



SUPPLEMENT

TO THE

NEW ZEALAND GAZETTE

OF

THURSDAY, SEPTEMBER 5, 1935.

Published by Authority.

WELLINGTON, FRIDAY, SEPTEMBER 6, 1935.

ELECTRICAL SUPPLY REGULATIONS, 1935,

AND

ELECTRICAL WIRING REGULATIONS, 1935.

Electrical Supply Regulations, 1935.

GALWAY, Governor-General.

ORDER IN COUNCIL.

At the Government House at Wellington, this 23rd day of July, 1935.

Present:

HIS EXCELLENCY THE GOVERNOR-GENERAL IN COUNCIL.

PURSUANT to the Public Works Act, 1928 (hereinafter called "the said Act"), His Excellency the Governor-General acting by and with the advice and consent of the Executive Council, doth hereby make the regulations hereinafter set forth and doth hereby revoke, as from the coming into force of the regulations hereby made, the regulations next hereinafter referred to and made or enuring under the said Act.

REGULATIONS REVOKED.

Date of Order.	Short Title or Description.	Date of Publication in Gazette.	Page
11 July, 1927	Electrical Supply Regulations, 1927	12 July, 1927	2360
1 July, 1929	Amendments of Electrical Supply Regulations, 1927	4 July, 1929	1792

REGULATIONS ENACTED.

THESE regulations are divided into Divisions and Parts as follows:—

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- Part 11. Definitions.
- Part 12. Application, Modification, and Exemption.
- Part 13. General.

Division II.—Conditions on which Licenses may be issued, and the Fees payable thereon.

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- Part 23. Records and Reports.
- Part 24. Monopoly, Compensation, and Assignment.
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- Part 26. Fees.
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- Part 32. Switchgear.
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- Part 45. Protection of Telegraph-lines and Telegraph Apparatus.
- Part 46. Railway Crossings.
- Part 47. Electric Services.
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Division V.—Testing, Maintenance, and Inspection.

- Part 51. Inspection and Testing.
- Part 52. Maintenance.
- Part 53. Right of Entry.

Division VI.—Removal or Alteration of Hazardous and Dangerous Lines and Apparatus.

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Division VII.—Penalties.

- Part 71. Penalties for Breaches of Licenses and Regulations.

Division VIII.—Tables.

DIVISION I.—GENERAL.

PART 11.—DEFINITIONS.

11-01. (1) These regulations may be cited as the Electrical Supply Regulations, 1935.

(2) These regulations shall come into force on the twenty-eighth day following the date of publication hereof in the Gazette.

11-02. In these regulations, unless the context otherwise requires,—

"Aerial conductor" means any conductor which is supported above the ground, and which, or the covering of which, is directly exposed to the open air.

"Approved" means approved by the Chief Electrical Engineer.

"Area of supply" means any defined area within which a licensee is authorized to erect electric lines for the purpose of supplying electrical energy to consumers.

"Authorized person" means and includes every person who is either (a) the owner or occupier of any premises, or (b) a contractor for the time being under contract with the owner or occupier, or (c) a person employed, appointed, or selected by the owner, occupier, or contractor as aforesaid to carry out certain duties incidental to the generation, transformation, distribution, or use of electrical energy; such owner, occupier, contractor, or person being a person who is competent for the purposes of the regulation in which the term is used.

"Chief Electrical Engineer" means the person for the time being holding that office in the Public Works Department.

"Conductor" means any wire, cable, bar, or tube used for conducting electrical energy.

"Consumer" means any body or person supplied or entitled to be supplied with electrical energy by the licensee, and includes any person who, being under no disability, and being competent to receive a supply, is willing to enter into a contract with the licensee for electrical energy to be supplied to him at a point within the licensee's area of supply on the terms and subject to the conditions generally prevailing for such contracts within the licensee's area of supply.

"Cut-out" comprises all the separate parts—e.g., fuse-link, fuse-carrier, fuse-contacts, fuse-extension, and circuit contacts—which, together with their mountings and base, form the complete protecting-device.

"Dead" when used with reference to parts which may sometimes be alive, means free from any electrical connection to a source of potential difference and free from electrical charge and not having a potential different from that of earth.

"Earthed" means connected to the general mass of earth in such a manner as to ensure at all times the immediate discharge of electrical energy, without electrical hazard.

"Electric distribution-line" means an electric line of the licensee's system to which electric service-lines may be connected.

"Electric service-line" means an electric line on one or more consumers' premises which terminates thereon and which is connected between an electric distribution-line and the consumers' service-main, and may include an electric line crossing a street to such premises.

"Electrical hazard" means danger to life and/or property from electrical energy.

"Electrical supply authority" means any person or body licensed or otherwise authorized to generate and/or to supply electrical energy; and, in respect of any premises, means the electrical supply authority authorized to supply electrical energy for consumption on such premises; and, in case more than one electrical supply authority is so authorized, means the electrical supply authority by whom or which electrical energy is so supplied or intended to be supplied; and, in respect of premises where there is no electrical supply authority so authorized, means the Chief Electrical Engineer.

"Extra-high pressure" means any pressure in excess of 6,600 volts.

"Extra-low pressure" means any pressure not exceeding in the case of alternating current 32 volts, and in the case of direct current 100 volts.

"Fuse-link" means the actual wire or strip of metal in a cut-out or other device which is intended to be fused by an excessive current.

- "Generating-station" means a building complete with equipment installed for the generation and supply of electrical energy.
- "High pressure" means any pressure exceeding 650 volts but not exceeding 6,600 volts.
- "Inspecting Engineer" means and includes any person authorized by the Minister to inspect electric lines and/or works.
- "Insulating-boots" means boots of such size, quality, and construction, according to the circumstances of the use thereof, that any person using the same is thereby adequately protected from electrical hazard.
- "Insulating-gloves" means gloves of such size, quality, and construction, according to the circumstances of the use thereof, that any person using the same is thereby adequately protected from electrical hazard.
- "Insulating-goloshes" means goloshes of such size, quality, and construction, according to the circumstances of the use thereof, that any person using the same is thereby adequately protected from electrical hazard.
- "Insulating-screen" means a screen of such size, quality, and construction, according to the circumstances of the use thereof, that any person using the same is thereby adequately protected from electrical hazard.
- "Insulating-stand" means a floor, platform, stand, stool, or mat of such size, quality, and construction according to the circumstances of the use thereof, that any person using the same is thereby adequately protected from electrical hazard.
- "Licensee" means any local authority, company, body, person, or persons authorized under the Public Works Act, 1928, or any other Act to lay, construct, put up, place, or use any electric line or work.
- "Live" (alive) is said of a conductor when a potential difference exists between it and earth.
- "Low pressure" means any pressure exceeding in the case of alternating current 32 volts, and in the case of direct current 100 volts, but not exceeding in either case 250 volts.
- "Maximum demand" means twice the number of units generated and/or recorded in the half-hour during which the output is the maximum for the period specified.
- "Medium pressure" means any pressure exceeding 250 volts but not exceeding 650 volts.
- "Minister" means the Minister of Public Works, and includes any Minister of the Crown acting on his behalf.
- "Power-house" means a building complete with equipment installed for the generation and supply of electrical energy.
- "Premises" includes any land owned or occupied by a licensee or consumer, as the case may be, on which electrical energy is generated, transmitted, or used.
- "Pressure" means the difference of potential:—
- (a) In the case of a medium pressure or any lower pressure three-phase or three-wire system of supply—
- (i) Between any unearthed conductor and earth if the system of supply is normally earthed without a circuit-breaker and/or added resistance, or
- (ii) Between any two unearthed conductors if the system of supply is normally unearthed, or is earthed through a circuit-breaker and/or added resistance; and
- (b) In the case of a medium pressure or any lower pressure two-wire system of supply, between conductors; and
- (c) In the case of a high pressure or extra-high pressure three-phase system of supply, between any two unearthed conductors; and
- (d) In the case of a high pressure or extra-high pressure two-wire system of supply, between conductors.
- In the case of high pressure and extra-high pressure the rated difference of potential shall be subject to such additional pressure, not exceeding 10 per cent., as may be necessary for line and transformer regulation.
- "Railways Board" means the Government Railways Board.
- "Service cut-out" means any device installed by the electrical supply authority for automatically disconnecting the consumer's installation.

