and the water in contact with the electrodes are so shielded in insulating material that it is impossible to touch either of the electrodes or the water in contact therewith while the electrodes are alive, the balanced current protective device called for in (A) above may be omitted, and a fuse in the phase conductor may be substituted for the circuit-breaker required in Regulation 711.

NOTE.—The general earthing requirements of Section 10 are applicable to electrode water-heater and electrode boiler installations. Compliance with Regulation 1006 may require the provision of a protective device to limit the voltage rise on exposed metalwork to 40 volts or to limit the leakage current to 15 % of the rated current for the circuit or 5 amperes whichever is the greater.

Inflammable or explosive conditions.

715 (A) In places where inflammable or explosive dust, vapour or gas is liable to be present under normal conditions, every current-using appliance, irrespective of the voltage used, shall be protected by a flameproof enclosure of an appropriate standard of construction, or be otherwise of such construction or intrinsically-safe characteristics as to prevent danger.

NOTE.—Requirements for flameproof enclosures of electrical equipment are contained in B.S. 229 and recommendations on the installation and maintenance of flameproof and intrinsically-safe electrical equipment are given in British Standard Code of Practice CP 1003.

Arc lamps.

(B) Arc lamps shall not be installed or used in positions where inflammable or explosive dust, vapour, or gas, is liable to be present under normal conditions.

(C) An open inverted arc lamp installed where readily combustible material is present shall be fitted with a metal reflector rigidly attached beneath the arc in accordance with B.S. 816. Where it is not practicable to fit such a reflector, e.g. in photographic work, the floor immediately underneath the lamp shall be protected from falling particles of carbon by incombustible material. In all other positions where an arc lamp is situated over a floor constructed of readily combustible material, or where heated particles of carbon might fall and constitute a danger to persons underneath, it shall be fitted with a globe or lantern complying with the requirements of B.S. 816. Wherever poisonous fumes are likely to be emitted from the lamp, suitable ventilation shall be provided.

Garages, etc.

(D) In places where petrol-driven vehicles are stored or repaired, every current-using appliance, other than a portable appliance, shall, unless of a totally-enclosed or flameproof type, be fixed at a height of at least 4 ft. above the general floor-level of the room or compartment.

NOTE.—It is strongly recommended that particular care be taken if portable current-using appliances are introduced into any position in which inflammable or explosive dust, vapour, or gas, is liable to be present under normal conditions.

Other appliances.

716 Except as specifically exempted below, every current-using appliance not otherwise provided for in Regulations 701 to 715 shall be controlled by a switch fixed in an adjacent readily accessible position.

Exemptions.—The switch may be omitted with the following appliances:—

(i) appliances on an a.c. installation if fed from a readily accessible socket-outlet and plug;

(ii) electric clocks fed from a specially constructed connector;

(iii) bell transformers fed from a separate final sub-circuit supplying only that transformer.

Section 8

Regulations 801–817

THE INSTALLING OF ELECTRIC DISCHARGE LAMPS (GENERAL)

Scope of Section 8.

801 The requirements of this Section shall apply to all electric-discharge-lamp installations irrespective of the voltage used, except in so far as specific exemptions are made herein.

Scope of Section 9.

802 The additional requirements of Section 9 shall apply to all electric-discharge-lamp installations for which a voltage exceeding 650 volts r.m.s., measured on open circuit, is used.

Applicability of other Regulations.

803 The Regulations as a whole shall apply to all types of electric-discharge-lamp installations except in so far as the requirements for such installations are modified or qualified by this Section, and by Section 9 where it applies.

Ancillary equipment.

804 Ancillary equipment, including inductors, capacitors and transformers, shall comply with the requirements of the relevant British Standards, in so far as these affect safety.

Switches.

805 Any switch not specifically designed to break an inductive load of its full rated capacity, shall, if used to control a discharge-lamp circuit, have a current rating of not less than twice the total steady current which it is required to carry, or, if used to control incandescent lamps and discharge lamps, have a current rating of not less than the sum of the current flowing in the incandescent lamps and twice the total steady current flowing in the discharge lamps.

NOTE.—A switch of the type commonly known as quick-break may not be specifically designed to break an inductive load of its full rated capacity.

Means for discharging capacitors.

806 Every capacitor used in a discharge-lamp circuit, unless incorporated for the sole purpose of radio-interference suppression, shall be provided with means, such as a high-resistance leak, for its prompt automatic discharge, immediately the supply is disconnected.

Loading of final sub-circuits.

807 (A) In every final sub-circuit the sum of the normal steady currents shall not exceed the rating of the final sub-circuit in amperes, and in every final sub-circuit by which inductor-operated discharge lamps are exclusively supplied, the total steady current in such final sub-circuit, multiplied by 1¼, shall not exceed the rating of the final sub-circuit.

(B) Where inductor-operated discharge lamps and incandescent lamps are both supplied by a single final sub-circuit, the sum of the total steady current taken by the incandescent lamps and 1¼ times the total steady current taken by the inductor-operated discharge lamps shall not exceed the rating of the final sub-circuit.

NOTE.—For circuits which are corrected to a power factor of not less than 0·85, the above Regulation is complied with if, when the number of lamps to be used on the final sub-circuit is being calculated, the rated lamp watts of the discharge lamps are multiplied by 2. In these circumstances the value:—

$$\frac{(2 \times \text{inductor-operated discharge lamp watts}) + (1 \times \text{incandescent lamp watts, if any})}{\text{mains volts}}$$

must not exceed the rating of the final sub-circuit.

Installation of ancillary apparatus.

808 Ancillary apparatus, including inductors, capacitors, resistors and transformers, shall be so installed as to be adequately ventilated and protected from risk of mechanical damage, and shall be either:—

(i) enclosed in a lighting fitting assembly,

or (ii) enclosed in a suitably designed incombustible enclosure,

or (iii) be so mounted that no wood, except hardwood, or other combustible material not protected by incombustible material is within 12 inches measured vertically above, or 6 inches measured in any other direction, from the ancillary gear.

NOTE.—Lighting fittings should not be installed immediately below sprinkler heads or, if this is unavoidable, the lighting fitting should be at least 12 in. below the sprinkler head.

Position of transformers and inductors.

809 Every inductor and "high-reactance" transformer shall be installed as near as is practicable to its associated discharge lamp.

810 When power-factor-correcting capacitors are provided in discharge-lamp circuits, each portion of a final sub-circuit which is controlled by a separate switch shall have separate power-factor correction. **Power-factor correction.**

NOTE.—The provision of power-factor correction is implicit if the guidance given by the Note to Regulation 807 is adopted.

811 All live parts of an installation, including all apparatus and conductors but excluding the lamps except in the neighbourhood of their terminals, shall be provided with effective screens of earthed metal or insulating material, of mechanical strength adequate to withstand the conditions of normal service. Insulating material used for this purpose shall be non-ignitable, non-hygroscopic and non-tracking. **Screening of live parts.**

Exemption.—For installations on the exterior of a building, such live parts may alternatively be so situated as to be accessible only to authorized persons.

NOTE 1.—For the purpose of this Regulation, glass is not deemed to be of sufficient mechanical strength unless suitably shielded by a rigid guard.

NOTE 2.—For the purpose of this Regulation, a discharge-lamp installation in a closed market or in an arcade is deemed to be an exterior installation; but an installation in a permanent building used for exhibitions is not so deemed.

812 Where live parts would otherwise be exposed to rain, dripping water or condensed water, they shall be protected by weatherproof housing. **Protection from water.**

813 All exposed metalwork shall be earthed, except that metal clips or clamps used in positions remote from terminals, to support discharge lamps, need not be earthed. **Earthing of exposed metal-work.**

814 Every transformer, other than an auto-transformer, shall have one point of its secondary winding earthed, except that a secondary winding on a "high-reactance" transformer, serving solely to energize a tesla coil or the heating electrode of a discharge lamp, need not be earthed. If earth-leakage protection is provided, the earth connection may be made through the winding of a solenoid to the local earth. The core of every transformer shall be earthed. **Earthing of transformers**

Auxiliary windings.

815 A circuit which is supplied from an auxiliary winding on a "high-reactance" transformer to energize a tesla coil or the heating electrode of a discharge lamp need not be separately protected by a fuse.

Motor-generators and convertors.

816 Every discharge-lamp circuit which is energized by a motor-generator or double-wound convertor shall be permanently earthed at a terminal of the motor-generator or convertor.

Voltages of 300–650 volts.

817 Discharge-lamp equipment which operates under steady running conditions at an r.m.s. voltage exceeding 300 volts but does not fall within the scope of Section 9, i.e. does not use a voltage exceeding 650 volts r.m.s. measured on open circuit, shall either be inaccessible to unauthorized persons or be so designed and installed that no live metal is exposed in such a manner that it may be touched, when a lamp is inserted or removed.

Section 9

Regulations 901–913

THE INSTALLING OF ELECTRIC DISCHARGE LAMPS (HIGH-VOLTAGE)

901 No discharge-lamp circuit shall use an r.m.s. voltage exceeding 5 000 volts to earth, measured on open circuit. **Maximum voltage permissible.**

902 Every high-voltage circuit supplied from a transformer having an input exceeding 500 watts shall be provided with means for the automatic disconnection of the supply in the event of short circuit, or of earth-leakage current which exceeds 20 % of the normal steady current in the circuit. **Transformers of input exceeding 500 watts.**

903 Ancillary equipment for high-voltage installations, including inductors, capacitors, resistors and transformers, shall be either totally enclosed in a substantial earthed metal container (which may form part of a lighting fitting), or alternatively shall be placed in a suitably ventilated enclosure of incombustible material or of fire-resisting construction which is reserved for high-voltage apparatus. A notice "DANGER. HIGH VOLTAGE" shall be placed and maintained on every such container or enclosure as is accessible to unauthorized persons, and otherwise where necessary. The word "DANGER" shall be in block letters not less than $\frac{3}{8}$ in. high and the words "HIGH VOLTAGE" in letters not less than $\frac{3}{16}$ in. high. The letters shall be red on a white background and the size of each notice shall not be less than $2\frac{1}{2}$ in. by 2 in. overall. **Installation of ancillary equipment.**

904 Except as exempted below, a conductor which is in metallic connection with the terminals of a discharge lamp shall not be in metallic connection with any conductor of the supply mains otherwise than by means of a connection with earth. **Isolation from supply mains.**

Exemption.—On a.c. 2-wire circuits in which one pole of the supply is connected with earth, it is permissible to use auto-transformers delivering a maximum voltage of 1 000 volts measured on open circuit, subject to the provision of means for the isolation of both poles of the supply.

Means of disconnection.

905 One of the following alternative means shall be provided for the isolation, from all poles of the supply, of every self-contained fitting, or alternatively, of every circuit supplying a high-voltage discharge lamp, except that means need not be provided for the isolation of the neutral of a 3-phase 4-wire installation:—

(i) an interlock on the self-contained fitting, so arranged that before access can be had to live parts the supply is automatically disconnected,

or (ii) effective local means for the isolation of the circuit from the supply (e.g. an adjacent plug and socket-outlet conveniently placed), such means being provided in addition to the switch normally used for controlling the circuit,

or (iii) a switch or fuseboard which can be locked, arrangements being made to prevent the restoration of the supply by unauthorized persons. Where an installation comprises more than one locked switch or fuseboard, the keys shall be non-interchangeable.

Fireman's switch.

906 A fireman's emergency switch shall be provided for:—

(i) exterior installations,

(ii) interior installations which run unattended (e.g. for window lighting or display purposes).

Every such fireman's switch shall comply with the following clauses (A) to (D).

(A) It shall be arranged to isolate the discharge-lamp installation from all poles of the supply, except that it need not isolate the discharge-lamp installation from the neutral of a 3-phase 4-wire supply.

(B) It shall be painted red and near it shall be fixed a nameplate marked with the words "FIREMAN'S SWITCH." Its "on" and "off" position shall be clearly indicated, and the "off" position shall be at the top. All lettering shall be legible by a person standing on the ground.

(C) It shall be fixed in a conspicuous position, reasonably accessible to firemen, and, except in the case of an agreement to the contrary with the local fire-brigade authority, at not more than 9 ft. from the ground.

(i) For exterior installations, it shall be as nearly as possible vertically below the discharge lamp or lamps, or alternatively, a notice indicating the position of the switch shall be placed directly below the discharge lamp or lamps and a name-plate shall be fixed near the switch so as to render it clearly distinguishable.

(ii) For interior installations, it shall be in the main entrance to the building or alternatively in a position to be agreed with the local fire-brigade authority.

(D) Where more than one fireman's switch is installed on any one building, every such switch shall be clearly marked to indicate the installation or section of the installation which it controls, and the local fire-brigade authority shall be notified accordingly.

NOTE 1.—It is desirable that the fireman's switch be provided with a lock or catch so designed as to prevent the switch being inadvertently or accidentally returned to the "on" position.

NOTE 2.—It is usually desirable that, wherever practicable, all the exterior installations on any one building should be controlled by a single fireman's switch.

Cables.

907 Except as provided in Regulations 908 and 913, high-voltage connections shall be made in cable complying with the appropriate clauses of B.S. 559. Metal-sheathed, armoured or metal-sheathed and armoured cable shall be used, except that insulated and braided cable may be used:—

(i) in exterior installations for inter-lamp series connections not exceeding 10 ft. in length which are not likely to suffer mechanical damage, or which are installed in box signs;

(ii) in interior installations, in self-contained fittings.

NOTE.—For the purpose of Regulations 906 and 907 a discharge-lamp installation in a closed market or in an arcade is deemed to be an exterior installation; but an installation in a permanent building used for exhibitions is not so deemed.

Bare or lightly-insulated conductors.

908 Bare or lightly-insulated conductors of copper (preferably tinned), or nickel, having a cross-sectional area not less than 0·0006 sq. in., may be used for high-voltage series connections provided that either:—

(i) the conductor does not exceed 36 in. in length, is supported at intervals not greater than 18 in., is not exposed to the likelihood of mechanical damage, and is completely protected by non-ignitable, non-hygroscopic insulating material, which, if in the form of glass tubing, has a wall thickness not less than 0·04 in., and an overall diameter not less than 0·2 in., and is so arranged as to be reasonably secure against being so displaced as to expose any part of the live metal,

or (ii) the conductor is in an enclosure to the interior of which only authorized persons can have access.

Metal-sheathed, armoured, or metal-sheathed and armoured cables.

909 Metal-sheathed, armoured, or metal-sheathed and armoured cables shall be installed in accordance with the following clauses (A) and (B):—

(A) They shall be supported at intervals not greater than the following:—

Cable run	*Metal-sheathed*	*Armoured or metal-sheathed and armoured*
Horizontal	30 in.	36 in.
Vertical	48 in.	60 in.

The supports shall hold the cable securely and shall themselves be rigidly mounted.

(B) All metal sheathing and armouring shall be earthed.

Insulated and braided cables and bare conductors.

910 Insulated and braided cables and bare conductors shall be supported at intervals not greater than the following:—

Cable run	*Insulated and braided cables*	*Bare conductors*
Horizontal	18 in.	18 in.
Vertical	30 in.	18 in.

The supports shall be of incombustible non-hygroscopic insulating material, e.g. glass or glazed porcelain, shall hold the cable or conductor securely and shall themselves be rigidly mounted.

Clearances.

911 (A) The length in inches, measured along its centre line, of every support which serves to separate bare high-voltage metal, or cables which are neither metal-sheathed nor

armoured, from earthed metalwork, woodwork or surfaces likely to become damp, shall be not less than the value obtained by dividing by 2·5 the voltage to earth in kilovolts (r.m.s.) of the transformer secondary, measured on open circuit.

(B) The air gap in inches from high-voltage metal or cables which are neither metal-sheathed nor armoured, to earthed metal, woodwork, or surfaces likely to become damp, shall be not less than the value obtained by dividing by 7 the voltage to earth in kilovolts (r.m.s.) of the transformer secondary, measured on open circuit.

912 (A) Each cable shall be supported close to each terminal connection and in no case at a distance greater than 6 in., or 12 in. if a glazed porcelain electrode-receptacle forming an adequate support for the cable is used. **The installing of cables.**

(B) The ends of stranded conductors shall be made solid by soldering or all the strands shall be twisted and clamped.

(C) When a connection is made to a cable, the insulation exposed by stripping back the metal sheath or braiding shall be suitably protected from the effects of ozone.

(D) Where likely to suffer mechanical damage, cable shall be armoured or otherwise suitably protected. Unarmoured cables shall not be installed in metal conduits, except where they pass through walls or floors, where they may be installed in short lengths of metal conduit which shall be earthed.

(E) Where otherwise not readily identifiable, cables or their protective coverings shall be distinguished by tabs or labels marked "DANGER," securely attached at intervals not greater than 5 ft. The letters shall be red on a white background, and shall be not less than $\frac{3}{8}$ in. high.

913 (A) The return cable from an electrode to a transformer terminal which is earthed may be in accordance with B.S. 7, 250-volt grade, provided that the cross-sectional area of the conductor is not less than 0·0045 sq. in. (7/·029 in.). **Earthed return conductors.**

(B) The metalwork of a rotating device (e.g. the hands of a clock), may be used as a return conductor provided that adjacent uninsulated metalwork is permanently and effectively earthed.

Section 10

Regulations 1001–1009

EARTHING

NOTE.—Earthing connections, especially those to portable apparatus, are difficult to maintain effectively; it is therefore strongly recommended that electrical apparatus should be of an all-insulated type wherever practicable. It is also recommended that lampholders and lighting fittings be so arranged that in normal operation no metal parts of lamp-caps or of lampholder plugs inserted in the lampholders can be touched. This result may be achieved either through the construction of the lighting fittings or by the provision of insulating shrouds for the lampholders.