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"Service-main" is that portion of the wiring on a consumer's premises between the main switchboard and the electric service-line from which supply is obtained.

"Signal and Electrical Engineer" means the person for the time being holding that office in the Railways Department.

"Source of supply" means either the generating-station, the substation, or the transformer, as the case may be, which is the immediate source of the electrical energy in the particular part of the system of supply concerned.

"Street" includes a road or other highway used by the general public for vehicular traffic.

"Substation" means any building, structure, or enclosure, either above or below ground, containing transforming or converting apparatus for the supply of electrical energy.

"Switchboard" means a panel, group of panels, or structure on which is located the normal point, or points, of control of switching equipment.

"Telegraph" includes telephone.

"Telegraph Engineer" means the officer of the Post and Telegraph Department discharging the duties of Telegraph Engineer in the locality where the electric lines are placed.

"Telegraph-line" has the same meaning as "electric line" in the Post and Telegraph Act, 1928, and includes also all telegraph, telephone, and electric signal-wires belonging to a Government Railway.

"Township" means any locality outside a borough or town district in which there is a group of not less than ten habitable buildings the frontages of which are completely contained within a length of not more than 20 chains of continuous street.

"Works" means the whole or any part of the undertaking constructed under the authority of a license.

11-03. All other terms used in these regulations shall, unless the context otherwise requires, have the meaning given to them in British Standard Specification No. 205.

11-04. The term "British Standard Specification" means a specification issued under that name by the British Standards Institution, and where any such specification is prescribed in these regulations the latest revision thereof or any specification issued in lieu thereof by that Institution prior to the date of enactment of these regulations is implied.

PART 12.—APPLICATION, MODIFICATION, AND EXEMPTION.

APPLICATION.

12-01. These regulations shall apply to all electric lines or works used for generating, transforming, converting, or conveying electrical energy (whether used pursuant to a license or not).

12-02. All additions to or alterations of existing electric lines or works shall be deemed to be new work, and all the provisions of these regulations shall apply to all work done in connection with such alteration or addition.

MODIFICATION AND EXEMPTION.

12-11. All permits, approvals, requirements, authorizations, and generally all acts of authority which originated under the Electrical Supply Regulations, 1927, or any regulations issued prior thereto, and are subsisting or in force on the coming into force of these regulations, shall take effect for the purposes of these regulations as fully and effectually as if they had originated under the corresponding provisions of these regulations, and shall, where necessary, be deemed to have so originated.

12-12. All actions, prosecutions, and other legal proceedings commenced under the Electrical Supply Regulations, 1927, and pending or in progress on the coming into force of these regulations may be continued, completed, and enforced either under the Electrical Supply Regulations, 1927, as if the same had not been revoked or under these regulations.

12-13. (1) In any case where the Chief Electrical Engineer, upon application being made to him in writing by the person intending to erect or construct or alter any electric line or work, is satisfied that strict compliance with these regulations would involve expenditure out of proportion to the degree of freedom from electrical hazard to be secured by such compliance he may modify such requirements if satisfied that reasonable freedom from electrical hazard can otherwise be secured.

(2) Every such application shall be accompanied by a full statement of the reasons why such modification is desired and of the nature thereof.

(3) In granting any such modification the Chief Electrical Engineer shall specify what special work (if any) he requires to be done to render the electric line or work reasonably free from electrical hazard.

PART 13.—GENERAL.

13-01. The Governor-General in Council may from time to time, by notice in the *Gazette*, approve methods or types of construction or materials not specially provided for in these regulations, and impose such conditions as he deems necessary with respect to the use thereof.

13-02. The Chief Electrical Engineer may prohibit the erection, construction, or use of any electric line or work which in his opinion constitutes or may constitute an electrical hazard.

13-03. No licensee shall cause, or suffer, or permit any person to be engaged, or employed, or to work, or undertake any work in breach of the requirements of these regulations.

DIVISION II.—CONDITIONS ON WHICH LICENSES MAY BE ISSUED AND THE FEES PAYABLE THEREON.

PART 21.—CONDITIONS OF SUPPLY.

SYSTEMS OF SUPPLY.

21-01. The supply of electrical energy shall be given on such one or more of the following systems as may be prescribed by the license :—

- (a) Three-phase four-wire system at a normal rated pressure of 400 volts between phases and 230 volts between each phase and the neutral conductor.
- (b) Three-phase three-wire system at a normal rated pressure of 400 volts between phases.
- (c) Three-wire system (whether direct current or single-phase alternating current) at a normal rated pressure of 460 volts between outer conductors and 230 volts between each outer conductor and the middle conductor.
- (d) Two-wire system (whether direct current or single-phase alternating current) at a normal rated pressure of 230 volts.
- (e) High pressure or extra-high pressure alternating current single-phase two-wire system.
- (f) High pressure or extra-high pressure alternating current three-phase system.
- (g) High pressure or extra-high pressure two-wire direct current system.
- (h) Series street-lighting system.
- (i) Direct current with one pole in contact with earth.
- (j) Such other systems as may be authorized by the license.

FREQUENCY.

21-11. The frequency of alternating current systems shall be 50 complete cycles per second.

21-12. The frequency shall be maintained within $1\frac{1}{2}$ per cent. above or below the standard of 50 cycles per second.

Provided that this regulation shall not apply to plants which are not used to supply electrical energy to consumers other than the licensee.

VOLTAGE OF SUPPLY.

21-21. (1) For the purpose of supply to any consumer the normal pressure, subject to the provisions of Regulation 21-22 hereof, shall not exceed :—

- (a) At the main switchboard on the consumer's premises :—
 - (i) 230 volts when the connected load does not exceed 2 kilowatts, except in the case of motors, power and/or heating for industrial purposes; or
 - (ii) 460 volts for motors and when the connected load exceeds 2 kilowatts, except in the case of motors, power and/or heating for industrial purposes; or
- (b) At the main switchboard or transformer, as the case may be on the consumer's premises, 11,000 volts for industrial purposes, either for transformation or for motors, power and/or heating, provided that the transforming apparatus and control gear shall be so enclosed as to be inaccessible to every unauthorized person.

(2) Supply for series street-lighting may be given at pressures not exceeding 3,300 volts between terminals at the source of supply.

(3) Direct current supply as prescribed by paragraph (i) of Regulation 21-01 hereof may be given at a pressure not exceeding 3,300 volts at the main switchboard on the consumer's premises.

21-22. (1) The pressure shall be maintained within 5 per cent. above or below the normal pressure at the main switchboard on the consumer's premises, and on complaint by him that the variation in pressure exceeds these limits,

or on the instructions of the Inspecting Engineer, the licensee shall connect a portable recording voltmeter (to be provided and maintained by the licensee), for such reasonable period in the circumstances as the Inspecting Engineer may require, to record the pressure at the main switchboard on the consumer's premises. If the variations thus recorded are caused within and by the licensee's system and exceed the above limits, the licensee shall take steps immediately to restore the pressure to within the prescribed limits.

(2) This regulation shall not apply to plants which are not used to supply electrical energy to consumers other than the licensee.

LOCATION OF LINES.

21-31. (1) The licensee, unless authorized in writing by the Minister,—

- (a) Shall not place any electric line along more than one side of any street; and
- (b) Shall keep his electric lines to the same side of a street for its whole length whether or not such street crosses or intersects any other street.

(2) Notwithstanding anything contained in these regulations, the licensee shall not, without the consent in writing of the Minister, place any electric line along the route of any Government main trunk electric transmission-line.

21-32. If prior to the placing of an electric line in any street a telegraph-line is placed on one side of such street the licensee shall not, except with the written permission of the Minister of Public Works, Minister of Telegraphs, Government Railways Board, or County Council maintaining such telegraph-line (as the case may be), place an electric line along the side of the street on which such telegraph-line is placed.

21-33. (1) Where the erection or operation of an overhead electric line necessitates, in the opinion of the Minister of Public Works, Minister of Telegraphs, Government Railways Board, or County Council, an alteration of any existing telegraph-line maintained by such authority, and such alteration is approved by the Minister of Public Works, Minister of Telegraphs, Government Railways Board, or County Council (as the case may be), the expense of such alteration shall be borne by the licensee.

(2) Such expense may include a reasonable allowance for supervision, inspection, and other charges connected with the alteration, and shall be recoverable as a debt due to the Crown or the County (as the case may be), and the certificate of the Controller and Auditor-General as to the amount thereof (given after such inquiry and examination of records and accounts as he may think fit to make, and without hearing parties or assuming the position of an arbitrator) shall be final and binding on all parties.

21-34. (1) Where a telegraph-line is placed and maintained on one side of a street and an electric line on the other side, whether such electric line be placed before or after the placing of the telegraph-line, the licensee shall give to the Minister of Public Works, Minister of Telegraphs, Government Railways Board, or County Council maintaining such telegraph-line reasonable facilities for carrying wires from such telegraph-line to premises on the side of the street on which such electric line is placed; provided that the licensee is given similar facilities in regard to any electric service-line to premises on the side of the street on which such telegraph-line is placed.

(2) Unless in the opinion of the Minister of Public Works it is impracticable so to do, the licensee shall, except as provided in Regulation 45-05 hereof, arrange that any aerial electric line shall, in crossing a telegraph-line, pass above the latter.

SUPPLY TO CONSUMERS.

21-41. (1) Regulations 21-42 to 21-49 (both inclusive) apply only in respect of a licensee that is an electrical supply authority.

(2) Any demand made upon a licensee pursuant to Regulations 21-42 or 21-43 hereof shall set out, with such particularity as the licensee may reasonably require, the nature, purpose, and quantity of the supply required.

21-42. (1) This regulation applies in respect of all premises which are :—

- (a) Within the area of supply described in the license; and
- (b) Sufficiently near, in the opinion of the Chief Electrical Engineer, to an electric distribution-line for the time being erected and maintained by the licensee (other than a line erected pursuant to a demand made under Regulation 21-43 hereof) to enable a supply of electrical energy to be furnished to such premises without the erection of an additional electric distribution-line.

(2) Every licensee, if a vendor of electrical energy, shall, on demand in writing made by the owner or occupier of any such premises, afford a supply of electrical energy to such premises under the terms and conditions set out in

clause (3) of this regulation, and every such owner or occupier shall be entitled in respect of such premises to a supply of electrical energy accordingly.

(3) The terms and conditions referred to in clause (2) of this regulation are the following:—

- (a) Where the length of an electric service-line inside the boundary of a consumer's premises does not exceed 60 ft. in the case of an overhead line or 20 ft. in the case of an underground line (the distance in each case being measured along the shortest practicable route of the service-line), such service-line (not including any terminal insulator on the building on the consumer's premises) shall be provided free by the licensee.
- (b) Except where special arrangements in that respect are made between a licensee and a consumer, the licensee shall erect an overhead or underground service-line according to whether his distribution-lines passing the consumer's premises are overhead or underground.
- (c) If the electric service-line is required for a greater distance than 60 ft. or 20 ft. as aforesaid (as the case may be) inside the boundary of a consumer's premises, the consumer may, at the discretion of the licensee, be required to bear the cost of such additional length. Subject to any express contract to the contrary, every service-line paid for by the consumer shall remain his property.
- (d) If any additional pole is required owing to the point of attachment to the consumer's installation being too low to give the overhead clearances prescribed in these regulations over a street without the use of such a pole, the cost of such pole shall be borne by the licensee.
- (e) Where any extension-piece on a building or any additional pole is required on a consumer's premises to give the necessary overhead clearance on the consumer's premises, the cost of such extension piece or additional pole shall, if the licensee so demands, be paid by the consumer. Subject to any express contract to the contrary, every such extension piece and pole paid for by the consumer shall remain his property.
- (f) Where any pole is required on a consumer's premises for the purpose of giving horizontal clearance from some obstruction on his premises, the cost of such pole shall, if the licensee so demands, be paid by the consumer. Subject to any express contract to the contrary, every such pole paid for by the consumer shall remain his property.

21-43. (1) This regulation applies in respect of all premises which are:—

- (a) Within the area of supply described in the license; but
- (b) Not sufficiently near in the opinion of the Chief Electrical Engineer to an electric distribution-line for the time being erected and maintained by the licensee (other than a line erected pursuant to a demand made under this regulation) to enable a supply of electrical energy to be furnished to such premises without the erection of an additional electric distribution-line or without employing a line erected pursuant to a demand made under this regulation.

(2) If any question arises as to whether any extension or any part thereof was reasonably necessary in order to enable a licensee to afford a supply of electrical energy to a consumer, the question shall be referred to the arbitration of the Chief Electrical Engineer, or an Engineer of the Public Works Department, or other person nominated for that purpose by the Chief Electrical Engineer, and the decision so arrived at shall be final and binding on all parties.

(3) For the purposes of this regulation an extension shall be deemed to include any alteration of or addition to existing lines, substations, or apparatus, and shall include the provision and erection of all poles, crossarms, conductors, insulators, and any apparatus or substation connected therewith necessary to give a satisfactory supply to the consumers affected by such extension.

(4) The capital cost of an extension shall include a reasonable allowance for supervision, inspection, and other charges connected with the extension, and the certificate of the Controller and Auditor-General as to the amount thereof (given after such inquiry and examination of records and accounts as he may think fit to make, and without hearing parties or assuming the position of an arbitrator) shall be final and binding on all parties.

(5) Every licensee, if a vendor of electrical energy, shall, within twelve months after demand in writing made by the owner or occupier of any such premises as are described in clause (1) of this regulation, afford a supply of electrical energy to such premises under the terms and conditions set out in clause (6) of this regulation, or in the option of such owner or occupier under the alternative terms

and conditions set out in clause (7) of this regulation, and every such owner or occupier shall, on the expiration of the said period of twelve months, be entitled in respect of such premises to a supply of electrical energy accordingly:

Provided that the alternative terms and conditions set out in clause (7) of this regulation shall not be available in respect of premises used as a mine, or in respect of a temporary service, or in respect of a demand which, in the opinion of the licensee, is not sufficiently permanent.

(6) The terms and conditions referred to in clause (5) of this regulation are the following:—

- (a) The consumer shall undertake to pay to the licensee the capital cost of such extension as may be reasonably necessary to enable the licensee to afford such consumer the supply of electrical energy for which he has made a demand as aforesaid; and
- (b) The consumer shall also undertake to pay to the licensee annually, for such period as the consumer receives a supply of electrical energy from such extension, a sum equal to 12½ per cent. (or such lower percentage as the licensee may fix) of the capital cost of the extension:

Provided that the licensee shall credit to the consumer in reduction of the annual sum so payable in respect of any year all moneys paid by the consumer for electrical energy used in that year charged according to the scale of charges in force at that time in that locality for the same type of service.

(7) The alternative terms and conditions referred to in clause (5) of this regulation are the following:—

- (a) The consumer shall, in respect of the capital cost of such extension as may be reasonably necessary to enable the licensee to afford such consumer the supply of electrical energy for which he has made a demand as aforesaid, undertake to pay to the licensee annually, for such period as the consumer may elect from the day next following the day on which the licensee gives notice to the consumer that a supply of electrical energy is available, an annual sum equal to the respective percentages set out in paragraph (b) hereof (or such lower percentage as the licensee may fix) of the capital cost of the extension:

Provided that the licensee shall credit to the consumer in reduction of the annual sum so payable in respect of any year all moneys paid by the consumer for electrical energy used in that year charged according to the scale of charges in force at that time in that locality for the same type of service.

(b)

If the Period in respect of which the Undertaking is given is—	The Percentage of the Capital Cost of the Extension shall be—
1 year or less	120 per cent.
2 years or less	60 per cent.
3 years or less	40 per cent.
4 years or less	30 per cent.
5 years or less	24 per cent.
More than 5 years	20 per cent.

(8) The liability imposed on any consumer under clause (6), or clause (7), or clause (11) of this regulation shall be abated according to the sums recovered, or recoverable, by the licensee from any other consumer from whom the licensee has obtained previously, or simultaneously, an undertaking either under clause (6), or under clause (7), or under clause (11) of this regulation in respect of a supply of electrical energy afforded, or to be afforded, by the use of the same extension or any part thereof, and if any question arises as to the amount of abatement, or reduction, proper in the premises it shall be referred to the arbitration of the Chief Electrical Engineer, or an Engineer of the Public Works Department, or other person nominated for that purpose by the Chief Electrical Engineer, and the decision so arrived at shall be final and binding on all parties.