Where portable appliances of all-insulated design cannot be obtained, it is recommended that consideration should be given to the use of portable appliances having double insulation. [See definition and the exemption to Regulation 1001 (B).]

The use of lampholder plugs or socket-outlets with two-pin reversible plugs, even in earth-free situations, is deprecated except (in the absence of statutory requirements to the contrary) for extra-low voltage circuits.

In localities where severe lightning storms are prevalent, it is undesirable for metalwork to be in close proximity to a thatched roof or other mass of combustible material.

Metalwork to be earthed.

1001 (A) Except as specifically exempted in the following exemptions (i) to (ix), all metalwork of electrical equipment, other than current-carrying parts, all metal conduits or ducts, all catenary wires, whether external to or embedded in a cable, and used for its support, and all close-fitting metal sheath and armour of cables shall be earthed.

In kitchens or sculleries where electricity is utilized for purposes other than fixed lighting and in which there is a metal sink, steps shall be taken to ensure that the sink is satisfactorily electrically bonded to the cold-water pipe.

Exemptions:—

(i) Metalwork of electrical equipment in earth-free situations (*see* Definition).

NOTE 1.—For purposes of this exemption metalwork of electrical equipment does not include runs of metal conduit or duct or close-fitting sheath or armour of cables.

NOTE 2.—In earth-free situations the connection of an earth-continuity conductor to the earth contact-tube of a socket-

outlet may be omitted, except where the socket-outlet is to supply portable appliances having exposed metalwork which are liable to be carried into non-earth-free situations while connected to that socket-outlet.

(ii) Short isolated lengths of metal conduit used for mechanical protection of metal-sheathed or tough-rubber- or p.v.c.-sheathed cables, other than cables of high-voltage circuits of electric discharge lamps; and short isolated lengths of catenary wire used for the support of cables.

(iii) Short unexposed isolated lengths of metal conduit used for the mechanical protection of cleated and similar-type wiring systems when passing through floors, walls, partitions or ceilings.

(iv) Metal parts of electrical apparatus, where such parts are so enclosed and/or shrouded by insulating material that they cannot be touched.

(v) Metal parts on, or screws in or through, non-conducting materials, which are separated by such material from current-carrying parts and from earthed non-current-carrying parts in such a way that in normal use they cannot become live or come into contact with earthed parts; provided, however, that metal hooks and clips intended for the support of flexible cords (e.g. on the handles of electric vacuum cleaners) shall be covered with insulating material.

(vi) Cleats, clips, saddles, clamps, etc., for fixing conduits and cables.

(vii) Lamp-caps.

(viii) Shades, reflectors, and guards, supported on lamp-holders or lighting fittings of non-conducting material.

(ix) Metalwork, other than the current-carrying parts of equipment, and metal conduits and ducts, or sheath, or armour, of extra-low-voltage circuits.

NOTE.—Exemption (ix) may not apply to premises subject to the Factories Act.

Earthing of portable equipment.

(B) Except as exempted below, the metalwork of all portable electric equipment, other than current-carrying parts and

metal exempted under items (ii) to (ix) in clause (A) above from the necessity of being earthed, shall be connected to an earth-continuity conductor in the flexible cord or cable supplying the equipment and thereby to the earthing-pin of a British Standard plug, in order to ensure that such exposed metal becomes earthed when the plug is inserted in any corresponding socket-outlet from which an appliance may be used in a non-earth-free situation.

Exemption.—Except in premises subject to the Factories Act, metalwork of any portable appliance having double insulation (*see* Definition), provided that the appliance conforms with the safety requirements of a British Standard which has been approved for the purpose of this Regulation.

Earthing of independent low-voltage circuits.

(C) Where a transformer or convertor is used to reduce the voltage in a circuit which is fed from but is not metallically connected to a primary circuit operating at a voltage to earth exceeding extra-low voltage, the secondary circuit and metal parts other than current-carrying parts of the equipment shall be connected with earth.

Additional precautions in a room containing a bath.

1002 (A) In every room containing a fixed bath, all metal forming part of the electrical equipment (other than current-carrying parts) and all metal conduits, ducts, sheath or armour shall, wherever practicable, be either completely shielded by non-conducting material, or be concealed within walls, floors, or ceilings. Where such complete screening is impracticable, a securely-fixed special conductor shall be provided for the purpose of maintaining at uniform potential the exposed metal described below. This uniform-potential conductor shall be permanently and rigidly connected to the earthing terminals of all electrical equipment in the room, including the earthing terminals of any socket-outlets, and to all exposed fixed metalwork in the room; including piping and the bath but excluding window frames, door locks, isolated furnishings such as hooks and brackets, or cleats, saddles, clamps, etc., for fixing cables and conduits.

NOTE.—The chief purpose of the uniform-potential conductor is to ensure that no dangerous voltage differences can exist between any two pieces of exposed metalwork in the room, but, since to comply with other requirements of the Regulations the metalwork concerned will normally require to be earthed, the uniform-potential conductor may if desired be

connected with earth and used as an earth-continuity conductor.

(B) Metal-to-metal-screwed pipe, compression joints, wiped joints, and metal-to-metal-bolted flange joints, or equivalent-entry joints to metal casings of water-heating apparatus, are normally electrically continuous; and where it has been verified that this is so in a particular installation it is permissible to employ such pipework as the uniform-potential conductor, provided that the resistance measured between any two points of the pipework within the room is such that the voltage between them cannot exceed 40 volts under fault conditions. Where the foregoing conditions in regard to electrical continuity are not verified and ensured, the special conductor, which shall be suitably protected from corrosion and mechanical damage, shall consist of either a tinned-copper strip not smaller than 0·5 in. × 0·02 in. or a stranded tinned-copper conductor of not less than 0·007 sq. in. nominal cross-sectional area (7/·036 in.).

NOTE.—To ensure that the voltage between any two points of the pipework referred to in clause (A) above does not exceed 40 volts under fault conditions, it is necessary that the product shall not exceed 40 when the electrical resistance (in ohms) between any two such points of the pipework is multiplied by the current (in amperes) at which the fuse protecting the circuit will blow.

(C) Those parts of a lampholder in a bathroom which are likely to be touched by a person replacing a lamp shall either be constructed of, or shrouded in, insulating material so as to prevent a person from inadvertently touching any metal part of the lampholder or of the lamp-cap.

(D) Every switch or socket-outlet or other means of non-automatic control or adjustment, unless bonded to a uniform-potential conductor in compliance with Clause (A) above, shall be so situated as to be out of reach of a person sitting in or on a bath.

NOTE.—In some cases this requirement may make it desirable to provide a ceiling switch operated by a non-conducting cord, or to place the wall switch outside the room.

(E) No provision shall be made for the use of portable appliances in a room containing a fixed bath.

NOTE.—Enclosure of electrical equipment within a cupboard is deemed to fulfil the requirement of shielding or con-

cealment within walls, etc., referred to in Clause (A), but does not constitute any exemption from the requirements of Clause (D).

Earth-continuity conductor

1003 (A) The electrical impedance of the earth-continuity conductor, including any metal conduits, metal sheath and/or armour of cable used as earth-continuity conductors, shall be such that the impedance between the earth electrode or earthing terminal or connection provided by the supply authority and any point on the earth-continuity conductor shall not exceed 1 ohm. For the purpose of this requirement the impedance of any operating coil of an earth-leakage circuit-breaker connected in the earth-continuity-conductor circuit may be excluded.

(B) Where a separate earth-continuity conductor is provided, which is not contained in a composite cable or flexible cord, the nominal cross-sectional area of the conductor shall be not less than 0·0045 sq. in. (7/·029 in.) and not less than one half that of the largest current-carrying conductor feeding the circuit, except that no earth-continuity conductor exceeding 0·1 sq. in. nominal cross-sectional area need be used.

(C) Every earth-continuity conductor contained in a metal-sheathed or tough-rubber-sheathed composite cable shall have a cross-sectional area in relation to the current-carrying conductors in the cable, not less than that set out in Table 18.

(D) Every earth-continuity conductor contained in a flexible cord or cable, other than those referred to in clause (C) above, shall have a cross-sectional area not less than (i) the cross-sectional area of the current-carrying conductors where these are of 0·0048 sq. in. or less, or (ii) 0·0048 sq. in. where the cross-sectional area of the current-carrying conductors lies between 0·0048 and 0·01 sq. in., or (iii) one-half the cross-sectional area of the current-carrying conductors where this exceeds 0·01 sq. in.

(E) Flexible metallic tubing shall not be used as an earth-continuity conductor. Where such tubing forms part of an earthed metal-conduit system, a separate earth-continuity conductor having a cross-sectional area not less than that required by clause (B) above shall be installed with the tubing and connected to it at each end and, in the case of long runs, at suitable intervals throughout the run.

NOTE.—The requirements for the construction of earth-continuity conductors contained in flexible cords or cables are set out in Regulation 1311.

(F) Any catenary wire, whether external to or incorporated in a cable, and used for its support, shall have a resistance not greater than that of the copper earth-continuity conductors specified in clauses (B) to (D) above, unless a separate earth-continuity conductor, to which the catenary is bonded at intervals, is used on the cable run concerned.

NOTE.—For the purpose of estimating the resistance of a catenary wire, it may be assumed that the resistivity of steel is eight times that of copper.

Joints in metal conduits and sheaths.

1004 Where metal conduits or the sheaths of cables have to be earthed, or are themselves used as earth-continuity conductors, every joint in such conduit or sheath shall be so made that its current-carrying capacity shall not be less than that of the conduit or sheath itself.

Systems of earthing.

1005 (A) Where the supply authority provides an earth-terminal or permits an earth connection to the lead sheath of the supply cable, that earthing terminal or lead sheath shall be used as the earth electrode of the installation.

(B) Where no metallic connection with the supply authority's earth electrode is provided, the earth electrode, which, subject to the requirements of Regulation 1007, may be a water-pipe, shall be so chosen or installed that where practicable the consumer's earth impedance shall be low enough, under all conditions of soil resistivity, to permit the passage to earth under fault conditions of the current necessary to blow the fuse, or to operate the excess-current trip of the circuit-breaker, protecting the circuit. Where it is not practicable to obtain such a value of the consumer's earth impedance, earth-leakage protective devices must be installed in accordance with the requirements of Regulation 1006.

NOTE.—Attention is drawn to the variation of the resistance of the connection between an earth electrode and the general mass of earth under differing weather conditions, and to the desirability of assessing the maximum resistance which is likely to develop.

Earth-leakage protection.

1006 Except as specifically exempted in the following exemptions (i) to (iv), there shall be provided in every installa-

tion an earth-leakage protective device or devices which on the occurrence of an earth fault will disconnect from the supply all live conductors of the faulty circuit (or circuits).

Exemptions.

(i) Where the maximum possible earth-leakage current from a circuit can be proved to be greater than the overload value at which the fuse or circuit-breaker will operate.

(ii) Where the current rating of the fuse or circuit-breaker controlling the circuit does not exceed 100 amperes and the metal to be protected is connected to an earth terminal provided for this purpose by the supply authority, or to a pipe forming part of an urban underground system of metal water-mains having metal-to-metal joints.

(iii) Installations having no exposed metal requiring earthing in accordance with the requirements of this Section.

(iv) Electrode-water-heater or electrode-boiler installations where the shell of the apparatus is solidly connected to the neutral conductor of the supply. (See Regulation 713.)

NOTE 1.—Exemptions (i) to (iv) do not preclude the fitting of earth-leakage protection on such installations, if desired.

NOTE 2.—For the purpose of exemption (i) the total impedance likely to be normally present in the earth-leakage circuit should be taken into account.

NOTE 3.—The earth-leakage protective device may be of a type operated by a rise in voltage between the metal to be protected and earth, in which case it should be arranged to operate with a rise not exceeding 40 volts or, alternatively, may be of a differential type arranged to operate when leakage current to earth attains 15% of the rated current for the circuit or 5 amperes, whichever is the greater.

NOTE 4.—Earth-leakage protective devices of the voltage-operated type rely on the combined impedance of the operating coil and the consumer's earth impedance being such as to permit the passage of a current sufficient to operate the tripping device before the voltage between the metal to be protected and earth reaches a dangerous value.

The main requirements to secure effective operation are as follows:—

(i) The earth terminal of the operating coil may be con-

nected to any earth electrode whose resistance is such as to satisfy the foregoing conditions.

(ii) The connection between the earth terminal of the operating coil and the earth electrode should be insulated, to minimize the effect of parallel paths on the sensitivity of the earth-leakage device.

The provision and maintenance of such insulation is particularly important where discrimination in operation between a number of earth-leakage devices is attempted by the introduction of a break in the earth-continuity conductor between a part of the installation protected by one earth-leakage device and adjacent parts.

(iii) As the sensitivity of operation of an earth-leakage device is liable to be affected by the existence of parallel current-paths between the earth-leakage device and the earth electrode referred to in (i), the earth terminal of the operating coil should be connected to a separate earth-electrode installed outside the resistance area of any other earth electrode, or metal acting as such and liable to form a parallel path to earth.

(iv) If, in addition to the use of an earth-leakage protective device, it is desired to earth the metal solidly to the best available means of earthing, it is essential that the earth electrode to which the operating coil is connected should be installed outside the resistance area of any such "earth."

(v) The effectiveness of the protection afforded by an earth-leakage device should be checked by actual trial, and the margin of safety ascertained by measurement of the current in the lead between the earth terminal of the operating coil and the earth electrode.

Water-pipes, etc.

1007 (A) Where it is permissible and satisfactory to use the water supply-mains as an earth electrode, the connection of the earthing lead to the pipe of such water-mains shall be made either (i) at the point of entry of the water service into the building, or (ii) at some other desired position, provided that the pipe has only metal-to-metal-screwed compression or wiped joints, or metal-to-metal-bolted flange joints, or the equivalent, and that the resistance measured between any two points on the current-carrying portion of the pipe is such that the voltage between them cannot exceed 40 volts under fault conditions.

NOTE 1.—Attention is directed to the "Regulations for controlling the earthing of electrical installations to metal water-pipes and water-mains"* drawn up and approved by The Institution of Civil Engineers, The Institution of Electrical

* See Appendix 4.

Engineers, The Institution of Water Engineers, The British Waterworks Association and The Water Companies' Association, and care should be taken to verify that the water-mains are suitable for use as an earth electrode before any connections are made.

NOTE 2.—A hot-water pipe, or a cold-water pipe fed from a cistern, is usually not in direct contact with earth, and is therefore unsuitable for use as an earth electrode.

NOTE 3.—The pipework of a sprinkler or a drencher system is not normally suitable for use as an earth electrode.

(B) No gas pipe or pipe containing an inflammable liquid shall be used as an earth electrode, or as an earth-continuity conductor, or as a uniform-potential conductor. Such pipes may however need to be connected to the uniform potential conductor for compliance with Regulation 1002 (A).

Earthing leads

1008 (A) Every conductor used as an earthing lead (see Definition) shall be of stranded or solid copper or suitable copper alloy, and shall be protected wherever liable to mechanical damage, and also, where necessary, against corrosion, particular attention being given in these respects to the earthing-lead at its point of connection with the earth electrode. The nominal cross-sectional area of every copper earthing-lead shall be at least 0·0045 sq. in. (7/·029 in.) and not less than one-half that of the largest of the conductors to be protected, except that no conductor larger than 0·1 sq. in. nominal cross-sectional area need be used, and that the conductor of the cable connecting an earth-leakage trip to an earth electrode need not have a larger nominal cross-sectional area than 0·0045 sq. in. (7/·029 in.). The nominal cross-sectional area of every copper-alloy earthing-lead shall be such as to provide a current-carrying capacity not less than that of a copper earthing-lead of the size specified above.

(B) The end of every circular earthing-lead, whether stranded or solid, shall be provided with a soldering socket of such a size as to contain the complete conductor, or alternatively shall be secured by a substantial mechanical clamp.

(C) Every connection of an earthing-lead to an installation or to an earth-electrode shall be readily accessible and made in such a manner as to ensure permanent satisfactory electrical conductance under all conditions of service. Such connections

shall be made either as soldered joints or by means of substantial clamps of non-ferrous material, and, where the connection is to a metal pipe having an internal diameter of not more than 3 in., any clamp shall be in compliance with B.S. 951.

(D) Where the metal sheath and armour of a cable are used as an earth electrode or as an earth-continuity conductor, the armour shall be bonded to the metal sheath and the principal connection between the cable and the earthing lead shall be to the metal sheath.

(E) Clamps for the connection of earthing leads to the armour of cables shall be so designed and fixed as to grip the armour firmly and permanently without damaging the metal sheath, if any, or the insulation of the cable.

NOTE.—The armouring of cables cannot in all cases be relied upon for the purpose of earthing.

Buildings of steel-frame construction.

1009 (A) Metal required to be earthed may, where convenient, be connected to the structural steelwork of a building, provided that such steelwork is itself in permanent and effective connection with earth.

(B) Where the structural steelwork is not earthed, all metal of the electrical equipment which might become live owing to defective insulation or to accidental contact with live metal, shall either be protected from contact with the steel structure, or be earthed.

(C) Where electrical apparatus is mounted on mobile equipment (e.g. cranes and lifts), the metal covers and frames of such apparatus and the metal conduits or sheaths of the cables shall be connected to the metal frame of the equipment, which shall itself be earthed.

Section 11

Regulations 1101–1108

THE TESTING OF INSTALLATIONS

NOTE.—This Section enumerates the routine tests essential for electrical installations. Satisfactory test results do not, however, in themselves necessarily ensure that the installation is satisfactory in all respects.

Periodical inspections and tests are essential if the installation is to be maintained in a sound condition and undue deterioration detected. All defects which the tests reveal should be made good without loss of time.

Where an addition is made to the fixed wiring of an existing installation, the latter should be examined and the consumer notified if it fails to comply with these Regulations.

Testing voltage

1101 The voltage used for insulation-resistance tests referred to in Regulations 1102 to 1104 shall be a d.c. voltage not less than twice that to which the circuits will normally be subject (twice the root-mean-square value if the supply is a.c.), provided that it need not exceed 500 volts for medium-voltage circuits.

Insulation resistance of an incomplete installation.

1102 (A) Where an insulation-resistance test of the permanent wiring of an installation is desired before lighting fittings, lamps, etc., are installed, the test shall be made with the conductors so connected together as to ensure that all parts of every circuit are simultaneously tested, and in these circumstances the insulation resistance to earth shall be not less in megohms than 100 divided by the number of outlets (points and switches) from the fixed wiring, the value 100 being reduced to 25 for installations using p.v.c.-insulated cables.

NOTE.—A switch combined with a socket-outlet, appliance or lighting fitting, is deemed to be one outlet for the purpose of this Regulation.

(B) When the insulation resistance of the permanent wiring is found by a test with a 500-volt instrument to be below 0·5 megohm, the permanent wiring must be subdivided for test purposes into sections such that the insulation resistance of each section is at least 0·5 megohm; the insula-

tion resistance of each section shall then be in accordance with the requirements of clause (A).

NOTE.—Since the type of instrument normally used for measuring insulation resistance applies only a proportion of its open-circuit or rated voltage to the circuits under test when their resistance is less than "infinity," readings of below 0·5 megohm usually indicate that an unduly low proportion of the test voltage is in fact being applied.

Insulation resistance of complete installation.

1103 (A) Before a complete installation, section of an installation, or addition to an existing installation, is permanently connected to the supply, an insulation-resistance test shall be made with all fuse-links in place, all switches (including the main switch, if practicable) closed, and, except with earthed-concentric wiring, all lamps in position or both poles of the wiring otherwise electrically connected together. In these circumstances, the insulation resistance to earth shall be not less in megohms than 50 divided by the number of outlets (points and switches) from the fixed wiring, the value 50 being reduced to 12½ for installations using p.v.c.-insulated cables; the insulation resistance need not, however, exceed 1 megohm for the whole installation.

NOTE.—A switch combined with a socket-outlet, appliance or lighting fitting, is deemed to be one outlet for the purpose of this Regulation.

(B) When the insulation resistance of a complete installation, section of an installation, or addition to an installation is found by a test with a 500-volt instrument to be below 0·5 megohm, the installation, section of an installation, or addition to an installation, shall be sub-divided for test purposes into sections such that the insulation resistance of each section is at least 0·5 megohm; such sections shall then each have an insulation resistance in accordance with the requirements of clause (A).

NOTE.—See note to Regulation 1102 (B).

(C) Control rheostats, heating and power appliances, and electric signs, may, if desired, be disconnected from the circuits during the test prescribed in clauses (A) and (B), but in that event the insulation resistance between the case, or framework, and all live parts of each rheostat, appliance, and sign, shall be not less than that specified in the appropriate

British Standard, or, where there is no such standard, shall be at least 0·5 megohm.

Test between conductors.

1104 (A) Where practicable, the insulation resistance shall also be measured between all the conductors connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or neutral or to the other pole or phase conductor of the supply. Such a test shall be made with all metallic connection between the two poles of the installation removed, and in these circumstances the insulation resistance between conductors of the complete installation or of a section of the installation shall be not less in megohms than 50 divided by the number of outlets (points and switches) from the fixed wiring, the value 50 being reduced to 12½ for installations using p.v.c.-insulated cables; the insulation resistance need not, however, exceed 1 megohm for the whole installation.

NOTE.—A switch combined with a socket-outlet, appliance or lighting fitting, is deemed to be one outlet for the purpose of this Regulation.

(B) When in the course of the test described in clause (A) the insulation resistance between conductors is found by a test with a 500-volt instrument to be below 0·5 megohm, the installation shall be sub-divided for test purposes into sections such that the insulation resistance between conductors in each section is at least 0·5 megohm; the insulation resistance between conductors of such sections shall then be in accordance with the requirements of clause (A).

NOTE.—See note to Regulation 1102 (B).

Testing of polarity of single-pole switches.

1105 (A) In a 2-wire installation a test shall be made to verify that all non-linked single-pole switches have been fitted in the same conductor throughout, and such conductor shall be labelled or marked for connection to a phase or outer conductor or to the non-earthed conductor of the supply.

(B) In a 3-wire or a 4-wire installation a test shall be made to verify that every non-linked single-pole switch is fitted in a conductor which is labelled or marked for connection to one of the phase or outer conductors of the supply.

1106 (A) A test shall be made to verify that the impedance of the earth-continuity path does not exceed the maximum value specified in Regulation 1003 (A). Testing of earth-continuity path.

(B) A test shall be made to verify the continuity of every ring circuit installed in accordance with Regulation 201 (C), Exemptions (iii) and (iv). Test of ring circuit.

1107 The following procedure shall be adopted when it is desired to measure the resistance of the earth-electrode:— Testing the effectiveness of earth.

(A) Alternating current of a steady value shall be passed between the earth electrode X and an auxiliary earth-electrode Y placed at such a distance from X that the resistance areas (*see* Definition) of the two electrodes do not overlap.

(B) A second auxiliary earth-electrode Z, which may be a metal spike driven into the ground, shall then be inserted half-way between X and Y and the voltage-drop between X and Z measured. The resistance of the earth electrode is then the voltage between X and Z divided by the current flowing between X and Y provided that there is no overlap of the resistance areas.

(C) To check that the resistance obtained in (B) is a true value, two further readings shall be taken with the auxiliary electrode Y moved 20 ft. further from and 20 ft. nearer to X respectively. If the three results are substantially in agreement, the mean of the three readings shall be taken as the resistance of the earth-electrode X. If there is no such agreement the tests shall be repeated with the distance between X and Y increased.

(D) The test shall be made either with current at power frequency, in which case the resistance of the voltmeter used must be large (of the order of 200 ohms per volt), or with alternating current from an earth tester comprising a hand-driven generator, a rectifier (where necessary), and a direct-reading ohmmeter. The second method is preferable because it is easier to manipulate and is more accurate.

(E) If the tests are made at power frequency the source of the current used for the test shall be isolated from the power mains (e.g. by a double-wound transformer), and in any event the earth electrode A under test shall be disconnected from all sources of supply other than that used for testing.

Certificate to be given.

1108 On the completion of an installation, or of an extension to an installation, a certificate shall be given by the contractor, or by an authorized person acting on his behalf, on the form (Form A) set out below. The space provided in the form for inserting the recommended number of years intervening between inspections should be filled in with the figure 5 or such lesser figure as is considered appropriate to the individual case.

Form A.

Form A *prescribed in the I.E.E. Regulations for the Electrical Equipment of Buildings.*

Initial Certificate to be given by the contractor responsible for the construction of the installation, or by an authorized person acting on his behalf.

Electrical installation at .....
.....Lighting points Fixed apparatus.....
..... -amp. socket-outlets .....

Certificate. I certify that the installation detailed above has been inspected and tested and that, to the best of my knowledge and belief, it complies with the Edition of the Regulations for the Electrical Equipment of Buildings published by The Institution of Electrical Engineers and current at the date of contract for the work, except as stated below.

I recommend that this installation be periodically inspected and tested at intervals of not more than .... years, and a report obtained on its condition, as prescribed in the above Regulations.

Signed ....
Date .....
Details of departures (if any) from the Regulations:—

NOTE.—It is recommended that the contractor or other person responsible for the construction of an installation should remind the consumer of the importance of re-inspection at the appropriate time. Every re-inspection of an installation should be reported upon on the form (Form B) set out below, which should be submitted to such consumer and be signed by a competent person who should preferably be a Chartered Electrical Engineer, a member of the Electrical Contractors' Association Inc., a member of the Electrical Contractors' Association of Scotland, a certificate holder of the National

Register of Electrical Installation Contractors, or a qualified person acting on behalf of one of these (in which event it should be stated for whom he is acting).

Form B *prescribed in the I.E.E. Regulations for the Electrical Equipment of Buildings.* Form B.

Maintenance Report.

I certify that the installation at.....
has been inspected and that:—

(*a*) The value of insulation resistance to earth is (*see* Regulation 1103).....
(*b*) The value of impedance of earth-continuity path is (*see* Regulation 1106).....
(*c*) The earthing is in accordance with the requirements of the Regulations, except as stated below.
(*d*) All flexible cords, switches, fuses, plugs, and socket-outlets, are in good serviceable condition, except as stated below.
(*e*) There is no sign of overloading of conductors or accessories, except as stated below.
(*f*) There is no evidence (after inquiry) of the use of portable appliances in any bathroom, except as stated below.
(*g*) There are no obvious defects, and the whole installation appears to be in good serviceable condition, except as stated below.

Signed .....
Date .....
Details of defects and exceptions, if any, referred to above:—

Section 12

Regulations 1201–1208

THE INSTALLING OF PRIVATE GENERATING PLANT AND SECONDARY BATTERIES

Generators, motors, etc.

1201 Every generator, motor or other rotating electrical machine, of private generating plant, shall be installed in accordance with the requirements of Section 7 of these Regulations.

Main switchgear.

1202 (A) Every main switchboard controlling the supply from a private generating plant shall be fitted with the switchgear specified in Table 3 as a minimum for each generator, for the respective systems of distribution, and for d.c. systems clause (B) below shall be observed.

(B) Where a d.c. generator is to run in parallel with other generators a reverse-current trip shall be inserted in the positive conductor of a 2-wire system and in each outer conductor of a 3-wire system. Where the generators are compound-wound, an equalizer connection with a single-pole switch shall also be installed.

Additional switch control.

1203 Where the private generating plant is in a building separated, and not at all times readily accessible, from that to which the supply is given, additional control switches or circuit-breakers, capable of completely disconnecting the supply, shall be installed in the building to which the supply is given.

Prohibition of fuses and non-linked switches in certain conductors.

1204 Where an installation, which is supplied from a private generating plant, has one pole permanently and effectively connected with earth, a fuse, non-linked switch or non-linked circuit-breaker shall not be inserted in the pole which is connected to earth.

NOTE.—A permanent and effective connection with earth is one in which the resistance between the earth electrode, or electrodes, and the general mass of earth, does not at any time exceed one ohm, and which is not broken in any circumstances, including testing and the location of faults, while any conductor is live.

It should be observed that the requirements of a permanent and effective connection with earth do not preclude

the provision, on all poles, of isolating links, a linked switch, or a linked circuit-breaker, as a means of completely disconnecting the installation from the generating plant.

Attention is drawn to the fact that the principle laid down in Regulation 1204 applies throughout an installation and therefore includes all 2-wire circuits connected to a 3-wire or a 4-wire system which is earthed as described therein.

Measuring instruments

1205 Every main switchboard controlling the supply from a private generating plant shall be fitted as a minimum with the measuring instruments specified in the following clauses (A), (B) and (C), for the respective systems of wiring.

Single-phase a.c. or d.c. two-wire systems of wiring.

(A) For single-phase a.c. or d.c. 2-wire systems of wiring:—

(*a*) Where only one generator is installed, one ammeter and one voltmeter.

(*b*) Where more than one generator is installed, the generators not being arranged to run in parallel, an ammeter for each generator and one voltmeter for use on any generator. The voltmeter shall be fitted with a multi-way switch or plug.

(*c*) Where more than one generator is installed, the generators being arranged to run in parallel, an ammeter for each generator, and two voltmeters; also, for a.c. systems, a synchronizing device for paralleling purposes, and a frequency indicator. For compound-wound d.c. machines, the ammeter shall be connected on the pole other than that to which the equalizer connection is made. One of the voltmeters shall be fitted with a multi-way switch or plug enabling it to be connected to any one generator before the machine is put in circuit; the other voltmeter shall either be permanently connected to the busbars, or be fitted with a multi-way switch or plug.

Single-phase a.c. or d.c. three-wire systems of wiring.

(B) For single-phase a.c. or d.c. 3-wire systems of wiring:—

In addition to the instruments required for 2-wire systems, an ammeter in each outer conductor, or, alternatively, one ammeter fitted with a multi-way switch to enable the current to be read in each outer conductor, from each generator, and a voltmeter connected between the neutral and each outer busbar.

Three-phase systems of wiring.

(C) For 3-phase systems of wiring:—

(*a*) Where only one generator is installed, an ammeter in each phase (or, alternatively, one ammeter fitted with a multi-way switch to enable the current to be read in each phase), and one voltmeter.

(*b*) Where more than one generator is installed, the generators being arranged to run in parallel, for each generator an ammeter in each phase conductor, or, alternatively, one ammeter fitted with a multi-way switch to enable the current to be read in each phase; also a frequency indicator, a synchronizing device for paralleling purposes and two voltmeters. One of these voltmeters shall be fitted with a multi-way switch or plug enabling it to be connected to one phase of any one generator before the machine is put into circuit. The other voltmeter shall be permanently connected to one phase of the busbars or shall be fitted with a multi-way switch or plug as above. All these voltmeter connections shall be made to the same phase in each case.

Secondary batteries.

1206 (A) Every battery shall be so arranged that each cell is readily accessible from the top and from at least one side.

(B) In a battery having a normal working voltage exceeding 60 volts, each cell shall be supported on glass or vitreous porcelain insulators, which may, if desired, form an integral part of the container. In addition the stands shall be insulated where a battery has a normal working voltage exceeding 120 volts.

(C) The battery connecting-bolts, unless of a non-corrosive type, shall be kept covered with petroleum jelly.

(D) Open-type cells shall be fitted with spray arresters.

(E) Celluloid shall not be used in the construction of non-portable secondary cells and batteries.

(F) Where celluloid is used for portable batteries the charging arrangements shall be such that if the containers become ignited the risk of a fire spreading shall be minimized.

(G) Where apparatus is supplied from secondary batteries the same general regulations shall be observed as apply to

similar apparatus fed from generators operating at the same voltage.

Control of secondary batteries.

1207 (A) Means shall be provided to protect the battery from excess charging current and from excess discharge current due to overload or reverse current in the charging circuit. These means shall, as a minimum, be as set out in clause (B) or (C) below, as may be appropriate.

(B) Where the charging equipment incorporates a rectifier circuit which will not permit a reversal of current, the protection shall be in the form of a fuse or a circuit-breaker operated by excess current.

(C) With charging circuits other than those to which clause (B) applies, the protection shall include a means of preventing the discharge of the battery through the charging circuit and it shall be in the form of either

(i) a fuse and automatic cut-in and cut-out switch, or
(ii) a circuit-breaker with over-current and reverse-current protection.

(D) Fuses or circuit-breakers need not be inserted in the connections between the regulating cells of a battery and the control panel.

Ventilation of battery room.

1208 The room in which batteries are placed shall be adequately ventilated.

Section 13

Regulations 1301–1315

REQUIREMENTS IN REGARD TO THE DESIGN AND CONSTRUCTION OF ELECTRICAL APPARATUS (INCLUDING CABLES)

Appropriate British Standard.

1301 The following materials, appliances, accessories, fittings, etc., used in installations constructed in compliance with these regulations, shall comply in all respects with the appropriate British Standards in so far as they are applicable:—

	Appropriate British Standard
Ammeters, indicating	89
Ammeters, graphic	90
Busbars and connections on switchboards	159
Cables	(*see* Regulations 1306 to 1311)
Capacitors for power-frequency circuits	1650
Ceiling roses	67
Circuit-breakers (above 15 amperes)	116, 862, 936
Conduits, copper, and fittings	840
Conduits, non-metallic	(*see* Regulation 1305)
Conduits, steel	31
Conduit boxes and fittings, steel	31
Conduit boxes and fittings, malleable cast iron	31
Conduit boxes, grey cast iron	820
Connectors, reversible, for portable appliances	562
Connectors, inlet and outlet, for radio circuits	(*see* Regulation 1312)
Consumer's electricity control units	1454
Contactors	775
Cooker control units	438
Cords, flexible	(*see* Regulations 1308 and 1309)
Distribution fuseboards	214

	Appropriate British Standard
Distribution fuseboards on earthed concentric wiring	(*see* Regulation 1303)
Double-capped tubular lamps, fittings for	495
Earthing clamps for metal pipes	951
Earth-leakage circuit-breakers for use on consumers' premises	842
Field rheostats	280
Fires, electric	1670
Flameproof enclosures for electrical apparatus	229
Flameproof lighting fittings	889
Fuses (electric)	88
Fuses, cartridge, for use in domestic consumers' units	1361
Fuses, cartridge (up to 5 amperes)	646
Fuse-links, cartridge, for use in plugs	1362
Fuse-switches	861, 88
Graphic ammeters, voltmeters, wattmeters, etc.	90
Indicating ammeters, voltmeters, wattmeters, etc.	89
Instrument transformers	81
Insulating materials, non-ignitable and/or self-extinguishing	(*see* Regulation 1302)
Intrinsically safe electrical apparatus	1259
Lamps, incandescent	(*see* Regulation 1304)
Lampholders and lamp-caps*	52, 98, 1164
Lampholders and lamp-caps for architectural lamps	841
Lampholders, for electric signs	52, 559
Lampholder plugs	52
Meters (electricity)	37
Motors and generators	168
Motors (fractional horse-power)	170
Motor starters and controllers	587
Motor starters and controllers (liquid type)	140

* Subject to B.S. 559, where lampholders are for use in electric signs

	Appropriate British Standard
Non-ignitable and/or self-extinguishing boards	737
Plugs and socket-outlets	(*see* Regulation 1312)
Radio apparatus (mains-operated)	415
Radio-interference suppression devices, components for	613
Rheostats, field	280
Rotary convertors	172
Signs, electric	559
Socket-outlet adaptors	546
Socket-outlets and plugs	(*see* Regulation 1312)
Switchboard slabs	160, 737
Switchgear, power	162
Switches and contactors, automatic change-over, for emergency lighting	764
Switches (above 15 amperes)	861, 816
Switches, tumbler	816, 1299
Synchronous clocks	472
Transformers for power and lighting	171, 816
Transformers, bell-ringing type	832, 816
Transformers for low-voltage lighting	794, 816
*Vacuum cleaners, domestic	1645
Voltmeters, graphic	90
Voltmeters, indicating	89
Water-heaters, thermostatically-controlled thermal-storage electric†	843
Wattmeters, graphic	90
Wattmeters, indicating	89

NOTE.—It is recommended that the following should be observed, when appropriate:—

	B.S.
Cable glands	94
Ceiling type fans	367
Ducts, under-floor, non-metallic	815
Ducts, under-floor, metallic	774
Identification of pipes, conduits, ducts and cables in buildings	617

* Approved for the purpose of the exemption to Regulation 1001 (B).