(9) It shall not be obligatory upon a licensee to comply with any demand made under this regulation:—

- (a) If an undertaking given by any person is not supported by a sufficient security for payment of all moneys thereby agreed to be paid; or
- (b) If the nature, or period, of the supply demanded is unsatisfactory; or
- (c) If the funds of the licensee are insufficient (after taking into consideration any moneys payable under any such undertaking as aforesaid) to provide any necessary extension:

Provided that any question arising as to the sufficiency of any security, or as to whether the nature or period of a supply is unsatisfactory, or as to the sufficiency of the funds

of the licensee shall in case of dispute be referred to the Minister, whose decision in the matter shall be final as to the demand in question, but shall not prevent the making of a fresh demand at any time after a lapse of twelve months from the date of such decision.

(10) If at any time an electric distribution-line erected pursuant to a demand made under this regulation is used by the licensee to afford a supply of electrical energy to any other consumer, whether the demand on the part of the person seeking to become a consumer has been made before, or at the same time as, or after, the demand pursuant to which the electric distribution-line was erected, then the obligations imposed under clause (6), or under clause (7), or under clause (11) of this regulation (as the case may be) on the person pursuant to whose demand the line was erected shall be abated proportionately, and the licensee shall do all things necessary to reduce accordingly the liability purporting to exist upon any undertaking given by such person last referred to and upon any security given by, or on behalf of, such person last referred to, and if any question arises as to the amount of abatement or reduction proper in the premises it shall be referred to the arbitration of the Chief Electrical Engineer, or an Engineer of the Public Works Department, or other person nominated for that purpose by the Chief Electrical Engineer, and the decision so arrived at shall be final and binding on all parties.

(11) Upon the expiration of the period covered by the undertaking first in point of time given in respect of any extension effected pursuant to a demand made under clause (7) of this regulation, and if such extension continues to be maintained by the licensee the consumer shall be entitled to continue to receive a supply of electrical energy provided that all moneys due by him to the licensee under the aforesaid undertaking have been paid to the licensee, and further provided that the consumer undertakes to pay to the licensee annually for such period as the consumer receives a supply of electrical energy from such extension a sum equal to 15 per cent. (or such lower percentage as the licensee may fix) of the capital cost of the extension:

Provided that the licensee shall credit to the consumer in reduction of the annual sum so payable in respect of any year all moneys paid by the consumer for electrical energy used in that year charged according to the scale of charges in force at that time in that locality for the same type of service.

21-44. If the electrical supply authority's plant or mains are, in the opinion of the Chief Electrical Engineer, of insufficient capacity to enable a satisfactory supply of electrical energy to be given or to continue to be given to any person in respect of any premises within the area of supply, the electrical supply authority shall, on being required so to do by the Minister, forthwith proceed to install such additional plant or mains of a greater capacity as may, in the opinion of the Chief Electrical Engineer, be required to give a satisfactory supply of electrical energy in respect of such premises as aforesaid:

Provided that nothing herein contained shall affect the right of any person concerned to require the electrical supply authority to furnish to any premises a supply of electrical energy pursuant to Regulations 21-42 and 21-43 hereof, as the case may be.

21-45. The charge for electrical energy may be altered from time to time on one month's prior notice having been given by means of adequate advertisement in a newspaper circulating within the district, or by one month's prior notice in writing to the consumers concerned.

21-46. Meters required by the electrical supply authority for the purpose of measuring the supply of electrical energy to any consumer shall be supplied free of charge. Where prior to the coming into force of these regulations rent has been charged for any such meter, no reduction shall be made in any section of a tariff until all such rent charged in respect of such section has been abolished.

21-47. A minimum charge may be made by the electrical supply authority and shall be shown on its scale of charges. The minimum charge for any period shall be subject to the approval of the Minister.

21-48. Every consumer within any part of the electrical supply authority's area of supply shall be entitled to a supply of electrical energy on the same terms and conditions as those on which any other consumer within such part of the area is receiving in similar circumstances a corresponding supply.

21-49. From the time when the licensee commences to supply electrical energy in pursuance of the license, the licensee shall continuously during the period of the day for which he has agreed with any consumer to supply electrical energy adequately maintain his plant and do all things necessary so as to afford to such consumer a supply of electrical energy to the maximum extent to which the licensee has undertaken to afford such supply; or if no maximum has been agreed upon, then to an extent which is reasonable in the circumstances:

Provided that for any purposes connected with the efficient working of the undertaking the Minister may give permission to the licensee to discontinue the supply at such intervals of time and for such periods as he may think expedient. When the supply is so discontinued public notice shall be given, when practicable, of such discontinuance, and of the probable duration thereof.

21-50. Every consumer's installation shall comply with the requirements of these regulations and of the Electrical Wiring Regulations, 1935.

21-51. Where the installation of any person and every appliance connected therewith complies with the requirements of the Electrical Wiring Regulations, 1935, the electrical supply authority shall not, without the permission of the Chief Electrical Engineer in writing, refuse to supply such person with electrical energy on the ground that the installation or any appliance connected therewith constitutes an electrical hazard.

PART 22.—COMMENCEMENT AND COMPLETION OF CONSTRUCTION.

22-01. In this part of these regulations:—

"Initial installation" means the first erection, or laying, or construction, of any electric line (whether above or below ground) authorized by a license, and includes the first erection, or laying, or construction, of any portion of such line used, or intended to be used, prior to the erection, or laying, or construction, of a further portion thereof, or used, or intended to be used, in connection with a portion thereof previously erected, or laid, or constructed.

"Alteration," in respect of an electric line that has been used for conveying, transmitting, or distributing electrical energy, includes the removal of the line to a new position, the use of the line to carry electrical energy at a pressure different from the pressure at which it was previously thereby carried, and an alteration, or replacement of the wires or other conductors, serving to increase, or reduce, the current-carrying capacity of the line, or any change in the number or position of the wires on a pole or other support.

"Additional installation" means any installation other than an initial installation and other than an alteration of an electric line, notwithstanding that in such additional installation use may be made of the poles or other supports or other apparatus already in use and continuing in use for the purposes of another installation.

TIME OF COMMENCEMENT AND COMPLETION.

22-11. The licensee shall, within twelve months from the date of the license, make a substantial commencement of the work to which the license relates, and shall proceed continuously and energetically with the construction of all such work.

22-12. The licensee shall substantially complete the several works referred to in the license within the time, or times, specified in that behalf in the license, or if no time be so specified, then within one year from the date of the grant of the license; provided that the Minister may, on the application of the licensee, and whether before or after any date for completion specified or implied in the license, substitute any later date for completion if, in the Minister's opinion, the work has been delayed by strikes, lock-outs, or combinations of workmen, by proceedings taken by third parties, by fire, flood, tempest, failure of soil, or breakdown of plant or works, or by any other cause not within the control of the licensee.

NOTIFICATION.

22-21. (1) Before commencing to erect, or lay, or construct, any initial installation (whether above or below ground) the licensee shall give the following notices of the intention so to do:—

(a) To the Chief Electrical Engineer, fourteen days' notice; and

(b) To the Telegraph Engineer, fourteen days' notice.

(2) Before commencing to erect, or lay, or construct, any additional installation (whether above or below ground), or make any alteration, the licensee shall give the following notices of the intention so to do:—

(a) To the Chief Electrical Engineer, seven days' notice:

Provided that notice to the Chief Electrical Engineer shall not be necessary in the case of—

(i) An electric line of medium pressure or any lower pressure not exceeding 40 chains in length; or

(ii) An electric service-line of medium pressure or any lower pressure whatever its length; or

(iii) The erection of an additional wire or wires serving to convert single-phase distribution into two-phase or three-phase distribution where three-phase distribution has already been generally used in installations belonging to the licensee; and

(b) To the Telegraph Engineer, seven days' notice :

Provided that notice to the Telegraph Engineer shall not be necessary where there is no telegraph-line within 5 chains of the proposed additional installation or alteration unless such electric line is—

- (i) An extra-high pressure electric line; or
- (ii) At a street intersection.