† B.S. 843 refers to water-heaters of the immersion-heater type.

	B.S.
Immersion heaters for domestic hot-water supply	1556
Lamps, reading	710
Lighting reflectors, open dispersive type	232
Portable fuse and plug boxes (applicable to film studios, stages, music halls, etc.)	828
Refrigerators, domestic electric	922
Radio-interference, limits of	800
Switchgear equipments*	194, 195
Symbols, graphical	108
Thermostats for domestic hot-water supply (A.C.)	1555
Transformers for use with electrically operated toys	831, 816
Washboilers, free-standing circular domestic electric	1326

1302 Solid insulating materials purporting to be non-ignitable and/or self-extinguishing shall conform to the test requirements specified in B.S. 738. Solid insulating materials.

1303 Distribution fuseboards shall comply with B.S. 214 and in addition, with the requirements of the following clauses (A) to (D) as may be appropriate:— Distribution fuseboards.

(A) Where combined with a main switch, the whole assembly shall be enclosed in a rigid case which shall either be of metal or of non-conducting, non-absorbent, incombustible material. Non-metallic cases shall only be used where they are not liable to suffer mechanical damage. Any slot through which the operating handle may pass shall be so shielded as to prevent contact with live metal.

(B) Where sunk into a wall, any adjacent part of which is not constructed entirely of incombustible material, they shall have their cases of rigid metal or other incombustible material.

(C) Where fixed in a position exposed to the weather, to dripping water, or to an abnormally moist atmosphere, their cases shall be of weatherproof construction and shall be provided with cable glands or bushings, or be adapted to receive screwed conduit, according to the type of cables in use.

(D) Where used on an earthed-concentric wiring system they shall comply with the following additional requirements:—

* These Standards specify more than the minimum requirements of Table 3.

(i) If the case be of metal, arrangements shall be made for the attachment thereto of all external conductors of the concentric cables which enter it.

(ii) If the case be of wood or insulating material, a sheet of incorrodible metal of the same area and shape as its base shall be interposed between it and the wall or other support to which it is attached. This sheet of metal shall be not less than $\frac{1}{16}$ in. thick and shall be electrically and mechanically connected to all external conductors of the concentric cables entering the case by means of a metal bar or rod, or bare wire conductor, the resistance of which shall not be greater than that of the internal conductor of the cable feeding the board.

Lamps and lighting fittings.

1304 (A) Lamps shall conform, as regards the type of lamp cap, mechanical qualities, and insulation resistance, to the requirements of the appropriate British Standard.

(B) Lighting fittings shall comply with B.S. 816 and where the wattage of a lamp is such that the insulation of the conductors feeding the fitting is liable to be damaged by the heat losses from the lamp, the type of fitting adopted for use with such a lamp shall be so designed that it is unnecessary to take any vulcanized-rubber-insulated connections not specially designed for the purpose into the high-temperature zone created by the lamp.

Non-metallic conduits.

1305 Non-metallic conduits shall be of non-inflammable, non-absorbent, damp-proof material and shall be mechanically continuous and strong.

Types of cables.

1306 (A) For all circuits other than extra-low-voltage circuits, only the following types of cables, which shall conform to the appropriate British Standards as far as they apply, are recognized for the purposes of these regulations:—

(i) Vulcanized - rubber - insulated or p.v.c. - insulated cables conforming with B.S. 7. The cable may, if desired, be reinforced by such means as a semi-embedded braid, internal or external catenary wire, or strain cord.

(ii) Impregnated-paper-insulated cables conforming with B.S. 480.

(iii) Impregnated-jute-insulated cables conforming with B.S. 1216.

(iv) Varnished-cambric-insulated lead-sheathed cables conforming with B.S. 608.

(v) Varnished-cambric-insulated cables, 660-volt grade, non-lead-sheathed, provided that such cables comply with the appropriate requirements of B.S. 608 and are employed only in short lengths for switchboard connections or as tails (e.g. connections from a joint box to adjacent equipment such as a transformer or an immersion heater) in dry situations and where spaced from earthed metal.

(vi) Mineral-insulated metal-sheathed cables (*see* Definition).

(vii) Cables in accordance with Regulation 907.

The cables under items (i), (ii), (iii) and (iv) may have aluminium sheaths instead of lead sheaths provided that all necessary precautions are taken against corrosion, which may be expected under certain conditions of installation. [*See* Notes 2 and 3 to Regulation 403(c).]

NOTE.—Guidance on the current ratings of aluminium-sheathed cable is given in the Note to Section 14.

(B) For extra-low-voltage circuits the cables shall be of a type suitable for the voltage at which they are designed to operate, in relation to the operating conditions of the particular installation.

Impregnated-paper-insulated cables and impregnated-jute-insulated cables.

1307 In addition to complying with the appropriate requirements of Regulation 1306, the insulation of impregnated-paper-insulated cables and impregnated-jute-insulated cables shall be impregnated throughout with chemically-neutral insulating compounds.

Flexible cords.

1308 Flexible cords, other than those dealt with in Regulation 1309, shall comply with the requirements of B.S. 7, except that a flexible armour of galvanized-steel or phosphor-bronze

may be used over the sheath or compounded textile braid as an alternative to those described in the Standard.

1309 For connection to immersion heaters, other heating appliances, and lighting fittings carrying lamps rated at 200 watts and above, unless the fitting is specially designed to limit the temperature of the wiring, flexible cords of one of the following types shall be used, installed in such a manner that the conductors are not liable to be subjected to a temperature higher than that for which they are designed:—

(i) asbestos-roved flexible cords complying with B.S. 1327, or

(ii) where the conductor temperature is not liable to exceed 150° F. (65·5° C.), flexible cords insulated with rubber of heat-resisting quality and complying with B.S. 7.

NOTE.—Cords to B.S. 1327 are not suitable for conditions where the conductor temperature is liable to exceed 176° F. (80° C.).

Earthed-concentric wiring.

1310 Where the metal sheath of a cable is used as one conductor, the resistance [measured at a temperature of 60° F. (15·6° C.)] of the sheath shall be not greater than that of the internal conductor.

Earth-continuity conductor.

1311 (A) The earth-continuity conductor in a flexible cord or flexible cable shall be insulated in accordance with the appropriate British Standard.

(B) The covering, including the insulation, of an earth-continuity conductor in a flexible cord or flexible cable shall be coloured green.

Socket-outlets and plugs.

1312 (A) Every socket-outlet and plug shall conform in all respects with an appropriate British Standard, except where for reasons of safety in operation (e.g. in theatres, laboratories, and hospitals and for special industrial applications) it is necessary that plugs and socket-outlets shall not be interchangeable, in which event the requirements of B.S. 816 shall be complied with.

NOTE.—The following British Standards deal with the construction of socket-outlets and plugs:—

	B.S.
Charging plugs and sockets for electric battery vehicles	74
Plugs and sockets, reversible protected-type 2-pin, with earthing connections	196
Plugs and sockets for domestic purposes, 2-pin	372 (Part I)
Plugs and socket-outlets, 2-pole and earth	546
Inlet and outlet connectors for radio circuits	666
Fused plugs and shuttered socket-outlets	1363
Cartridge fuse-links for use in plugs	1362
Plugs and socket-outlets for stage lighting	*

Attention is drawn to the requirements in the above Specifications for the marking of the terminals of certain socket-outlets and plugs and to the requirements specified in Regulation 608 for connecting conductors to the terminals so marked.

It is not intended to prohibit the use of specially constructed connectors for electric clocks (*see* Regulation 716).

(B) A plug containing a fuse shall be non-reversible and shall be so arranged and connected that the fuse will control an outer or phase conductor, or the non-earthed conductor of the circuit.

(C) Every socket-outlet and plug shall be so designed and constructed as to prevent a current-carrying pin of the plug from making contact with a current-carrying contact-tube of the socket-outlet while any pin of the plug is completely exposed.

(D) Where in order to accommodate different types of system or systems at different voltages it is necessary to use two or more types of plugs and socket-outlets intended not to be interchangeable, the types of plug and socket-outlet shall be so selected that no pin of any plug can be caused to make contact with any contact-tube of any of the other types of socket-outlet selected.

1313 All live parts of open-type resistors and machine control-gear shall be so guarded as to prevent their being inadvertently touched. Resistors and machine control-gear.

1314 Water-heaters and boilers other than those of the Water-heaters and boilers.

* In preparation.

electrode type (*see* Regulations 711 to 714) shall be so designed and constructed that the water is not in direct electrical contact with that portion of the heating element which is live.

Other materials, appliances, etc.

1315 Materials, appliances, fittings, etc., not specifically referred to in Regulations 1301 to 1314, or not included within the scope of the British Standards named therein, shall comply with B.S. 816.

Section 14

TABLES

The Tables referred to in the Regulations but not contained in their text will be found on pages 116 to 152. The following is a list of the Tables and of the Regulations making reference to them:—

Table		Regulation, etc.
	Diversity Factor	
1.	Loadings of various types of circuit	303 (Note), 304 (B)
	Control of Supplies	
2.	From public supply authority ..	101-106, 110, 111
3.	From private generating plant..	1202 (A)
	Dimensions and Resistances	
4.	Solid and stranded circular conductors 0·0015 to 1·0 sq. in.	301 (A)
	Current Ratings and Voltage Drops	
5.	Cables 1/·044 to 7/·029 ..	114 (A) 302 (A), 303 Note, 304, Table 22 Note, Table 23 Note
6.	Earthed-concentric cables 0·0015 to 0·0045 sq. in.	
7.	Mineral-insulated metal-sheathed cables 0·0015 to 0·0045 sq. in.	
8.	Rubber- or p.v.c.-insulated cables 7/·036 to 127/·103 in. (up to 4 bunched cables)	
9.	Rubber- or p.v.c.-insulated cables 7/·036 to 37/·083 in. (over 4 bunched cables)	
10.	Rubber-insulated braided cables on cleats 7/·036 to 127/·103 in.	
11.	Rubber-insulated lead-sheathed cables on cleats 7/·036 to 127/·103 in.	
12.	Mineral-insulated metal-sheathed cables 0·007 to 0·2 sq. in. ..	
13.	Lead-sheathed cables, other than rubber-insulated, 7/·036 to 127/·103 in. (up to 4 bunched cables)	

Current Ratings and Voltage Drops

Table		Regulation, etc.
14.	Lead-sheathed cables, other than rubber-insulated, 7/·036 to 61/·103 in. (over 4 bunched cables)	114 (A) 302 (A), 303 Note, 304, Table 22 Note, Table 23 Note
15.	Lead-sheathed cables on cleats, other than rubber-insulated, 7/·036 to 127/·103 in. ..	

Flexible Cables and Cords

16.	Dimensions, current ratings, and resistances of flexible cables 0·01 to 0·5 sq. in.	301 (A), 302 (A), 303 Note
17.	Current ratings, resistances and limiting mechanical loadings for flexible cords 0·0006 to 0·007 sq. in.	

Earth-Continuity Conductors

18.	Size of earth-continuity conductor combined in composite cable	301 (A), 1003 (C)

Bare Copper Conductors

19.	Current ratings and voltage drop	302 (B), 303 Note, 304

Rating Factors

20.	Table of half-hour and one-hour rating factors	302 (A)

Fuse Elements

21.	Approximate current ratings of fuse wires	

Capacity of Conduits

22.	250-volt grade cables	405 (D)
23.	660-volt grade cables	

NOTE.—The current ratings of cables and bare conductors, set out in Tables 5, 8 to 11, 13 to 15 and 19, are calculated from experimental data, for full-load conditions, provided by the British Electrical and Allied Industries Research Association, and are based on a temperature-rise of 30° F. (16·7° C.) for vulcanized-rubber-insulated cables, 70° F. (38·9° C.) for impregnated-paper-insulated cables, varnished-cambric-insulated cables, and impregnated-jute-insulated cables, and

100° F. (55·5° C.) for bare copper conductors. These current ratings have been rounded off to apply, under practical conditions, to the respective cables and bare conductors, and methods of installation, defined in the Tables. The current ratings given in the remaining table are arbitrary figures, based on ratings which have proved satisfactory in service.

The ambient air temperature at a situation in which the cables are installed, or are to be installed, is, for the purpose of these Regulations, the temperature of the air under normal operating conditions. The term does not take account of increase of temperature in the immediate neighbourhood of the cables, due to the heat arising therefrom. Two methods for the determination of ambient air temperature are described as Methods (*a*) and (*b*) below. These methods do not purport to include every condition of ambient air temperature to which cables may be subjected in practice. In the determination of ambient air temperature by either of the methods, account must also be taken of the artificial heating of the building from any source.

Method (*a*). For cables erected in air (cables unenclosed or cables in conduits or cables in wood casing) the determination may be made by thermometers placed in free air near the cables and in such a position that the readings of the thermometers are not influenced by the heat arising from the cables. This position may be from 1 to 2 ft. from the cables, depending on their size, in the horizontal plane, or 6 in. below the lowest of the cables.

Method (*b*). Where space does not allow the use of Method (*a*) and especially where cables are installed in ducts or troughing, the determination may be made by thermometers placed close to the cables, but in such instances the cables must not be loaded. Alternatively, the determination may be made by means of thermometers placed in the ducts or troughing before the cables are installed.

If the ambient air temperature at the position of the cables does not exceed 90° F. (32·2° C.) at any time during the year, excepting only abnormally hot periods of short duration, normal current-rating tables apply. Where the ambient air temperature consistently attains values higher than 90° F. (32·2° C.), the current-rating factor applicable to the highest ambient air temperature attained is to be used.

For aluminium cables the sheath losses are greater than for the equivalent sizes of lead-sheathed cables owing to the lower specific resistance of aluminium. The current ratings of aluminium-sheathed cables are therefore lower than those of the corresponding lead-sheathed cables. The exact amount of the decrease depends upon the size of the cable and method of installation, but, as an example, the single-phase ratings of aluminium-sheathed single-core cables of 0·5 sq. in. section and over installed as in Table 15, are of the order of 20% less than the corresponding values for lead-sheathed cables.

TABLE 1.—*Estimation of the maximum current which will normally flow in an installation [for use in computing the sizes of cables, other than those of final sub-circuits, switchgear, etc.].*

NOTE.—It is impossible to specify in these Regulations the value of diversity factor for every type of installation, but the figures given below may be taken as a guide. The values in Table 1 refer to percentage of connected load, or, where followed by the letters "F.L.," to the percentage of full-load current of a heating appliance, motor, or other current-consuming device, or a socket-outlet. In calculating the maximum current, appliances and socket-outlets should be considered in the order of their current ratings, the largest first. The values in the Table are not intended to be cumulative, e.g. in the case of a block of flats, when applying the appropriate diversity factor to the rising mains, the calculation for diversity should be based on the aggregate current rating of all points connected to the system and not based on the sum of the normal demands of the flats obtained after applying diversity to each flat.

Type of equipment	Type of installation			
	Individual domestic installations, including individual flats of a block	Blocks of residential flats	Hotels boarding houses, lodging houses, etc.	Shops, stores, offices and business premises, other than factories
Lighting	66%	50%	75%	90%
Socket-outlets other than those installed in accordance with the exemptions to Regulation 201 (C)	100% F.L. of largest outlet + 40% F.L. of other outlets	100% F.L. of largest outlet + 40% F.L. of other outlets	100% F.L. of largest outlet + 75% F.L. of outlets in main rooms (dining-rooms, etc.) + 40% F.L. of remaining outlets	100% F.L. of largest outlet + 75% F.L. of other outlets
Socket-outlet circuits installed in accordance with the exemptions to Regulation 201 (C)	100% largest fuse-rating of individual circuits + 40% sum of fuse-ratings of other circuits	100% largest fuse-rating of individual circuits + 40% sum of fuse-ratings of other circuits	100% largest fuse-rating of individual circuits + 50% sum of fuse-ratings of other circuits	100% largest fuse-rating of individual circuits + 50% sum of fuse-ratings of other circuits

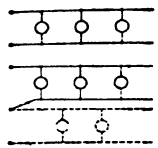
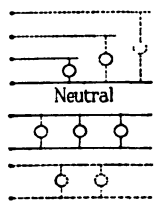
Fixed heating and power appliances other than motors, cookers, or water heaters	100% F.L. up to 10 amperes + 50% of any load in excess of 10 amperes	100% F.L. of largest appliance + 50% F.L. of 2nd largest appliance + 33% F.L. of 3rd largest appliance + 25% F.L. of 4th largest appliance + 20% F.L. of remaining appliances	100% F.L. of largest appliance + 80% F.L. of 2nd largest appliance + 60% F.L. of remaining appliances	100% F.L. of largest appliance + 75% F.L. of remaining appliances
Fixed cooking appliances	100% F.L. up to 10 amperes + 50% of any load in excess of 10 amperes	100% F.L. of largest appliance + 50% F.L. of 2nd largest appliance + 33% F.L. of 3rd largest appliance + 25% F.L. of 4th largest appliance + 20% F.L. of remaining appliances	100% F.L. of largest appliance + 80% F.L. of 2nd largest appliance + 60% F.L. of remaining appliances	100% F.L. of largest appliance + 80% F.L. of 2nd largest appliance + 60% F.L. of remaining appliances
Motors, other than lift motors	—	—	100% F.L. of largest motor + 50% F.L. of remaining motors	100% F.L. of largest motor + 80% F.L. of 2nd largest motor + 60% F.L. of remaining motors
Water-heaters (intermittent type*)	100% F.L. of largest appliance + 100% F.L. of second largest appliance + 25% F.L. of remaining appliances			To be assessed by competent authority
Water-heaters (constant type)	100% F.L. in all cases			
Lifts	100% F.L. largest lift motor + 75% F.L. second largest lift motor + 50% F.L. of remaining lift motors			

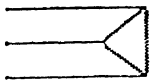
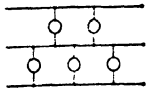
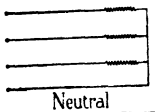
* For the purpose of this Table an intermittent water-heater is deemed to be a water-heater consuming more than 3 kW which, by reason of the relative rate of consumption of electrical energy with respect to its water capacity, is obviously intended for intermittent use.

TABLE 2

Control of the supply from an Electricity Supply Authority (*see Regulations* 101 *to* 106, 110 *and* 111).

NOTE.—In the following Table columns 4 and 5, or 6 and 7, set out the alternative requirements of the Regulations in regard to the main switchgear for the respective types of consumer's installation detailed in columns 1, 2 and 3, of which column 3 gives details of the form of earthing adopted for the supply system from which the consumer's installation is supplied.

Consumer's installation			Main switchgear required to control consumer's installation			
			Type of circuit-breaker (linked)		Alternative to circuit-breaker	
Wiring from consumer's terminals	System of wiring and diagram showing type of the supply system from which the installation is derived	Form of earth connection in use by Supply Authority	No. of poles	Over-current release	Switch (linked)	Fuse†
1	2	3	4	5	6	7
2-wire	A.C. single-phase or d.c. 2-wire supply A.C. single-phase or d.c. derived from a 3-wire supply 	Permanently and effectively earthed on one pole	2	In non-earthed conductor	2-pole	In non-earthed conductor only
	A.C. single-phase derived from a 3-phase 4-wire supply A.C. single-phase derived from a 2-phase 4-wire supply 	Not permanently and effectively earthed on any pole**	2	In each conductor	2-pole	In each conductor

3-wire	A.C. three-phase 3-wire		At one point or more but neutral not used	3	In non-earthed conductor of at least two phases	3-pole	In each conductor
	A.C. single-phase 3-wire, or d.c. 3-wire		None, or at one or more points	3 or 2¶	In each outer, or phase conductor	3-pole or 2-pole¶	In each outer, or phase conductor only
4-wire	A.C. three-phase 4-wire		None, or at one or more points	4 or 3*	In each phase conductor	4-pole or 3-pole*	In each phase conductor only

* One pole in each phase conductor, if a 3-pole circuit-breaker or 3-pole switch is employed.

† Wherever separate fuses and linked switches are specified in Table 2, they may be replaced by linked fuse-switches, and where a splitter unit is used, it is permitted under the provisions of Regulation 106 to omit the fuses specified in Table 2.

¶ One pole in each outer or phase conductor, if a 2-pole circuit-breaker or 2-pole switch is employed.

** This applies only to installations connected to systems which are not operated in accordance with the requirements of the Electricity Supply Regulations 1937.

TABLE 3

Control of the supply from private generating plant.

[*See Regulation* 1202 (A).]

NOTE.—In the following Table columns 3 and 4 and 5 and 6 set out the alternative requirements of the Regulations in regard to the main switchgear for the respective types of private generating plant supply systems detailed in cols. 1 and 2, of which col. 2 gives the form of earth connection adopted for the system.

System of wiring in use	Form of earth connection	Minimum switchgear required for each generator*†‡			
		Type of circuit-breaker (linked)		Alternative to circuit-breaker	
		No. of poles	Over-current release	Switch (linked)	Fuse‖
1	2	3	4	5	6
A.C. single-phase or d.c. 2-wire	In accordance with Regulation 1204	2	In non-earthed conductor	2-pole	In non-earthed conductor only
	Not in accordance with Regulation 1204	2	In each conductor	2-pole	In each conductor
A.C. single-phase 3-wire or d.c. 3-wire	None, or at one or more points	3 or 2¶	In each outer, or phase conductor	3-pole or 2-pole¶	In each outer, or phase conductor only

A.C. three-phase 3-wire	At one or more points, but neutral not used	3	In non-earthed conductor of at least two phases	3-pole	In each conductor
A.C. three-phase 4-wire††	None, or at one or more points	4 or 3**	In each phase conductor	4-pole or 3-pole**	In each phase conductor only

* Where a stand-by or duplicate supply is provided.—

(i) The linked switches referred to in Table 3 may be change-over switches; if so, they shall be installed in addition to circuit-breakers where the latter are fitted.

(ii) If linked switches in conjunction with fuses are installed instead of circuit-breakers where this is permitted in Table 3, such fuses should be fitted on the supply side of the linked switch, whether the change-over switch is used as the linked switch or not.

† A generator driven by an internal-combustion engine need not be protected by a circuit-breaker or fuse, provided that:—

(i) The generator is not required in any circumstances to operate in parallel with any other electrical machine, or with a secondary battery.

(ii) The output of the generator does not exceed 10 kilowatts.

(iii) The maximum output of the engine expressed in kilowatts does not exceed the British Standard continuous rating of the generator (*see* B.S. 168) by more than 10 per cent.

‡ Requirements which deal with the prohibition of the use of fuses, non-linked switches, etc., in the neutral, middle wire, or common return, are contained in Regulation 111.

‖ Wherever separate fuses and linked switches are specified in Table 3, they may be replaced by linked fuse-switches, and where a splitter unit is used it is permitted under the provisions of Regulation 106 to omit the fuses specified in Table 3.

¶ One pole in each outer or phase conductor, if a 2-pole circuit-breaker or 2-pole switch is employed.

** One pole in each phase conductor if a 3-pole circuit-breaker or 3-pole switch is employed.

†† When generators are run in parallel the neutral point of not more than one generator should be connected to earth.

TABLE 4

Dimensions and resistance of solid and stranded circular conductors.

Nominal cross-sectional area	Calculated cross-sectional area	Number and diameter (in.) of wires forming conductor	Overall diameter	Resistance per 1 000 yards at 60° F. (15·6° C.)		
				Standard	Maximum allowable for plain wires*	Maximum allowable for tinned wires*
1	2	3	4	5	6	7
sq. in.	sq. in.		in.	ohms	ohms	ohms
0·0015	0·001521	1/·044	0·044	15·79	16·26	16·42
0·002	0·001943	3/·029	0·062	12·36	12·61	12·85
0·003	0·002994	3/·036	0·078	8·019	8·180	8·260
0·0045	0·004546	7/·029	0·087	5·281	5·387	5·493
0·007	0·007005	7/·036	0·108	3·427	3·496	3·530
0·01	0·01046	7/·044	0·132	2·294	2·3401	2·363
0·0145	0·01462	7/·052	0·156	1·643	1·675	1·692
0·0225	0·02214	7/·064	0·192	1·084	1·106	1·117
0·03	0·02840	19/·044	0·220	0·8468	0·8637	0·8721
0·04	0·03960	19/·052	0·260	0·6063	0·6184	0·6244

0·06	0·05999	19/·064	0·320	0·4002	0·4082	0·4122
0·1	0·1009	19/·083	0·415	0·2380	0·2427	0·2451
0·15	0·1478	37/·072	0·504	0·1625	0·1657	0·1673
0·2	0·1964	37/·083	0·581	0·1223	0·1247	0·1259
0·3	0·3024	37/·103	0·721	0·07939	0·08098	0·08177
0·4	0·4064	61/·093	0·837	0·05908	0·06026	0·06085
0·5	0·4985	61/·103	0·927	0·04816	0·04913	0·04961
0·75	0·7435	91/·103	1·133	0·03229	0·03294	0·03326
1·0	1·0376	127/·103	1·339	0·02314	0·02360	0·02383

* This does not include an allowance (usually some 2%) for the lay where cores are laid up into twin or multi-core cables.

1/·044 in. to 7/·029 in. Cables.

TABLE 5

Current rating for vulcanized-rubber-, p.v.c.-, impregnated-paper-, or varnished-cambric-insulated cables, run:—*

(i) Bunched, and enclosed in one conduit, troughing, or casing: Col. 3 or Col. 6, according to the type and number so run;

(ii) Bunched, and open: Col. 3 or Col. 6, according to the type and number installed;

(iii) Separated, and open: Col. 3 only.

Conductor		Not more than:—Four single-core cables, or two twin (or concentric) cables, or one three-core cable			Not more than:—Eight single-core cables, or four twin (or concentric) cables, or two three-core cables		
		Current rating† for d.c., or single-phase or 3-phase a.c.	Approximate length of run** for 1-volt drop with current rating in col. 3		Current rating† for d.c., or single-phase or 3-phase a.c.	Approximate length of run** for 1-volt drop with current rating in Col. 6	
Nominal cross-sectional area	Number and diameter (in.) of wires		D.C. or single-phase a.c.	Balanced 3-phase a.c.		D.C. or single-phase a.c.	Balanced 3-phase a.c.
1	2	3	4	5	6	7	8
sq. in.		amperes	ft.	ft.	amperes	ft.	ft.
0·0015	1/·044	5	18	21	5	18	21
0·002	3/·029	5	23	27	5	23	27
0·003	3/·036	10	17	20	8††	21	24
0·0045	7/·029	15	17	20	12††	21	24

NOTE.—Table 5 applies to cables employed in the wiring of buildings, but does not apply to every condition under which cables may be used. (Vulcanized-rubber-insulated and braided cables and p.v.c.-insulated cables run open are required under Regulation 402 to be spaced on insulators.)

In conditions of abnormally high ambient air temperature, the Notes to Table 8 should be consulted for vulcanized-rubber or p.v.c.-insulated cables, and the Notes to Table 13 for cables insulated with impregnated paper, varnished cambric, or impregnated jute.

The current rating of a fittings wire (3/·020 in.) is 3 amperes.

* Including tough-rubber-sheathed cables and metal-sheathed cables, but excluding, for use with a.c., single-core cables armoured with wire or tape of magnetic material and such ferrous-sheathed cables as are prohibited under Regulation 308.

† The current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.

†† These figures (8 and 12) may be increased to 9 and 13·5 amperes respectively, where a diversity factor can properly be applied to the circuit which feeds the cables forming the group of final sub-circuits.

** For the purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Cols. 5 and 8 for 1-volt drop in the line voltage.

Cables of Earthed-Concentric Wiring Systems.

0·0015 to 0·0045 sq. in.

TABLE 6

Current rating for small single-core, vulcanized-rubber- or mineral-insulated cables of earthed-concentric wiring systems carrying alternating current run with metal sheath bare or substantially bare, the sheath being used as the return conductor.

Nominal cross-sectional area of conductor	Current rating for single-phase a.c.	Approximate length of run* for 1-volt drop with current rating in Col. 2
1	2	3
sq. in.	amperes	ft.
0·0015	10	18
0·002	15	16
0·003	20	17
0·0045	30	17

* For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables.

Mineral-Insulated Metal-Sheathed Cables.

0·0015 to 0·0045 sq. in.

TABLE 7

Current rating for mineral-insulated metal-sheathed cables, other than those used on an earthed-concentric system (see Table 6).

Conductor	Not more than:—Four single-core cables, or two twin cables, or one three-core cable		
Nominal cross-sectional area	Current rating for d.c. or single-phase or 3-phase a.c.	Approximate length of run* for 1-volt drop with current rating in Col. 2	
		D.C. or single-phase a.c.	Balanced three-phase a.c.
1	2	3	4
sq. in.	amperes	ft.	ft.
0·0015	5	17	20
0·002	10	11	13
0·003	15	11	13
0·0045	20	12	14

* For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Col. 4 for 1-volt drop in the line voltage.

Rubber or P.V.C. Cables [see also Table 9]
7/·036 in. to 127/·103 in.

TABLE 8

Current rating for vulcanized-rubber or p.v.c.-insulated cables run:—*

(i) Bunched, and enclosed in one conduit, troughing, or casing: Cols. 3 and 4 or Col. 7, according to the type and number installed);

(ii) Bunched, and open: Cols. 3 and 4 or Col. 7, according to the type and number installed.

Conductor		Not more than:—Two single-core cables†				Not more than:—Four single-core cables, or two twin cables, or one concentric cable			
		Current rating††		Approximate length of run** for 1-volt drop		Current rating††	Approximate length of run** in circuit for 1-volt drop with current rating in Col. 7		
Nominal cross-sectional area	Number and diameter (in.) of wires	D.C.	Single-phase a.c.	D.C. with current rating in Col. 3	Single-phase a.c. with current rating in Col. 4	D.C., or single-phase or 3-phase a.c.	D.C.	Single-phase a.c.	Balanced 3-phase a.c.
1	2	3	4	5	6	7	8	9	10
sq.in.		amperes	amperes	ft.	ft.	amperes	ft.	ft.	ft.
0·007	7/·036	29	29	13	13	23	17	17	20
0·01	7/·044	38	38	15	15	30	19	19	22
0·0145	7/·052	45	45	18	18	36	22	22	25
0·0225	7/·064	56	56	22	22	45	27	27	31
0·03	19/·044	65	65	24	23	52	30	30	35
0·04	19/·052	78	78	28	27	62	35	35	41

0·06	19/·064	102	102	32	31	82	40	40	46
0·1	19/·083	147	147	38	35	118	47	46	53
0·15	37/·072	189	189	43	37	151	54	49	57
0·2	37/·083	229	229	47	38	183	59	50	58
0·3	37/·103	298	298	56	37	238	70	50	58
0·4	61/·093	358	358	62	35	286	78	46	53
0·5	61/·103	413	413	66	32	330	83	41	48
0·75	91/·103	575	530	71	26	—	—	—	—
1·0	127/·103	740	648	77	23	—	—	—	—

NOTE.—Table 8 applies to cables employed in the wiring of buildings, but does not apply to every condition under which cables may be used. (Vulcanized-rubber-insulated and braided cables and p.v.c.-insulated cables run open are required under Regulation 402 to be spaced on insulators.)

Table 8 refers to situations where the ambient air temperature does not exceed 90° F. (32·2° C.). Where the ambient air temperature is abnormally high the current ratings given in Table 8 shall be multiplied, and the lengths for 1-volt drop divided, by the appropriate factor as follows:—

Ambient air temperature	95° F. (35° C.)	100° F. (37·8° C.)	105° F. (40·5° C.)	110° F. (43·3° C.)	115° F. (46·1° C.)
Factor	0·90	0·80	0·69	0·55	0·38

* Including tough-rubber-sheathed cables and lead-sheathed cables, but excluding (for use with alternating current) such of the following cables as are prohibited under Regulation 308:—
(*a*) Single-core armoured or ferrous-sheathed cables.
(*b*) Single-core cables above 0·2 sq. in. encased in brass, copper, etc.

† For one twin cable *see* Columns 7 to 9.

†† The current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.

** For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Col. 10 for 1-volt drop in the line voltage.

Rubber or P.V.C. Cables [see also Table 8].
7/·036 in. to 37/·083 in.

TABLE 9

Current rating for vulcanized-rubber or p.v.c.-insulated cables run:—*
(i) Bunched, and enclosed in one conduit, troughing, or casing: Col. 3 or Col. 7, according to the type and number installed;
(ii) Bunched, and open: Col. 3 or Col. 7, according to the type and number installed.

Conductor		Not more than six single-core cables, or three twin cables, or one three-core or four-core cable, or two concentric cables				Not more than ten single-core cables, or five twin cables, or two three-core or four-core cables, or three concentric cables			
		Current rating†	Approximate length of run** for 1-volt drop with current rating in Col. 3			Current rating†	Approximate length of run** for 1-volt drop with current rating in Col. 7		
Nominal cross-sectional area	Number and diameter (in.) of wires	D.C., or single-phase or 3-phase a.c.	D.C.	Single-phase a.c.	Balanced 3-phase a.c.	D.C., or single-phase or 3-phase a.c.	D.C.	Single-phase a.c.	Balanced 3-phase a.c.
1	2	3	4	5	6	7	8	9	10
sq. in.		amperes	ft.	ft.	ft.	amperes	ft.	ft.	ft.
0·1007	7/·036	20	19	19	22	17	23	23	26
0·01	7/·044	27	21	21	25	23	25	25	29
0·0145	7/·052	32	25	25	29	27	30	30	34
0·0225	7/·064	39	31	31	36	34	36	36	41
0·03	19/·044	46	34	34	39	39	40	40	46
0·04	19/·052	55	40	40	46	47	46	46	53

0·06	19/·064	71	46	46	54	61	54	54	62
0·1	19/·083	103	54	53	61	88	63	62	72
0·15	37/·072	132	62	56	65	113	72	65	75
0·2	37/·083	160	67	57	66	—	—	—	—

NOTE.—Table 9 applies to cables employed in the wiring of buildings, but does not apply to every condition under which cables may be used. (Vulcanized-rubber-insulated and braided cables and p.v.c.-insulated cables run open are required under Regulation 402 to be spaced on insulators.)

Table 9 refers to situations where the ambient air temperature does not exceed 90° F. (32·2° C.). Where the ambient air temperature is abnormally high the current ratings given in Table 9 shall be multiplied, and the lengths for 1-volt drop divided, by the appropriate factor as follows:—

Ambient air temperature	95° F. (35° C.)	100° F. (37·8° C.)	105° F. (40·5° C.)	110° F. (43·3° C.)	115° F. (46·1° C.)
Factor	0·90	0·80	0·69	0·55	0·38

* Including tough-rubber-sheathed cables and lead-sheathed cables, but excluding (for use with a.c.) such single-core armoured or ferrous-sheathed cables as are prohibited under Regulation 308.