(3) If before an initial installation, or additional installation, is used for conveying, transmitting, or distributing electrical energy any variation is made or intended to be made in the erection, or laying, or construction thereof from the plans and other particulars accompanying any notices given under clause (1) or clause (2) hereof, then before erecting, or laying, or constructing any work in accordance with such variation the licensee shall give the like notices of such variation as are required by clause (1) or clause (2) hereof (as the case may be) :

Provided that this clause shall not apply in the case of an electric line of medium pressure or any lower pressure.

(4) Nothing in this regulation shall require notice of maintenance work not amounting to an alteration as herein defined.

(5) No extra-high pressure electric line shall be erected until the route has been approved in writing.

22-22. (1) Every notice required by the last preceding regulation shall be in writing.

(2) Every such notice shall be accompanied by a plan (or plans) showing the location of all electric lines proposed to be erected, the material of the covering (if any), the height of the poles or other supports (if any), and the pressure at which it is proposed to operate such lines.

(3) Every notice to be given to the Chief Electrical Engineer under clause (1) or clause (2) of the last preceding regulation shall also be accompanied by a statement, in such form as the Minister directs, of the calculated strength of all line supports.

(4) If any aerial conductor of a size other than that mentioned in the tables of sags and tensions set out in Division VIII hereof is proposed to be used, the notice to be given to the Chief Electrical Engineer as aforesaid shall also be accompanied by a table giving in respect of such conductor similar particulars to those given in the tables in the said Division.

(5) The plan (or plans) showing the location of the lines shall be on a white ground of durable material, and be prepared to a scale of not less than 1 in. to a mile. All plans shall, wherever practicable, be supplied in foolscap size, but where that size is not practicable they shall be supplied in sections not greater than 22 in. by 30 in.

(6) All locality plans shall have the north point marked thereon and shall contain sufficient information to enable the locality to be readily identified on a survey map. In showing the pressure at which it is proposed to operate the electric lines the following colours shall be used on all plans :—

- (a) Blue to indicate extra-high pressure over 11,000 volts; and
- (b) Red to indicate extra-high pressure not over 11,000 volts; and
- (c) Yellow to indicate high pressure; and
- (d) Green to indicate medium pressure and any lower pressure.

INSPECTION.

22-31. (1) Before using any initial installation, or any additional installation, to which clause (2) of Regulation 22-21 hereof applies, for conveying, transmitting, or distributing electrical energy (otherwise than for testing purposes as may be required by the Chief Electrical Engineer or the Telegraph Engineer), the licensee shall, for the purpose of enabling inspections to be made of such installation or any part thereof, give the following notices of completion of the work of erection, or construction :—

(a) To the Chief Electrical Engineer, one month's notice; and

(b) To the Telegraph Engineer, one month's notice :

Provided that such notice may be given prior to the actual completion of the work if the estimated date of completion be set out in the notice.

(2) Each of the notices to be given under clause (1) of this regulation shall be accompanied by a plan of the lines to be inspected, setting out such details as are necessary to show routes completed and pressure at which it is proposed to operate the electric lines. Every such plan shall be in accordance with the requirements of clause (5) and clause (6) of Regulation 22-22 hereof.

22-32. The licensee shall not, without the written permission of the Minister, use any initial installation for conveying, transmitting, or distributing electrical energy (otherwise than for testing purposes as may be required by the Chief Electrical Engineer or the Telegraph Engineer) until the licensee has received from the Minister notice in writing that the Inspecting Engineer has certified to him that the work of

erection and construction hereof has been satisfactorily carried out.

22-33. (1) The licensee shall not use any additional installation, or resume after alteration thereof the use of any electric line, unless the work of erection, or laying, or construction, or alteration thereof (as the case may be) has been carried out in strict conformity with the requirements of these regulations and, in the case of high pressure or extra-high pressure lines, unless the licensee shall have given to the Telegraph Engineer notice in writing at least seven days before the lines are so used of the intention of the licensee so to use the lines.

(2) If an Inspecting Engineer is at any time of opinion that the erection, or laying, or construction, or alteration of any line used pursuant to clause (1) of this regulation has not been carried out in strict conformity with the requirements of these regulations, the Minister may, by notice in writing :—

- (a) Call upon the licensee forthwith to discontinue the use of such line until the Minister is satisfied that the requirements of these regulations have been complied with, and upon receipt of such notice it shall not thereafter be lawful for the licensee to use such line until the licensee has received from the Minister notice in writing that the Minister is so satisfied; or
- (b) Call upon the licensee forthwith to carry out, within such time as may be specified in such notice, such work as may be necessary to make the line comply with the requirements of these regulations; and after the expiration of the time specified in such notice it shall not be lawful for the licensee to use such line until the licensee has received from the Minister notice in writing that the Minister is satisfied that the line has been made to comply with the requirements of these regulations.

PART 23.—RECORDS AND REPORTS.

RECORDS TO BE KEPT.

23-01. (1) From the date of commencement of supply the licensee, if a local authority or other public body, shall keep such records as may be necessary to supply annually to the Chief Electrical Engineer such information as he may require.

(2) The electrical supply authority shall also keep a record of each consumer's installation connected to the system, showing in a readily accessible form the names of the contractor, registered electrical wireman in charge, and inspector responsible for such installation, together with all relevant dates and tests in connection with the carrying out and inspection of such installation.

23-02. (1) The licensee shall prepare and maintain a plan or plans showing the location of all works, lines (other than service-lines), substations, and transformers erected from time to time.

(2) Such plan (or plans) shall be brought up to date within one month of the completion of any extension, shall show the date of putting each electric line into service, and shall be available at any time for examination by the Inspecting Engineer.

23-03. (1) The licensee shall, not later than the thirtieth day of June each year, furnish to the Chief Electrical Engineer, in such form as the Minister may require, a summarized list of, or, alternatively, a plan showing all extensions and alterations (whether more or less than 40 chains in length) to the electric lines of the licensee made during the twelve months ended on the thirty-first day of March of that year.

(2) Each of such respective lists (or plans) shall contain the following details :—

- (a) Date of completion of erection, or laying, or construction of each extension or alteration; and
- (b) Location or route; and
- (c) Whether bare, covered (T.B.), or covered (V.I.R.); and
- (d) Length of each extension erected or alteration made; and
- (e) Voltage of each extension erected or alteration made.

(3) In the case of extensions to, or alterations of, underground cables the licensee shall, within fourteen days after the end of each calendar month, furnish to the Telegraph Engineer a plan (or plans) giving all details of the actual location of such cables.

(4) For the purposes of this regulation an extension that has been erected, or made, includes every electric distribution-line that is used, or available for use, for the supply of electrical energy to consumers notwithstanding that such distribution-line comprises part of an installation the other part of which is not so used or available for use.

(5) For the purposes of this regulation the terms "altered" and "alteration" shall have the same meaning as that given to the term "alteration" in Part 22 hereof.

23-04. The licensee shall keep records of—

- (a) Every earth test in accordance with Regulation 51-03 hereof; and

- (b) Every test of insulating-gloves, boots, and goloshes, and rubber protective covers, and mats, in accordance with Regulation 51-23 hereof; and
- (c) Every inspection of electric lines and works in accordance with Regulation 51-51 hereof.

REPORT OF ACCIDENTS, FIRES, INTERRUPTIONS, AND BREAKAGES.

23-11. (1) The licensee shall give notice to the Chief Electrical Engineer of—

- (a) Every accident caused by electric lines, electrical apparatus, or electrical equipment connected with the licensee's plant.
- (b) Every accident to the licensee's plant caused by explosion or fire.
- (c) Every fire or accident on a consumer's premises due to electrical causes.
- (d) Every interruption exceeding twelve hours' duration to any part of any electric line or work (other than service-lines), and the duration of such interruption.
- (e) Every broken pole, giving the following information :—
- (i) Date; (ii) voltage of lines; (iii) apparent cause; (iv) species of timber or material; (v) number broken; (vi) approximate length of time in service;
- (f) Every broken wire, giving the following information :—
- (i) Date; (ii) voltage; (iii) number of wires broken; (iv) type—specify whether transmission-line (T.L.), or distribution-line (D.L.), or service-line (S.), or street-lighting (S.L.), or neutral (N.); (v) apparent cause; (vi) type of protective apparatus installed, and whether such apparatus operated; (vii) metal; (viii) T.B., or V.I.R., or bare.