† The current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.

** For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Cols. 6 and 10 for 1-volt drop in the line voltage.

Rubber-Insulated Braided Cables on Cleats.
7/·036 in. to 127/·103 in.

TABLE 10

Current rating for single-core, vulcanized-rubber-insulated, braided and compounded cables (unarmoured), run open on cleats as defined on page 144.*

Conductor		Current rating† for 2 or 3 cables run under the conditions defined on page 144			Approximate length of run** for 1-volt drop		
Nominal cross-sectional area	Number and diameter (in.) of wires	D.C.	Single-phase a.c.	3-phase a.c.	D.C., with current rating in Col. 3	Single-phase a.c., with current rating in Col. 4	Balanced 3-phase a.c., with current rating in Col. 5
1	2	3	4	5	6	7	8
sq. in.		amperes	amperes	amperes	ft.	ft.	ft.
0·1	19/·083	172	172	170	32	30	35
0·15	37/·072	219	219	216	37	32	37
0·2	37/·083	262	262	259	41	32	37
0·3	37/·103	342	342	338	49	30	35
0·4	61/·093	425	423	410	52	23	28
0·5	61/·103	490	485	470	56	21	26
0·75	91/·103	647	610	585	63	19	24
1·0	127/·103	785	697	669	73	19	23

NOTE.—Table 10 applies to cables employed in the wiring of buildings, but does not apply to every condition under which cables may be used.

Table 10 applies to two or three cables run spaced as shown on page 144. Where four or more cables are so spaced the current ratings are reduced to 90 % of those set out in Col. 3 or Col. 4 above for d.c. or a.c., either single-phase or three-phase, loading respectively.

For two or three smaller cables (7/·036 in. to 19/·064 in. inclusive) so spaced the current ratings are those given in Col. 3 or Col. 4 of Table 8, and for four or more such smaller cables the current ratings are 90 per cent of those given in Col. 3 or Col. 4 of Table 8, for d.c. or a.c., either single-phase or three-phase, respectively.

Table 10 refers to situations where the ambient air temperature does not exceed 90° F. (32·2° C.). Where the ambient air temperature is abnormally high the current ratings given in Table 10 shall be multiplied, and the lengths for 1-volt drop divided, by the appropriate factor as follows:—

Ambient air temperature	95° F. (35° C.)	100° F. (37·8° C.)	105° F. (40·5° C.)	110° F. (43·3° C.)	115° F. (46·1° C.)
Factor	0·90	0·80	0·69	0·55	0·38

* Including single-core, tough-rubber-sheathed cables (unarmoured); but excluding, for use with a.c., such cables as are prohibited under Regulation 308.

† The current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.

** For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Col. 8 for 1-volt drop in the line voltage.

Rubber-Insulated Lead-Sheathed Cables on Cleats.
7/·036 in. to 127/·103 in.

TABLE 11

Current rating for single-core, vulcanized-rubber-insulated, lead-sheathed cables (unarmoured), run open on cleats as defined on page 144.

Conductor		Current rating* for 2 or 3 cables run under the conditions defined on page 144			Approximate length of run** for 1-volt drop		
Nominal cross-sectional area	Number and diameter (in.) of wires	D.C.	Single-phase a.c.	Three-phase a.c.	D.C., with current rating in Col. 3	Single-phase a.c., with current rating in Col. 4	Balanced 3-phase a.c., with current rating in Col. 5
1	2	3	4	5	6	7	8
sq. in.		amperes	amperes	amperes	ft.	ft.	ft.
0·1	19/·083	160	160	157	35	32	37
0·15	37/·072	207	206	201	39	33	39
0·2	37/·083	251	249	242	43	32	39
0·3	37/·103	320	314	304	52	31	37
0·4	61/·093	402	377	355	55	25	31
0·5	61/·103	458	421	390	60	24	30
0·75	91/·103	580	510	455	70	22	30
1·0	127/·103	701	583	512	81	22	29

NOTE.—Table 11 applies to cables employed in the wiring of buildings, but does not apply to every condition under which cables may be used.

Table 11 applies to two or three cables run spaced as shown on page 144. Where four or more cables are so spaced the current ratings are reduced to 90 per cent of those set out in Col. 3 or Col. 4 above for d.c. or a.c., either single-phase or three-phase, respectively.

For two or three smaller cables (7/·036 in. to 19/·064 in. inclusive) so spaced, the current ratings are those given in Col. 3 or Col. 4 of Table 8, and for four or more such smaller cables the current ratings are 90 per cent of those given in Col. 3 or Col. 4 of Table 8, for d.c. or a.c., either single-phase or three-phase, respectively.

Table 11 refers to situations where the ambient air temperature does not exceed 90° F. (32·2° C.). Where the ambient air temperature is abnormally high the current ratings given in Table 11 shall be multiplied, and the lengths for 1-volt drop divided, by the appropriate factor as follows:—

Ambient air temperature	95° F. (35° C.)	100° F. (37·8° C.)	105° F. (40·5° C.)	110° F. (43·3° C.)	115° F. (46·1° C.)
Factor	0·90	0·80	0·69	0·55	0·38

* The current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.

** For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Col. 8 for 1-volt drop in the line voltage.

Mineral-Insulated Metal-Sheathed Cables.
0·007 to 0·2 sq. in.

TABLE 12

Current rating for mineral-insulated metal-sheathed cables.

Nominal cross-sectional area of conductor	Single-core cables		Twin cables		Three-core or four-core cables	
	Current rating*	Approximate length of run** for 1-volt drop for a.c. with current rating in Col. 2	Current rating*	Approximate length of run** for 1-volt drop for a.c. with current rating in Col. 4	Current rating*	Approximate length of run** for 1-volt drop for balanced 3-phase a.c. with current rating in Col. 6
1	2	3	4	5	6	7
sq. in.	amperes	ft.	amperes	ft.	amperes	ft.
0·007	55	7	45	8	35	13
0·01	70	8	55	10	45	14
0·0145	90	9	70	11	55	16
0·0225	110	11	85	14	70	20
0·03	130	12	100	16	85	22
0·04	150	14	—	—	—	—

0·06	200	15	—	—	—	—
0·1	260	19	—	—	—	—
0·15	330	22	—	—	—	—
0·2	400	22	—	—	—	—

* Current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.

** For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Col. 7 for 1-volt drop in the line voltage.

Paper-, Jute- or Cambric-insulated, Lead-Sheathed Cables [see also Table 14].
7/·036 in. to 127/·103 in.

TABLE 13

Current rating for impregnated-paper-, varnished-cambric-, or impregnated-jute-insulated, lead-sheathed cables, armoured or unarmoured, and installed:—*

(i) Bunched, and enclosed in one troughing or casing: Cols. 3 and 4 or Col. 7, according to the type and number installed;
(ii) Bunched and open. Cols. 3 and 4 or Col. 7, according to the type and number installed.

Conductor		Not more than:—Two single-core cables†				Not more than:—Four single-core cables, or two twin cables, or one concentric cable			
		Current rating††		Approximate length of run** for 1-volt drop with current rating in Col. 3 or Col. 4		Current rating††	Approximate length of run** for 1-volt drop with current rating in Col. 7		
Nominal cross-sectional area	Number and diameter (in.) of wires	D.C.	Single-phase a.c.	D.C.	Single-phase a.c.	D.C., or single-phase or 3-phase a.c.	D.C.	Single-phase a.c.	Balanced 3-phase a.c.
1	2	3	4	5	6	7	8	9	10
sq. in.		amperes	amperes	ft.	ft.	amperes	ft.	ft.	ft.
0·007	7/·036	33	33	11	11	26	14	14	16
0·01	7/·044	50	50	11	11	40	13	13	15
0·0145	7/·052	67	67	11	11	54	14	14	16
0·0225	7/·064	89	89	12	12	71	16	16	18
0·03	19/·044	103	103	14	14	82	18	18	20
0·04	19/·052	123	123	16	16	93	22	22	25

0·06	19/·064	160	160	19	19	128	24	24	28
0·1	19/·083	229	229	22	21	183	28	27	31
0·15	37/·072	295	295	25	22	236	32	29	3[illegible]
0·2	37/·083	354	354	28	23	283	35	30	35
0·3	37/·103	460	460	33	22	368	42	30	35
0·4	61/·093	555	555	37	21	444	47	27	32
0·5	61/·103	646	646	39	19	516	49	24	28
0·75	91/·103	884	803	43	16	—	—	—	—
1·0	127/·103	1116	952	47	14	—	—	—	—

NOTE.—Table 13 applies to cables employed in the wiring of buildings, but does not apply to every condition under which cables may be used.

Table 13 refers to situations where the ambient air temperature does not exceed 90° F. (32·2° C.). Where the ambient air temperature is abnormally high, the current ratings given in Table 13 shall be multiplied, and the lengths for 1-volt drop divided, by the appropriate factor as follows:—

Ambient air temperature ..	95° F. (35° C.)	100° F. (37·8° C.)	105° F. (40·5° C.)	110° F. (43·3° C.)	115° F. (46·1° C.)	120° F. (48·9° C.)
Factor	0·96	0·92	0·88	0·84	0·79	0·74
Ambient air temperature ..	125° F. (51·7° C.)	130° F. (54·4° C.)	135° F. (57·2° C.)	140° F. (60° C.)	145° F. (62·8° C.)	150° F. (65·5° C.)
Factor	0·69	0·63	0·57	0·51	0·43	0·35

* Excluding, for use with a.c., such single-core armoured cables as are prohibited under Regulation 308.

† For one twin cable, *see* Cols. 7 to 9.

†† The current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.

** For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Col. 10 for 1-volt drop in the line voltage.

Paper-, Jute- and Cambric-insulated Lead-Sheathed Cables, etc. [see also Table 13].
7/·036 in. to 61/·103 in.

TABLE 14

Current rating for impregnated-paper-, varnished-cambric-, or impregnated-jute-insulated lead-sheathed cables, armoured or unarmoured, and installed:—*

(i) Bunched, and enclosed in one troughing or casing: Col. 3 or Col. 7, according to the type and number installed;
(ii) Bunched, and open: Col. 3 or Col. 7, according to the type and number installed.

Conductor		Not more than six single-core cables, or three twin cables, or one three-core or four-core cable, or two concentric cables				Not more than ten single-core cables, or five twin cables, or two three-core or four-core cables, or three concentric cables			
		Current rating†	Approximate length of run** for 1-volt drop with current rating in Col. 3			Current rating†	Approximate length of run** for 1-volt drop with current rating in Col. 7		
Nominal cross-sectional area	Number and diameter (in.) of wires	D.C., or single-phase or 3-phase a.c.	D.C.	Single-phase a.c.	Balanced 3-phase a.c.	D.C., or single-phase or 3-phase a.c.	D.C.	Single-phase a.c.	Balanced 3-phase a.c.
1	2	3	4	5	6	7	8	9	10
sq. in.		amperes	ft.	ft.	ft.	amperes	ft.	ft.	ft.
0·007	7/·036	23	15	15	18	20	18	18	21
0·01	7/·044	35	15	15	18	30	18	18	21
0·0145	7/·052	47	16	16	18	40	19	19	22
0·0225	7/·064	62	18	18	21	53	21	21	25
0·03	19/·044	72	20	20	23	62	23	23	27
0·04	19/·052	86	23	23	27	74	27	27	32

0·06	19/·064	**112**	27	**27**	32	**96**	**32**	32	37
0·1	19/·083	**160**	32	31	36	**137**	**37**	36	42
0·15	37/·072	**206**	36	33	38	**177**	43	39	45
0·2	37/·083	**248**	40	**34**	39	—	—	—	—
0·3	37/·103	**322**	48	34	39	—	—	—	—
0·4	61/·093	**388**	53	31	36	—	—	—	—
0·5	61/·103	**452**	56	28	32	—	—	—	—

NOTE.—Table 14 applies to cables employed in the wiring of buildings, but does not apply to every condition under which cables may be used.

[141]

Table 14 refers to situations where the ambient air temperature does not exceed 90° F. (32·2° C.). Where the ambient air temperature is abnormally high, the current ratings given in Table 14 shall be multiplied, and the lengths for 1-volt drop divided, by the appropriate factor as follows:—

Ambient air temperature ..	95° F. (35° C.)	100° F. (37·8° C.)	105° F. (40·5° C.)	110° F. (43·3° C.)	115° F. (46·1° C.)	120° F. (48·9° C.)
Factor	0·96	0·92	0·88	0·84	0·79	0·74
Ambient air temperature ..	125° F. (51·7° C.)	130° F. (54·4° C.)	135° F. (57·2° C.)	140° F. (60° C.)	145° F. (62·8° C.)	150° F. (65·5° C.)
Factor	0·69	0·63	0·57	0·51	0·43	0·35

* Excluding, for use with a.c., such single-core armoured cables as are prohibited under Regulation 308.
† The current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.
** For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Cols. 6 and 10 for 1-volt drop in the line voltage.

Paper-, Jute- and Cambric-insulated Lead-Sheathed Cables on Cleats.
7/·036 in. to 127/·103 in.

TABLE 15

Current rating for single-core, impregnated-paper-, varnished-cambric-, or impregnated-jute-insulated lead-sheathed cables, unarmoured, and run open on cleats as defined on page 144.

Conductor		Current rating* for 2 or 3 cables run under the conditions defined on page 144			Approximate length of run** for 1-volt drop		
Nominal cross-sectional area	Number and diameter (in.) of wires	D.C.	Single-phase a.c.	Balanced Three-phase a.c.	D.C., with current rating in Col. 3	Single-phase a.c., with current rating in Col. 4	Balanced 3-phase a.c., with current rating in Col. 5
1	2	3	4	5	6	7	8
sq. in.		amperes	amperes	amperes	ft.	ft.	ft.
0·1	19/·083	**262**	**262**	**261**	20	18	21
0·15	37/·072	**340**	**339**	**336**	22	19	22
0·2	37/·083	**412**	**410**	**405**	24	20	22
0·3	37/·103	**530**	**523**	**513**	29	18	22
0·4	61/·093	**630**	**613**	**583**	33	15	19
0·5	61/·103	**739**	**690**	**655**	34	15	17
0·75	91/·103	**952**	**856**	**788**	40	14	17
1·0	127/·103	**1188**	**1005**	**898**	45	13	17

NOTE.—Table 15 applies to cables employed in the wiring of buildings, but does not apply to every condition under which cables may be used.

Table 15 applies to two or three cables run spaced as shown on page 144. Where four or more cables are so spaced the current ratings are reduced to 90% of those set out in Col. 3 or Col. 4 above for d.c. or a.c., either single-phase or three-phase, respectively.

For two or three smaller cables (7/·036 in. to 19/·064 in. inclusive) so spaced the current ratings are those given in Col. 3 or Col. 4 of Table 13, and for four or more such smaller cables the current ratings are 90 per cent of those given in Col. 3 or Col. 4 of Table 13, for d.c. or a.c., either single-phase or three-phase, loading respectively.

Table 15 refers to situations where the ambient air temperature does not exceed 90° F. (32·2° C.). Where the ambient air temperature is abnormally high the current ratings given in Table 15 shall be multiplied, and the length for 1-volt drop divided, by the appropriate factor as follows:—

Ambient air temperature ..	95° F. (35° C.)	100° F. (37·8° C.)	105° F. (40·5° C.)	110° F. (43·3° C.)	115° F. (46·1° C.)	120° F. (48·9° C.)
Factor	0·96	0·92	0·88	0·84	0·79	0·74
Ambient air temperature ..	125° F. (51·7° C.)	130° F (54·4° C.)	135° F. (57·2° C.)	140° F. (60° C.)	145° F. (62·8° C.)	150° F. (65·5° C.)
Factor	0·69	0·63	0·57	0·51	0·43	0·35

* The current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.
** For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the cables and for balanced 3-phase a.c. the length of run is given in Col. 8 for 1-volt drop in the line voltage.

NOTE TO TABLES 10, 11, AND 15.

CABLES RUN UNDER DEFINED CONDITIONS.

The current ratings and corresponding lengths (approximate) of run for 1-volt drop set out in Table 10, 11, and 15, apply to cables run under the conditions defined below:—*

(1) The circuit comprises two single-core cables carrying d.c. or single-phase a.c., or three single-core cables carrying three-phase a.c.
(2) Where the cables are lead-sheathed, the lead sheaths are electrically bonded together, at each end of the cable run, with bonds of negligible resistance.
(3) The cables are remote from iron, steel, or ferro-concrete.
(4) The cables are supported horizontally one above the other on cleats on a vertical wall, and are separated from one another and from the wall by the following distances:—

Nominal cross-sectional area of conductor	Approximate vertical distance between cable centres	Approximate horizontal distance of cable centres from wall
1	2	3
sq. in.		
0·1 to 0·3 inclusive	Twice the diameter of the finished cable	1¼ in.
0·4 to 1·0 inclusive	3½ in.	2¼ in.

* For cables run under certain other conditions see Appendix 3 (page 159).