(2) The licensee shall retain, for a period of one calendar month after notice has been given to the Chief Electrical Engineer, all poles, damaged ends of wires, and insulators damaged or broken by the accident or other happening to which the notice relates, or which caused such accident, or happening by reason of their being defective, so that they may be inspected by an officer of the Public Works Department, the Post and Telegraph Department, or the Railways Department, and shall during the said period afford to any such officer facilities for inspecting the same, and shall, if required, deliver the same to such officer for laboratory tests or other examination, whether or not such tests or examination may involve the destruction of the material so delivered.

(3) The notice required to be given to the Chief Electrical Engineer under clause (1) hereof in respect of the matters mentioned in paragraphs (a) and (b) thereof shall be given in writing forthwith after the accident or other happening. Notice of the matters mentioned in paragraphs (c), (d), (e), and (f) thereof shall be given in writing within seven days after the end of each month in respect of happenings that occurred during that month.

(4) All notices shall be given in such form as the Minister may from time to time require, and shall specify the steps taken to prevent a recurrence of the accident or other happening.

PART 24.—MONOPOLY, COMPENSATION, AND ASSIGNMENT.

MONOPOLY.

24-01. Nothing in the license or otherwise shall be deemed to give to the licensee a monopoly or the exclusive right to supply electrical energy within the area of supply.

24-02. The licensee shall not grant, or agree to grant or purport to grant, to any person, firm, or company the sole right to supply or erect the electrical wiring on the premises of any consumer.

24-03. The licensee shall not impose as a condition precedent to the giving of a supply of electrical energy by the licensee to any consumer the requirement that any material or apparatus for installing the electrical wiring of any premises shall be purchased from the licensee, or from the assigns or nominee of the licensee, or that any work of electrical wiring shall be carried out by the licensee, or the assigns, or nominee of the licensee.

24-04. If the parties so agree, it shall be lawful at any time for the licensee to surrender the license and for the Governor-General in Council or the Minister (according to which of them granted the license) to accept such surrender, subject to such terms and conditions as may be agreed upon.

COMPENSATION.

24-11. Nothing herein contained shall be deemed in any way—

- (a) To interfere with, affect, or abridge any rights or powers vested in His Majesty the King, or the Governor-General on his behalf, or the Minister, or any other person, under any Act of the General Assembly authorizing the construction, management, or working of any public works; or

- (b) To render His Majesty the King, or the Governor-General, or the Minister, or any other person liable to pay to a licensee any compensation for injury to the works authorized by the license done by the construction, management, or working of any authorized public work, or for any loss occasioned thereby, or for the exercise of any such right or power vested in His Majesty the King, or the Governor-General on his behalf, or the Minister, or any other person as aforesaid:

Provided that the foregoing provision is without prejudice to any liability arising otherwise than under these regulations.

24-12. Neither the granting of the license nor anything in the license expressly or by implication contained shall impose on His Majesty the King or upon the Government of New Zealand any liability to pay compensation or damages to any person or local authority by reason of the exercise by the licensee of the powers conferred by the license.

24-13. Neither the granting of the license nor anything in the license expressly or by implication contained shall affect or prejudice any liability imposed by law on the licensee to pay compensation or damages to any person arising by reason of the exercise by the licensee of the powers conferred by the license.

ASSIGNMENT.

24-21. (1) The licensee shall not assign, sublet, delegate, or part with the license, or the benefits thereof, or the rights or powers thereby conferred, or any of them, without the previous consent in writing of the Governor-General in Council.

(2) The Governor-General in Council may give such consent subject to such terms and conditions as he thinks fit to impose.

PART 25.—GOVERNOR-GENERAL'S DECISION.

25-01. The Governor-General shall be the sole judge of the fact whether the foregoing requirements of these regulations have been complied with, and he may from time to time cause inquiry to be made into any matter connected therewith or arising hereunder, in such manner as he thinks fit, and his decision shall be final, and the licensee shall comply with such decision: Provided that this regulation shall not affect the right of any person, corporate body, or local authority, in cases of damage or injury for which action or claim for compensation by such person, corporate body, or local authority may lie against the licensee.

PART 26.—FEES.

26-01. (1) The following fees shall be payable on the issue of licenses or permits to erect electric lines :—

	£	s.	d.
(a) For any installation up to and including 100 kilowatts	2	2	0
(b) For any installation over 100 kilowatts and not exceeding 500 kilowatts ..	3	3	0
(c) For any installation over 500 kilowatts and not exceeding 1,000 kilowatts ..	4	4	0
(d) For any installation over 1,000 kilowatts	5	5	0
(e) For any license taking effect as an extension to, or amendment of, or for any consent to an assignment of an existing license	1	1	0

(2) For the purposes of this regulation the rating in kilowatts of any installation shall be deemed to be the capacity of the generating or main transforming plant.

PART 27.—GENERAL.

APPLICATIONS FOR LICENSES.

27-01. Any person desiring a license to erect electric lines under the Public Works Act, 1928, shall make application to the Minister of Public Works in writing in that behalf signed by the applicant.

27-02. Such application shall include the following particulars—

- (a) In the case of an individual, the full name, full postal address, and occupation of the applicant.
- (b) In the case of an incorporated company or other corporate body, the full name of such corporate body, its registered office (if any), and otherwise the full postal address of its principal place of business, together (in every case) with evidence to the satisfaction of the Minister of its due incorporation and a copy of its memorandum of association, articles of association, charter, or other constating documents.
- (c) In the case of several applicants, a statement as to whether the license is sought by them as joint tenants or tenants in common, and if as tenants in common, in what shares.

- (d) A lithograph or sketch-plan to a suitable scale showing section and block numbers and boundaries of sections and blocks, name of survey district or other district, and position of all proposed works.
- (e) A description of the electric system proposed to be adopted, whether direct current or alternating current, and if the latter, the number of phases and frequency, and in either case the actual pressure of generation, transmission, and supply, and the rated output in kilowatts of the generators to be installed, also the manner in which the electrical energy will be generated (*e.g.*, by water-power, steam, gas, or oil-engine), or if the electrical energy is to be purchased in bulk, the source and nature of such bulk supply.
- (f) A statement of the extent of the electrical energy proposed to be developed in the initial installation and to be provided for in future extensions, and the use intended to be made of it.
- (g) A plan, in triplicate, showing by means of a distinctly coloured border the boundaries of the proposed area of supply of electrical energy (if any), the site of the power-house and substations, the routes for the initial transmission-lines (if any), indicating all roads, rivers, telegraph and telephone lines and other electric lines, and indicating the status and tenure of all Crown and other lands proposed to be traversed.
- (h) A statement of the period for which the license is desired.
- (i) Plans shall be preferably in black and white and be prepared to a scale of not less than 1 in. to a mile, and should be prepared to the largest scale reasonably consistent with keeping such within the limits of foolscap size. Where that size is not practicable they shall be supplied in sections not greater than 22 in. by 30 in.
- (j) All locality plans shall have the north point marked thereon, and shall contain sufficient information to enable the locality to be readily identified on a survey map.
- (k) In showing the pressure at which it is proposed to operate the electric lines the following colours shall be used on all plans:—
- (i) Blue to indicate extra-high pressure over 11,000 volts; and
 - (ii) Red to indicate extra-high pressure not over 11,000 volts; and
 - (iii) Yellow to indicate high pressure; and
 - (iv) Green to indicate medium pressure and any lower pressure.

27-03. In cases where the applicant desires to supply electrical energy to other persons and is not a local authority, or if a local authority desires to operate beyond its own boundaries, the written consent of the local authority concerned must be applied for and the local authority's reply forwarded with the application for a license.

27-04. In cases where an Electric-power District has been constituted under the Electric-power Boards Act, 1925, the written consent of the Electric-power Board must be applied for and the Board's reply forwarded with the application.

27-05. Before entertaining any application the Minister may require the applicant to furnish any further information which the Minister may deem relevant to the decision as to whether a license should be granted or the terms and conditions of the license.

CONDITIONS OF LICENSES.

27-11. In every license to erect electric lines the conditions prescribed by Regulations 27-12 to 27-16 (both inclusive) hereof shall be deemed to be implied, except so far as the same may be expressly negatived or modified or inconsistent with the terms of the license.