TABLE 16.—*Flexible cables, other than flexible cords: dimensions, current rating, and resistance.*

Nominal cross-sectional area of conductor	Number and diameter of wires forming conductor				Current rating (subject to voltage drop) for vulcanized-rubber-insulated cables		Approximate resistance** of conductor per 1 000 yards at 60° F. (15·6° C.)	
	Diameter 0·010 in.	Diameter 0·012 in.	Diameter 0·018 in.	Diameter 0·029 in.	Twin	Three-core	Standard	Maximum allowable for tinned wires
1	2	3	4	5	6	7	8	9
sq. in.					amperes	amperes	ohms	ohms
0·01	140/·010	97/·012*	—	—	30	27	2·292	2·384
0·0145	195/·010	—	60/·018*	—	36	32	1·646	1·712
0·0225	296/·010	—	91/·018*	—	45	39	1·084	1·127
0·03	—	266/·012	117/·018*	—	52	46	0·838	0·871
0·04	—	368/·012	163/·018*	—	62	55	0·606	0·630
0·06	—	557/·012	248/·018*	—	82	71	0·400	0·416
0·1	—	—	416/·018	160/·029*	118	103	0·238	0·248
0·15	—	—	610/·018	235/·029*	151	132	0·163	0·169
0·2	—	—	810/·018	312/·029*	183	160	0·123	0·127
0·3	—	—	1 248/·018	481/·029*	238	—	0·0794	0·0826
0·4	—	—	1 677/·018	646/·029*	286	—	0·0591	0·0615
0·5	—	—	2 057/·018	792/·029*	330	—	0·0482	0·0501

NOTE.—A flexible cable should be so supported that there is no appreciable mechanical stress on any socket or terminal fitted thereto [*see* Regulation 312 (B)] and the use of flexible cables of undue length is deprecated.

An earth-continuity conductor, forming part of a flexible cable, is not regarded as a conductor for the purposes of Table 16.

* For trailing cables and similar purposes. For resistance values appropriate to these cables see B.S. 7.
** This does not include an allowance for lay where cores are laid up into twin or multi-core cables.

TABLE 17

Flexible cords: Current rating, resistance, and weight supportable.

Conductor		Current rating (subject to voltage drop)		Resistance* per 1 000 yards at 60° F. (15·6° C.)		Maximum permissible weight supportable by twin flexible cord [see Regulation 605 (B)]
Nominal cross-sectional area	Number and diameter (in.) of wires	Twin, three-core or four-core circular type	Twin or three-core twisted type	Standard	Maximum allowable for tinned wires	
1	2	3	4	5	6	7
sq. in.		amperes	amperes	ohms	ohms	lb.
0·0006	14/·0076	2	2	39·7	41·3	3
0·001	23/·0076	4	3	24·2	25·1	5
0·0017	40/·0076	7	5	13·9	14·4	10
0·003	70/·0076	13	10	7·94	8·26	10
0·0048	110/·0076	18	15	5·05	5·25	10
0·007	162/·0076	23	20	3·43	3·57	10

NOTE.—See note below Table 16.

* This does not include an allowance for lay, where cores are laid up into twin or multi-core flexible cords.

Earth-Continuity Conductors.

TABLE 18—*Size of earth-continuity conductor in metal-sheathed cables and tough-rubber-sheathed cables.*

Size of current-carrying conductor		Size of wires forming earth-continuity conductor			
		Flat twin and flat three-core metal-sheathed cables		Flat twin tough-rubber-sheathed cables	
Nominal cross-sectional area	Number and diameter (in.) of wires	Approximate cross-sectional area of earth-continuity conductor	Number and diameter (in.) of wires	Approximate cross-sectional area of earth-continuity conductor	Number and diameter (in.) of wires
1	2	3	4	5	6
sq. in.		sq. in.		sq. in.	
0·0015	1/·044	0·001	1/·036	0·0015	1/·044
0·002	3/·029	0·001	1/·036	0·0015	1/·044
0·003	3/·036	0·0015	1/·044	0·0015	1/·044
0·0045	7/·029	0·0015	1/·044	0·003	3/·036
0·007	7/·036	0·0015	1/·044	0·0045	7/·029
0·01	7/·044	0·002	1/·052	0·007	7/·036
0·0145	7/·052	0·003	1/·064	0·01	7/·044
0·0225	7/·064	0·004	1/·072	0·0145	7/·052

Bare Copper Conductors.

TABLE 19

Current rating of bare solid copper conductors of circular cross-section, run with a spacing of 3 inches between centres of conductors.

Conductor		Current rating*			Approximate length of run** for 1-volt drop		
Diameter	Approximate cross-sectional area	D.C.	Single-phase a.c.	Three-phase a.c.	D.C., with current rating in Col. 3	Single-phase a.c., with current rating in Col. 4	†Balanced 3-phase a.c., with current rating in Col. 5
1	2	3	4	5	6	7	8
in.	sq. in.	amperes	amperes	amperes	ft.	ft.	ft.
$\frac{3}{8}$	0·11	230	230	230	25	20	21
$\frac{1}{2}$	0·20	320	320	320	31	21	22
$\frac{5}{8}$	0·31	430	430	400	36	20	21
$\frac{3}{4}$	0·44	550	540	490	41	18	19
1	0·79	800	800	700	49	15	16

NOTE.—The current ratings given in Table 19 may be increased by 20% where the conductors are painted dull black. Table 19 does not apply to busbars and connections on switchboards; details for these are contained in B.S. 159 [*see* Regulation 302 (C)].

* The current ratings are given subject to the maximum permissible voltage drop (*see* Regulation 304) not being exceeded.

† For the conductor having the greatest impedance.

** For purposes of the Table the "length of run" is the point-to-point distance measured along the route taken by the circuit, and for balanced 3-phase a.c. the length of run is given in Col. 8 for 1-volt drop in the line voltage.

Rating Factors.

TABLE 20

Rating factors for intermittently-loaded cables, however run:—

(i) Vulcanized-rubber-insulated cables (Cols. 3 and 4).

(ii) Paper-insulated and varnished-cambric-insulated cables (Cols. 5 and 6).

Conductor		Vulcanized-rubber-insulated cables		Paper-insulated and varnished-cambric-insulated cables	
Nominal cross-sectional area	Number and diameter (in.) of wires	Half-hour rating factor	One-hour rating factor	Half-hour rating factor	One-hour rating factor
1	2	3	4	5	6
sq in.					
0·0145	7/·052	1·02	1·00	1·05	1·00
0·0225	7/·064	1·02	1·00	1·05	1·00
0·03	19/·044	1·05	1·02	1·08	1·01
0·04	19/·052	1·06	1·02	1·08	1·01
0·06	19/·064	1·10	1·02	1·12	1·02
0·1	19/·083	1·20	1·05	1·18	1·04
0·15	37/·072	1·25	1·08	1·23	1·06
0·2	37/·083	1·34	1·10	1·27	1·08
0·3	37/·103	1·46	1·18	1·36	1·13
0·4	61/·093	1·57	1·24	1·43	1·17
0·5	61/·103	1·61	1·27	1·49	1·20
0·75	91/·103	1·68	1·31	1·60	1·26
1·0	127/·103	1·74	1·35	1·66	1·30

NOTE.—Rating factor is used here to denote the ratio of half-hour or one-hour rating to the continuous rating given in Tables 8–11 and 13–15 inclusive. The factors given are applicable to cables having conductors not smaller than 0·014 sq. in. (7/·052) and should be used only when it can be established that the appropriate time ratings will not be exceeded in service

TABLE 21

Approximate sizes of fuse-elements composed of tinned copper wire or standard-alloy wire for use in semi-enclosed fuses.*

Current rating of fuse	Tinned copper wire		Standard-alloy* wire	
	Diameter (in.)	S.W.G.	Diameter (in.)	S.W.G.
1	2	3	4	5
amperes				
1·8	—	—	0·0164	27
3·0	0·006	38	0·024	23
5·0	0·0084	35	0·032	21
8·5	0·0124	30	—	—
10·0	0·0136	29	—	—
15·0	0·020	25	—	—
17	0·022	24	—	—
20	0·024	23	—	—
24	0·028	22	—	—
29	0·032	21	—	—
38	0·040	19	—	—
45	0·048	18	—	—
65	0·056	17	—	—
78	0·072	15	—	—
102	0·080	14	—	—

NOTE.—The use of cartridge fuses to the appropriate British Standard is normally recommended, but where fuse wire is to be used as an alternative, the figures given in the above table will provide an approximate guide to the size of wire required in relation to the normal maximum current-carrying capacity of the circuit. The excess current at which the fuse will blow will depend also upon the construction of the fuse in which the wire is used.

* The term "standard alloy" refers to the eutectic tin-lead alloy (63% tin, 37% lead).

Capacity of Conduits:
(250-volt Grade Cables).

TABLE 22

Maximum capacity of conduits (B.S. 31) for the drawing-in of 250-volt-grade vulcanized-rubber-insulated and taped or taped and braided or p.v.c.-insulated cables to Table 5 of B.S. 7. [See Regulation 405 (D).]

Size of conduit			⅜ in.	¾ in.	1 in.	1¼ in.	1½ in.	2 in.
Conductor of cable		Approximate overall diameter of taped and braided cable	Maximum number of vulcanized-rubber-insulated and taped or taped and braided or p.v.c.-insulated cables					
Nominal cross-sectional area	Number and diameter (in.) of wires							
sq in.		in.						
0·0015	1/·044	0·165	4	6	10	14	—	—
0·002	3/·029	0·190	3	5	10	14	—	—
0·003	3/·036	0·210	2	4	8	12	—	—
0·0045	7/·029	0·220	2	4	6	10	—	—
0·007	7/·036	0·245	—	2	5	8	—	—
0·01	7/·044	0·280	—	—	4	7	—	—
0·0145	7/·052	0·310	—	—	3	5	6	—
0·0225	7/·064	0 355	—	—	2	4	6	—
0·03	19/·044	0·390	—	—	—	3	5	7
0·04	19/·052	0·435	—	—	—	2	4	6
0·06	19/·064	0·51	—	—	—	—	3	5

NOTE.—This Table shows the maximum capacity of conduits for the simultaneous drawing-in of cables. The maximum numbers of cables shown in the Table apply to all types of conduits irrespective of whether they are light-gauge or heavy-gauge. Attention is drawn to Tables 5, 8 and 9 of the Regulations, which give the current ratings of cables bunched in one conduit.

Capacity of Conduits:
(660-volt Grade Cables).

TABLE 23

Maximum capacity of conduits (B.S. 31) for the drawing-in of 660-volt grade vulcanized-rubber-insulated and taped or taped and braided or p.v.c.-insulated cables to Table 6 of B.S. 7. [See Regulation 405 (D).]

Size of conduit			¾ in.	1 in.	1¼ in.	1½ in.	2 in.
Conductor of cable		Approximate overall diameter of taped and braided cable	Maximum number of vulcanized-rubber-insulated and taped or taped and braided or p.v.c.-insulated cables				
Nominal cross-sectional area	Number and diameter (in.) of wires						
sq. in.		in.					
0·002	3/·029	0·230	4	9	—	—	—
0·003	3/·036	0·245	3	6	—	—	—
0·0045	7/·029	0·265	2	5	9	—	—
0·007	7/·036	0·290	—	4	8	—	—
0·01	7/·044	0·315	—	4	7	9	—
0·0145	7/·052	0·340	—	3	5	7	—
0·0225	7/·064	0·380	—	—	4	6	—
0·03	19/·044	0·410	—	—	3	5	—
0·04	19/·052	0·450	—	—	2	4	6
0·06	19/·064	0·52	—	—	—	3	5
0·1	19/·083	0·64	—	—	—	—	3
0·15	37/·072	0·77	—	—	—	—	2

NOTE.—This Table shows the maximum capacity of conduits for the simultaneous drawing-in of cables. The maximum numbers of cables shown in the Table apply to all types of conduits irrespective of whether they are light-gauge or heavy-gauge. Attention is drawn to Tables 5, 8 and 9 of the Regulations which give the current ratings of cables bunched in one conduit.

APPENDICES

1

LIST OF BRITISH STANDARDS* REFERRED TO IN THE REGULATIONS

2

BRITISH STANDARD GRAPHICAL SYMBOLS FOR GENERAL ELECTRICAL PURPOSES

3

CORRECTION FACTORS FOR CURRENT RATINGS FOR SINGLE-CORE CABLES RUN IN CONDITIONS DIFFERENT FROM THOSE IN TABLES 10, 11 AND 15

4

REGULATIONS FOR EARTHING ELECTRICAL INSTALLATIONS TO METAL WATER-PIPES AND WATER-MAINS

* Obtainable from Sales Department, British Standards Institution, 24–28 Victoria Street, London, S.W.1.

APPENDIX I

LIST OF BRITISH STANDARDS REFERRED TO IN THE REGULATIONS

NOTE.—Where a British Standard is referred to in the Regulations the latest revision of such Standard is implied, and at the date of publication of the Twelfth Edition of the Regulations the latest revisions are as set out below.

Title	B.S. No.
Ammeters, Graphic	90—1940
Ammeters, Indicating	89—1937
Busbars and busbar connections	159—1932
Busbars (switchgear), Marking and arrangement for	158—1938
Cables and flexible cords, Rubber-insulated	7—1946
Cables, Jute-insulated	1216—1945
Cables, Metal-sheathed impregnated-paper-insulated	480—1942
Cables, Varnished-cambric-insulated	608—1943
Capacitors for power-frequency circuits	1650—1950
Ceiling roses, two- and three-terminal	67—1938
Charging plugs and sockets, Electric battery vehicles	74—1937
Circuit-breakers, Air-break (including totally-enclosed and flameproof types up to 660 V)	862—1939
Circuit-breakers and switches, Oil-immersed (for a.c. circuits)	116—1937
Circuit-breakers, Oil, for a.c. circuits up to and including 660 V	936—1940
Circuit-breakers, Voltage-operated earth-leakage, for use on consumers' premises	842—1939
Clocks, Main-operated synchronous	472—1932
Conduit boxes (grey cast-iron) for electrical wiring	820—1938
Conduits (light-gauge seamless copper) and fittings	840—1939
Conduits (steel) and fittings for electrical wiring	31—1940
Connectors, Inlet and outlet, for radio circuits	666—1936
Connectors, Reversible (with earthing facilities) for portable electrical appliances	562—1934
Consumers' electricity control units	1454—1948
Contactors	775—1938
Cooker control units (for 2-wire circuits)	438—1941
Distribution boards	214—1939
Ducts, Under-floor non-metallic	815—1938
Ducts, Under-floor steel	774—1938
Earthing clamps for use on metal pipes of internal diameter up to 3 in.	951—1941
Electric signs and luminous-discharge-tube installations	559—1938
Fans, ceiling-type, Performance of	367—1941
Field rheostats for electric generators, motors, convertors and balancers	280—1928
Fire-resistance, incombustibility and non-inflammability of building materials and structures	476—1932
Fires, electric	1670—1950
Flameproof enclosure of electrical apparatus	229—1946

Appendix 1 (*contd.*)

Title	B.S. No
Flameproof electric lighting fittings	889—1940
Flexible cords, Insulated-asbestos-roved	1327—1946
Fuse-links, Cartridge, for use in plugs	1362—1947
Fuses, Cartridge, for domestic consumers' units	1361—1947
Fuses, Ordinary-duty 250-volt cartridge (rated up to 5 amperes) for a.c. and d.c.	646—1935
Fuses, Electric, low-voltage and medium-voltage	88—1947
Generators and motors with class A insulation (Electrical performance)	168—1936
Glands, Watertight, for electric cables	94—1920
Graphic (recording and chart recording) ammeters, voltmeters, wattmeters, power-factor meters and frequency meters	90—1940
Graphical symbols for general electrical purposes	108—1950
Identification of pipes, conduits, ducts and cables in buildings	617—1942
Immersion heaters for domestic hot-water supply	1556—1949
Indicating ammeters, voltmeters, wattmeters, frequency and power-factor meters	89—1937
Insulating slabs, slate and marble	160—1936
Lamp-caps and lampholders for architectural lamps	841—1939
Lamp-caps, lampholders, and lampholder-plugs (Bayonet)	52—1941
Lamp-caps and lampholders (Edison-type)	98—1947
Lamp-caps and lampholders, Prefocus type	1164—1944
Lamps, Tungsten-filament general-service	161—1940
Lamps, Tungsten-filament (other than general-service)	555—1939
Meters, Electricity	37—1937
Minimum requirements for electrical appliances and accessories	816—1938
Motors, Fractional-horse-power (electrical performance)	170—1939
Motors and generators with class A insulation (electrical performance)	168—1936
Motor starters, controllers, and resistors (excluding liquid starters and controllers and single-phase a.c. models)	587—1940
Non-ignitable and self-extinguishing boards (with mineral base)	737—1937
Non-ignitable and self-extinguishing properties of solid electrical insulating materials, Definitions for	738—1937
Portable fuse and plug boxes (applicable to film studios, stages, music-halls, etc.)	828—1939
Plugs (Fused-) and shuttered socket-outlets	1363—1947
Plug and socket-outlets, Two-pole and earthing-pin	546—1934
Plugs and sockets for domestic purposes, 2-pole, Side-entry wall-type	372—1930

Appendix 1 (*contd.*)

Title	B.S. No.
Plugs and socket-outlets for stage lighting	*
Radio and other apparatus for radio, acoustic and visual reproduction, Mains-operated (Safety requirements)	415—1941
Radio-interference, Limits of	800—1939
Radio-interference, Components for, suppression devices	613—1940
Reading table lamp	710—1936
Reflectors for electric lighting, Vitreous-enamelled steel (open dispersive type)	232—1938
Refrigerators, Domestic electric	922—1940
Rotary convertors (electrical performance)	172—1927
Starters, Liquid (for induction motors)	140—1935
Switches, Air-break (up to 660 V)	861—1939
Switches and circuit-breakers, Oil-immersed (for a.c.)	116—1937
Switches and contactors, Automatic change-over, for emergency lighting systems	764—1937
Switches, Tumbler-, and associated switch-plates and switch-boxes (5-ampere flush-type)	1299 Part 1—1946
Switchgear, Electric power	162—1938
Switchgear equipments for d.c. circuits (up to 660 V)	194—1926
Switchgear equipments for 3-phase a.c. circuits (up to 33 kV)	195—1929
Thermostats for domestic hot-water supply (a.c. only)	1555—1949
Transformers, Bell	832—1939
Transformers, Instrument	81—1936
Transformers for electrically-operated toys	831—1939
Transformers for low-voltage lighting	794—1938
Transformers for power and lighting	171—1936
Vacuum cleaners, domestic	1645—1950
Voltmeters, Graphic	90—1940
Voltmeters, Indicating	89—1937
Water-heaters, Thermostatically-controlled thermal-storage, with copper containers from 1½ to 100 gallons capacity	843—1939
Wattmeters, Graphic	90—1940
Wattmeters, Indicating	89—1937

*In preparation.