27-12. (1) Any notice to be given to the licensee shall be sufficient if served personally on the licensee or (in the case of the licensee being a corporate body) delivered at the registered office or usual place of business of the licensee to a person appearing to have for the time being the control of such office, or sent by registered post letter addressed to the licensee at the postal address set out in the application for a license or any subsequent address notified by the licensee to the Minister for the purpose of this clause, and if so served shall be sufficient, notwithstanding the death or incapacity of the licensee and notwithstanding that no legal personal representative of the licensee may have been appointed, and service on any one of several licensees shall be good service on all of them.

(2) Any notice to be given on the part of the Minister shall be sufficient if given in writing signed by the Minister or by any person purporting to act on behalf of or under the authority of the Minister.

(3) Any notice to be given to the Minister shall be sufficient if given in writing delivered to or sent by registered post letter addressed to the Minister at the office in Wellington of the Minister of Public Works.

(4) Any notice sent by registered post letter shall be deemed to be served at the time when it would be delivered at its destination in the ordinary course of registered post.

27-13. (1) Without prejudice to the operation of the provisions expressly or by implication contained in the license as conditions upon and subject to which the license is granted, the licensee shall be deemed to covenant with His Majesty the King that the licensee will at all time during the continuance of the license observe, perform, and comply with all the provisions expressly or by implication contained in the license and with all regulations applicable to the circumstances.

(2) In the case of a license granted to an individual, such covenant shall be deemed to be entered into by the licensee so as to bind himself, his executors, administrators, and assigns; in the case of a license granted to two or more persons as tenants in common, so as to bind jointly and severally them and each of them, their and each of their executors, administrators, and assigns; in the case of a license granted to a corporate body, so as to bind such body, its successors, and assigns.

(3) The determination of the license, whether on the expiration of the term or by surrender or revocation or otherwise, shall not affect any liability accrued prior to such determination.

27-14. (1) Subject to the provisions of the Electric-power Boards Act, 1925, and provided the licensee shall have legal power so to do, the licensee shall, if so required, sell, either to His Majesty the King or to an Electric-power Board, the license, together with the whole or (at the option of the purchaser) any severable part of the business and undertaking of the licensee so far as it relates to or is connected with the exercise of the license, and together with all real and personal property and all rights vested in the licensee and used or engaged in connection with the business or undertaking so to be purchased (all hereinafter in this regulation referred to as "the undertaking").

(2) The option hereby conferred shall, if exercised by His Majesty the King, relate to the whole of the undertaking, and if exercised by an Electric-power Board shall relate to so much of the undertaking as is situate within the electric-power district or outer area of such electric-power district.

(3) The said option may be exercised at any time during the currency of the license by notice in writing to the licensee signed by the Minister or executed under the common seal of the Electric-power Board (as the case may be).

(4) The price to be paid upon the purchase shall be such as may be agreed upon between the licensee and the purchaser, or, failing agreement, shall be determined by the arbitration of one arbitrator if the parties can agree upon one, otherwise of three arbitrators, or any two of them, one arbitrator being appointed by the licensee, another by the purchaser, and the third arbitrator by the other two arbitrators.

(5) The said valuation shall not include any sum in respect of the value of the goodwill of the undertaking or in respect of the value of the license for the unexpired period thereof.

(6) The date of giving and taking possession and delivery of the undertaking or so much of the undertaking as is comprised in the purchase shall be such as may be agreed upon between the licensee and the purchaser, or, failing agreement, shall be fixed by arbitration as aforesaid.

(7) On the completion of the purchase the purchaser shall be deemed to be the assignee of the licensee, and all the rights vested in the licensee shall vest in the purchaser during the remainder of the term of the license.

(8) In any case to which subsection (6) of section 318 of the Public Works Act, 1928, applies, the provisions of this regulation shall be read subject to the provisions of that subsection.

27-15. Upon the determination of the license the licensee shall thereupon, if so required by notice in writing by the Minister, remove from the ground all buildings, poles, and other erections, and all transmission-lines, plant, and machinery, and other removable equipment authorized by the license to be erected, installed, or provided, and if within twelve months after being so required the licensee fails or neglects to remove the same, then the same shall, without payment of any compensation, vest in and become the property of the Crown, and it shall be lawful for any person authorized by the Minister in that behalf to enter upon any land or premises and take possession of and remove the same or any part thereof.

27-16. Nothing in the license expressly or by implication contained shall be deemed to authorize the licensee to erect, construct, or maintain any works except subject to such conditions (not inconsistent with the regulations) as may from time to time be lawfully imposed by any Borough Council, County Council, Town Board, or other local authority within the district of which such work may be situated.

DIVISION III.—ERECTION, CONSTRUCTION, AND USE OF SYSTEMS OF SUPPLY.

PART 31.—CONDITIONS OF SUPPLY.

CONNECTION OF A.C. SYSTEMS WITH EARTH.

31-01. In medium pressure or any lower pressure alternating current systems the connection of circuits with earth shall be made in accordance with the following requirements:—

- (a) The neutral conductor of a three-phase four-wire system, and the middle conductor of a single-phase three-wire system shall be earthed in multiple—that is, at the source of supply and at one or more other points along the distribution-line or service-line in addition to any connection with earth which may be on a consumer's premises.
- (b) The resistance between any point of the middle or neutral conductor and earth shall not exceed the limits prescribed by Regulation 51-01 hereof.
- (c) The neutral point of a star-connected or delta-connected three-phase three-wire system shall be earthed at the source of supply.

31-02. In high pressure and extra-high pressure three-phase alternating-current systems the connections of the circuits with earth shall be made in accordance with the following requirements:—

Star-connected systems with earthed neutral—

- (a) The neutral point shall be earthed at the source of supply and it may be earthed at any other point, provided that no interference of any description is caused by such earthing.
- (b) In the event of an appreciable harmonic current flowing in the neutral connection so as to cause interference with communication circuits, the generator or transformer neutral shall not be earthed, but a suitable earthing-transformer shall be used.
- (c) In generating-stations or substations supplying aerial electric lines, if such stations or substations are not continuously attended, earth-leakage relays shall be provided so that in the event of a leak to earth occurring either the faulty line will be made dead or the whole of the system supplied from this station or substation will be made dead.
- (d) The earth-leakage relays shall be set to operate with a time-lag not exceeding five seconds.
- (e) The maximum permissible setting of the earth-leakage equipment shall be such that operation of same will take place at the undermentioned values of the fault current to earth—

Pressure.	Primary Earth-leakage Current.
Not exceeding 25,000 volts	12½ per cent. of the rated full-load of the feeder (as determined by the current transformer ratio).
Exceeding 25,000 volts, but not exceeding 36,000 volts	30 amperes.

For pressures exceeding 36,000 volts the primary earth-leakage current shall be prescribed by the Chief Electrical Engineer.

- (f) Should the full-load rating of the lines (as determined by the current transformer ratio) operating at less than 25,000 volts be such that the 12½ per cent. leakage current requirement will render the relays unduly sensitive, the following maximum values for earth-leakage current will be permitted—

Up to 3,300 volts	1.5 amperes.
Over 3,300 volts but not over 6,600 volts	2.0 amperes.
Over 6,600 volts but not over 11,000 volts	2.5 amperes.

- (g) The Chief Electrical Engineer may give consent to the omission of earth-leakage relays:—
 - (i) Where conditions are such that their use is impracticable; or
 - (ii) Where some other suitable method is used or proposed to be used.
 Every such consent shall be in writing and shall specify what special work (if any) the Chief Electrical Engineer deems necessary to secure reasonable freedom from electrical hazard.
- (h) In continuously attended generating-stations or substations supplying aerial electric lines a visual and audible indicator may be used in place of automatic disconnection of supply. The sensitivity of the indicator shall be such that operation thereof will take place on the occurrence of a fault current to earth of the respective values prescribed by paragraphs (e) and (f) of this regulation. Upon the operation of such indicator immediate steps shall be taken to remove the fault or disconnect the faulty feeder or line.

Delta-connected systems or star-connected systems with isolated neutrals—

- (i) In the case of delta-connected systems or star-connected systems with isolated neutrals, earthing-transformers or other approved means shall be provided to give an artificial neutral point, which shall be earthed. Earthing equipment shall be of sufficient capacity to ensure the effective operation of the protective apparatus.
- (j) Similar leakage protection or indication shall be provided for these systems to that specified in paragraphs (c) to (h) of this regulation for systems with earthed neutrals.