NOTE.—Reference is also made to the following British Standard Codes of Practice:—

CP 211 (1949) Internal plastering.

CP 1003 (1948) Installation and maintenance of flameproof and intrinsically-safe electrical equipment (for industries other than coal-mining).

APPENDIX 2

BRITISH STANDARD GRAPHICAL SYMBOLS FOR GENERAL ELECTRICAL PURPOSES

The following symbols* are extracted from B.S. 108: 1950; for further information reference should be made to the full Standard.

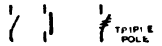
Contact, separable .. .. ○

Contact, not separable in ordinary use .. .. .. ●

Isolating contact .. .. ⊥

Plug .. .. ♦

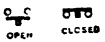
Socket .. .. Y

Switch, general symbol .. .. .. 

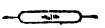
Circuit-breaker, general symbol for schematics .. .. 

Fuse, with separable contacts .. .. 

Link with separable contacts .. .. 

Pushbutton switch .. .. 

Filament lamp, general symbol .. .. 

Discharge lamp .. .. 

Clock, general symbol .. .. 

Main control .. .. 

Main switch .. .. 

Change-over switch .. .. 

Switchboard, distribution board, or fuseboard .. .. 

*At the time of going to press the symbols have not been finally approved and it is possible that they may be modified in certain particulars when the revised B.S. 108 appears.

Contactor .. .. 

Meter .. .. 

Ceiling outlet lighting, filament lamp .. .. .. 

Wall outlet lighting, filament lamp .. .. 

Ceiling outlet for discharge lamp .. .. 

NOTE.—When it is intended to use a tubular or other discharge lamp, reference should be made in the drawing or schedule to the exact location of the outlet in relation to lamp position, and also to the position of the ancillary apparatus.

General symbol for local switch when considered applicable •

1-way switch .. .. 

2-way switch .. .. 

Intermediate switch .. .. 

Pendant switch .. .. 

Pull switch .. .. 

Socket-outlet .. .. 

Fixed point (requirement unspecified, characteristics to be given in drawing or schedule) .. .. 

Outlet for motor to fixed fan .. .. 

Outlet for motor to ceiling fan .. .. 

Fan regulator .. .. 

Cooker control unit .. .. 

Earth (general symbol) .. ..

APPENDIX 3

CORRECTION FACTORS FOR CURRENT RATINGS OF SINGLE-CORE CABLES

Where single-core unarmoured cables, run open on cleats, are installed under conditions differing from those defined in items (3) and (4) in the Note (page 144) to Tables 10, 11 and 15, the current ratings set out in those Tables no longer apply.

Parts I and II below specify correction factors for the determination of the current ratings under certain specified conditions. under which either item (3) or item (4) does not apply. The factors are based on experimental data provided by the British Electrical and Allied Industries Research Association.

Where neither condition (3) nor condition (4) of the Note (page 144) to Tables 10, 11 and 15 is met, an appropriate factor should be applied for each condition, i.e. the current ratings should be multiplied by, and the lengths per volt divided by, the product of two factors.

PART I—*Effect of disposition.*

To obtain the current ratings for cables installed as defined in Table A (page 160), the current ratings set out in Tables 10, 11 and 15, should be multiplied by the appropriate factor from Table B, Table C, or Table D (pages 161, 162, and 163). The corresponding lengths of run for a 1-volt drop, set out in Tables 10, 11 and 15, should be divided by the appropriate factor from Table B, Table C, or Table D.

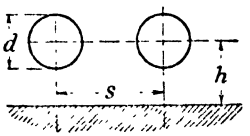
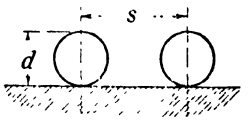
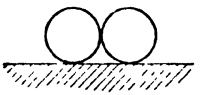
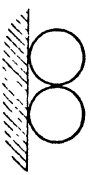
NOTE.—Attention is drawn to the effect of departure, in any important respect, from the dispositions defined in this Appendix. A largely increased spacing, for instance, may cause a considerable increase in the heating of a cable carrying a.c. *Example.*—The current rating of a single-core cable of 0·75 sq. in. nominal cross-sectional area was reduced by 30% when an increase from 3½ in. to 20 ft. was made in the distance between the outgoing and return conductors of the circuit formed by the cable. [The cable was of the unarmoured, lead-sheathed, impregnated-paper-insulated type, and the lead sheaths were bonded at each end, in accordance with condition (2) of the Note (page 144) to Tables 10, 11, and 15.]

PART II—*Effect of proximity to iron, etc.*

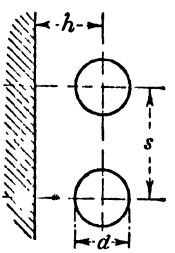
To obtain the current ratings for single-core cables carrying alternating current and run for considerable parts of their lengths in proximity to iron, steel, or ferro-concrete, the current ratings set out in Tables 10, 11, and 15, should be multiplied by the appropriate factor from Table E or Table F (pages 164 and 165). The corresponding lengths of run for a 1-volt drop, in a.c. circuits, set out in Tables 10, 11, and 15, should be divided by the appropriate factor from Table E or Table F.

TABLE A

Dispositions of cables.

First disposition	Two cables separated from each other by a distance s* between centres, and supported on cleats at a centre height h† above a non-metallic floor	
Second disposition	Two cables lying on a non-metallic floor, and separated from each other by a distance s* between centres	
Third disposition	Two cables lying on a non-metallic floor, close to (touching) each other and the floor throughout their whole length	
Fourth disposition	Two cables supported horizontally one above the other on a non-metallic wall, close to (touching) each other and the wall throughout their whole length	

NOTE.—For reference, the disposition defined in the Note (page 144) to Tables 10, 11 and 15, is included below:—

Two cables supported on cleats horizontally one above the other at an axial distance h† from a vertical wall, and separated from each other by a distance s* between centres	

* For cables of cross-sectional area less than 0·4 sq. in., s = twice the diameter (d) of the finished cable. For cables of 0·4 sq. in. cross-sectional area and larger, s = 3½ in.

† The corresponding values of h are 1¼ in. and 2¼ in. respectively.

TABLE B

Factors for current rating, and for length of run for a 1-volt drop, for cables installed as defined in Table A.

Vulcanized-rubber-insulated, braided and compounded cables with or without tape (*see* Table 10).

Nominal cross-sectional area of conductor	Type of current	Correction for:—	Disposition			
			First	Second	Third	Fourth
1	2	3	4	5	6	7
sq in.						
0·1	D.C.	Current rating	1·04	0·92	0·88	0·82
	D.C.	Run for 1-V drop	1·04	0·92	0·88	0·82
0·15	A.C.	Current rating	1·01	0·91	0·88	0·82
	A.C.	Run for 1-V drop	1·01	0·91	0·82	0·77
0·2	D.C.	Current rating	1·04	0·92	0·88	0·82
	D.C.	Run for 1-V drop	1·04	0·92	0·88	0·82
0·3	A.C.	Current rating	1·01	0·91	0·88	0·82
	A.C.	Run for 1-V drop	1·01	0·91	0·73	0·68
0·4	D.C.	Current rating	1·04	0·94	0·88	0·83
	D.C.	Run for 1-V drop	1·04	0·94	0·88	0·83
0·5	A.C.	Current rating	1·00	0·92	0·86	0·80
	A.C.	Run for 1-V drop	1·00	0·92	0·56	0·52
0·75	D.C.	Current rating	1·05	0·99	0·92	0·85
	D.C.	Run for 1-V drop	1·05	0·99	0·92	0·85
1·0	A.C.	Current rating	1·07	1·03	0·90	0·87
	A.C.	Run for 1-V drop	1·07	1·03	0·60	0·58

TABLE C

Factors for current rating, and for length of run for a 1-volt drop, for cables installed as defined in Table A.

Vulcanized-rubber-insulated lead-sheathed cables (*see* Table 11).

Nominal cross-sectional area of conductor	Type of current	Correction for:—	Disposition			
			First	Second	Third	Fourth
1	2	3	4	5	6	7
sq. in.						
0·1	D.C.	Current rating	1·04	0·92	0·88	0·82
	D.C.	Run for 1-V drop	1·04	0·92	0·88	0·82
0·15	A.C.	Current rating	1·06	0·99	0·88	0·82
	A.C.	Run for 1-V drop	1·06	0·99	0·81	0·75
0·2	D.C.	Current rating	1·04	0·92	0·88	0·82
	D.C.	Run for 1-V drop	1·04	0·92	0·88	0·82
0·3	A.C.	Current rating	1·06	0·99	0·88	0·82
	A.C.	Run for 1-V drop	1·06	0·99	0·72	0·67
0·4	D.C.	Current rating	1·04	0·94	0·88	0·83
	D.C.	Run for 1-V drop	1·04	0·94	0·88	0·83
0·5	A.C.	Current rating	1·02	1·00	0·95	0·85
	A.C.	Run for 1-V drop	1·02	1·00	0·63	0·56
0·75	D.C.	Current rating	1·05	0·99	0·92	0·85
	D.C.	Run for 1-V drop	1·05	0·99	0·92	0·85
1·0	A.C.	Current rating	1·08	1·06	1·04	0·95
	A.C.	Run for 1-V drop	1·08	1·06	0·70	0·64

TABLE D

Factors for current rating, and for length of run for a 1-volt drop, for cables installed as defined in Table A.

Impregnated-paper-, varnished-cambric-, or impregnated-jute-insulated lead-sheathed cables (*see* Table 15).

Nominal cross-sectional area of conductor	Type of current	Correction for:—	Disposition			
			First	Second	Third	Fourth
1	2	3	4	5	6	7
sq. in.						
0·1	D.C.	Current rating	1·06	0·99	0·88	0·82
0·1	D.C.	Run for 1-V drop	1·06	0·99	0·88	0·82
0·15	A.C.	Current rating	1·06	0·99	0·88	0·82
0·15	A.C.	Run for 1-V drop	1·06	0·99	0·82	0·76
0·2	D.C.	Current rating	1·06	0·99	0·88	0·82
0·2	D.C.	Run for 1-V drop	1·06	0·99	0·88	0·82
0·3	A.C.	Current rating	1·06	0·99	0·88	0·82
0·3	A.C.	Run for 1-V drop	1·06	0·99	0·73	0·68
0·4	D.C.	Current rating	1·02	0·96	0·88	0·83
0·4	D.C.	Run for 1-V drop	1·02	0·96	0·88	0·83
0·5	A.C.	Current rating	1·02	1·00	0·95	0·87
0·5	A.C.	Run for 1-V drop	1·02	1·00	0·62	0·56
0·75	D.C.	Current rating	1·02	0·98	0·92	0·83
0·75	D.C.	Run for 1-V drop	1·02	0·98	0·92	0·83
1·0	A.C.	Current rating	1·03	1·02	0·98	0·89
1·0	A.C.	Run for 1-V drop	1·03	1·02	0·65	0·59

TABLE E

Factors for single-core, unarmoured cables carrying a.c. and run near steel or ferro-concrete.

Braided and compounded cables with or without tape (*see* Table 10).

Nominal cross-sectional area of conductor	Axial distance of cables from steel	Axial distance of cables from ferro-concrete*	Factors for current rating†	Factors for approximate length of run for a 1-volt drop—alternating-current circuits only		
				Spacing between external surfaces of the finished cables.—		
				1 in.	3 in.	6 in.
1	2	3	4	5	6	7
sq. in.						
0·1	Under 3 in.	Under 1 in.	1·00	1·05	1·10	1·20
0·15	3 in. to 6 in.	1 in. to 4 in.	1·00	1·00	1·05	1·05
0·2	6 in. to 10 in.‡	4 in. to 8 in.‡	1·00	1·00	1·00	1·00
0·3						
0·4	Under 3 in.	Under 1 in.	0·95	1·15	1·15	1·30
0·5	3 in. to 6 in.	1 in. to 4 in.	1·00	1·00	1·05	1·10
	6 in. to 10 in.‡	4 in. to 8 in.‡	1·00	1·00	1·05	1·05
0·75	Under 3 in.	Under 1 in.	0·95	1·20	1·30	1·35
1·0	3 in. to 6 in.	1 in. to 4 in.	0·95	1·05	1·15	1·20
	6 in. to 10 in.‡	4 in. to 8 in.‡	1·00	1·05	1·05	1·05

* The factors given apply where there is 2 in. thickness of concrete covering the steel reinforcement.
† For spacing between external surfaces of the finished cables not exceeding 6 in.
‡ For axial distances of the cable exceeding 10 in. from steel, or 8 in. from ferro-concrete, the factor is 1·00.

TABLE F

Factors for single-core, unarmoured cables carrying a.c. and run near steel or ferro-concrete.

Lead-sheathed cables (*see* Tables 11 and 15).

Nominal cross-sectional area of conductor	Axial distance of cables from steel	Axial distance of cables from ferro-concrete*	Factors for current rating†	Factors for approximate length of run for a 1-volt drop—alternating-current circuits only		
				Spacing between external surfaces of the finished cables:—		
				1 in.	3 in.	6 in.
1	2	3	4	5	6	7
sq. in.						
0·1	Under 3 in.	Under 1 in.	1·00	1·10	1·20	1·25
0·15	3 in. to 6 in.	1 in. to 4 in.	1·00	1·05	1·05	1·05
0·2	6 in. to 10 in.‡	4 in. to 8 in.‡	1·00	1·00	1·00	1·00
0·3						
0·4	Under 3 in.	Under 1 in.	0·95	1·10	1·20	1·20
0·5	3 in. to 6 in.	1 in. to 4 in.	1·00	1·05	1·10	1·10
	6 in. to 10 in.‡	4 in. to 8 in.‡	1·00	1·00	1·05	1·05
0·75	Under 3 in.	Under 1 in.	0·90	1·05	1·10	1·20
1·0	3 in. to 6 in.	1 in. to 4 in.	0·95	1·00	1·05	1·05
	6 in. to 10 in.‡	4 in. to 8 in.‡	1·00	1·00	1·05	1·05

* The factors given above apply where there is 2 in. thickness of concrete covering the steel reinforcement.
† For spacing between external surfaces of the finished cables not exceeding 6 in.
‡ For axial distances of the cable exceeding 10 in. from steel or 8 in. from ferro-concrete, the factor is 1·00.

APPENDIX 4

REGULATIONS FOR CONTROLLING THE EARTHING OF ELECTRICAL INSTALLATIONS TO METAL WATER-PIPES AND WATER-MAINS*

Drawn up and approved by The Institution of Civil Engineers, The Institution of Electrical Engineers, The Institution of Water Engineers, The British Waterworks Association, and The Water Companies' Association.

Preamble.

These Regulations have been drafted under the auspices of The Institution of Civil Engineers as the result of agreement come to between representatives of water and electrical interests. They are subject to any amendment which may be shown to be desirable as a result of further experience or research.

Clause 1.

An earth-wire connecting an electrical installation to a water-main or water-pipe is to be used only:—

(*a*) As a measure of safety for the purpose of returning to the source of supply such leakage current as may flow, or result from a failure of insulation.

(*b*) For radio-frequency currents and those from radio-interference-suppression devices.

Clause 2.

A water-main or water-pipe shall not be cut, drilled or broken, for purposes of Clause 1, and all reasonable and proper care shall be exercised, in making any earth-connection, to prevent injury or damage to a water-main or water-pipe.

Clause 3.

Every earth-connecting device to a water-main or water-pipe shall be of such an approved design† as to ensure an efficient electrical connection, and other than as provided for in Clause 4 shall be attached in a position convenient for, and easy of, access.

Clause 4.

An earth-connection shall only be made to a buried water-main or water-pipe after notice to, and in a manner approved by, the water authority concerned.

Clause 5.

Wherever an earth-connection is made to a water-main or water-pipe on any premises in which is installed a water-meter, a proper,

* These regulations are reproduced by courtesy of The Institution of Civil Engineers. See also *Journal I.E.E.*, September 1938, vol. 83, pp. 434–5.

† For the purposes of Clause 3 the approval of the design of the earth-connecting device should rest with a joint committee of electrical and water representatives.

sufficient, and suitable bond shall in all such cases be placed across such water-meter by the user of the meter, free of expense to the water authority.

Clause 6.

Where the water-supply authority has reason to believe that damage to water-mains or water-pipes is being caused by an excessive flow of current from an earth-connection made to a water-main or water-pipe they shall, in general, request the electricity-supply undertakers for the district to test the installation, arrangements being made for a representative of the water-supply authority to be present at the time the test is made. If, however, for any reason the water-supply authority should desire to test for electrical leakage from an installation to water-mains or water-pipes, that authority will be at liberty to make such test after advising the electricity-supply undertakers for the district of their intention, giving such notice to the consumer as may be necessary, and inviting the presence of a representative of the electrical undertakers when the test is made.

Water-supply authorities (whilst maintaining the powers which they are advised are conferred by existing water-supply legislation to enter premises, and if necessary to test for electrical leakage) agree that, in general, tests for electrical leakage, and any notice to the consumer which may be necessary in connection therewith, should be made and given by the electricity-supply undertakers, who will usually possess the better facilities.

NOTE.—Attention is drawn to the fact that in certain cases non-metallic water-pipes are in use, and the electrical implications of this should be recognized.

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