31-03. High pressure or extra-high pressure single-phase systems shall be earthed in an approved manner.

31-04. When the return current of any individual distribution transformer does not exceed 2 amperes, and the transformer supplying the lines and any distribution transformer supplied by such lines are not less than six miles from any telephone exchange, the earth may, with the previous consent in writing of the Minister of Telegraphs, be used to carry the return current of the distribution transformer.

CONNECTION OF D.C. SYSTEMS WITH EARTH.

31-11. In medium pressure or any lower pressure direct current systems the connections of circuits with earth shall be made in accordance with the following requirements:—

- (a) In a direct current three-wire system the middle conductor shall be earthed at the generating-station only, and the current from the middle conductor to earth shall be continuously recorded by means of a recording ammeter, and if at any time the current exceeds one-thousandth part of the maximum supply-current immediate steps shall be taken to improve the insulation of the system.
- (b) Where the middle conductor is earthed by means of a circuit-breaker with a resistance connected in parallel the resistance shall not exceed 10 ohms, and, on the opening of the circuit-breaker, immediate steps shall be taken to improve the insulation of the system, and the circuit-breaker shall be reclosed as soon as possible.
- (c) The resistance shall be used only as a protection for the ammeter in case of earths on the system and until such earths are removed. Immediate steps shall be taken to locate and remove the earth.

CONNECTION WITH EARTH IN GENERAL.

31-21. Where any part of a supply system is normally connected with earth—

- (a) The connection with earth shall be efficiently maintained, except when it is interrupted for the purpose of periodical tests; and
- (b) No switch, fuse-link, or circuit-breaker shall, except as provided in Regulation 22-25 of the Electrical Wiring Regulations, 1935, be inserted in the earthed conductor, or in any conductor connected thereto.

31-22. Notwithstanding anything contained in the last preceding regulation, systems including more than one three-phase star-connected generator operating in parallel may have the neutral conductor disconnected when necessary to prevent the circulation of local currents:

Provided that where all the generators are located in one power-house at least one generator in operation shall have its neutral point connected to earth:

Provided further that where the generators are contained in more than one power-house and the power-houses are interconnected, a neutral point shall be provided at each power-house and earthed, and all such neutral points shall be so arranged that no earth-circulating current will flow between the power-houses.

31-23. Notwithstanding anything contained in Regulation 31-21 hereof, the middle conductor of a three-wire direct current system may be earthed through a circuit-breaker with a resistance of not over 10 ohms in parallel, in accordance with Regulation 31-11 hereof.

31-24. Notwithstanding anything contained in Regulation 31-21 hereof, in the case of a traction system a circuit-breaker may be inserted in the conductor which is in contact with earth.

EARTHING-LEADS AND CONNECTIONS.

31-31. (1) Every earthing-lead shall be of copper, and of a cross-sectional area not less than 0.02 square inches (1/160 in. No. 8 S.W.G. 7/064 in. or 7/16 S.W.G. or their equivalent) outdoors, or 0.0045 square inches (1/08 in. No. 14 S.W.G. or 7/029 in. or their equivalent) indoors.

Provided that galvanized-iron strip not less in cross-section than 1 in. by 1/8 in. or stranded steel cable or copper-covered steel not less in cross-sectional area than 0.02 square inches (7/064 in. or 7/16 S.W.G.) may be used for earthing line hardware, earthing-bars or stay-wires.

(2) Earthing-leads of flat copper strip shall not be less than $\frac{3}{4}$ in. wide by 18 S.W.G.

(3) Earthing-leads for apparatus shall be of a current-carrying-capacity not less than one-quarter that of the largest of the conductors to be protected.

31-32. Where earthing-leads are exposed to mechanical injury they shall be protected by a wooden batten or other suitable guard. Earthing-leads which are led down the outside of poles shall be protected by a wooden casing for a distance of not less than 8 ft. from ground-level.

31-33. Where a testing-link is provided in any earthing-lead fixed on a pole it shall be installed not less than 8 ft. above the ground, unless suitably protected to the satisfaction of the Inspecting Engineer so as to prevent electrical hazard.

31-34. (1) Every lightning-arrester shall, except with permission in writing of the Chief Electrical Engineer, be earthed by means of an independent earthing-lead and earth-connection spaced well apart from any earthing-lead or earth-connection used for earthing any circuit or equipment.

(2) The earth-connection for the lightning-arrester shall on no account be interconnected with any earth-connection used for the earthing of any circuit or equipment, and shall, except in the case of pole-substations, be placed not less than 6 ft. from any other earth-connection.

(3) Where in the case of a pole-substation the distance of 6 ft. specified in the last preceding clause cannot be obtained, the distance shall be the maximum obtainable on the substation structure.

(4) No earthing-lead for a lightning-arrester shall pass through any iron or steel pipe, and it shall be taken as direct as possible between the lightning-arrester and the earth-connection. Bends shall be avoided where possible, but where a bend is unavoidable it shall have as large a radius as possible.

31-35. On alternating current star-connected systems with the neutral earthed, pipe crossings for medium pressure or any lower pressure electric lines may be earthed by connecting to the neutral.

31-36. The neutral of a medium pressure or any lower pressure three-phase four-wire system may be used for earthing stays, outdoor lamp-brackets, earthing-guards, and other line hardware, provided that it is of a cross-sectional area not less than that prescribed by Regulation 31-31 hereof, or is earthed at points as nearly equidistant as possible and at intervals of not more than 15 chains each.

31-37. Every joint in an earthing-lead shall be soldered or made with a suitable clamp or metal sleeve.

31-38. Every earthing-lead, if and so far as it is laid underground, shall have all joints kept carefully and sufficiently painted or otherwise adequately protected against corrosion, and shall, unless otherwise mechanically protected, be laid slack to prevent it being readily broken.

PART 32.—SWITCHGEAR.

SWITCHBOARDS.

32-01. (1) All power-house and substation switchboards, including the frames to which they are attached, shall be made of durable non-ignitable material of adequate mechanical strength, and the maximum permissible current and temperature in any conductor mounted thereon or leading thereto shall not exceed the values permitted under British Standard Specification No. 159.

(2) All live metal at a pressure exceeding 110 volts which is mounted on the front of any switchboard shall be screened so as to prevent any person making accidental contact therewith, and the back of every switchboard on which is mounted bare live metal at a pressure of 250 volts and over to earth shall be made inaccessible to unauthorized persons by means of screens or otherwise.

(3) Every door leading to the back of a switchboard shall be provided with a spring or other approved device which shall ensure that the door remains wide open when not properly shut and locked.

(4) No equipment shall be mounted on the back of any switchboard if its operation will be hazardous when so mounted.

32-02. (1) All power-house and substation switchboards controlling high pressure or extra-high pressure circuits shall be provided with two efficient and independent earth-connections, connected in parallel, to which all metal frames, all metal instrument-cases, and other metal parts thereof not normally alive shall be connected, either directly or through a common earthing bus-bar:

Provided that the metal cases of instruments operated from the secondary winding of instrument transformers having the secondary winding earthed, or which are otherwise suitably protected, need not be earthed.

(2) The resistance through the earth between these two connections shall be tested as specified in Regulations 51-01 and 51-02 hereof.

32-03. (1) A rubber mat of not less than $\frac{1}{4}$ in. thickness shall be provided for the protection of operators in front of every power-house and substation switchboard—

- (a) Which directly controls lines or apparatus working at a pressure above 250 volts to earth; or
- (b) Which, being mounted on a floor of conducting material, directly controls lines or apparatus working at a pressure above 100 volts to earth, other than a switchboard of the totally enclosed metal-clad type.

(2) A rubber mat as aforesaid shall be provided in the screened-in space at the rear of every power-house and substation switchboard when such switchboard controls lines or apparatus working above medium pressure, or where such switchboard is mounted on a floor of conducting material, and controls lines or apparatus working at a pressure above 250 volts to earth.

32-04. All switchboard circuits shall be so arranged that the course of any main conductor may be readily identified. The standard colourings and conductor location shall comply with British Standard Specification No. 158.

32-05. All panels shall have marked thereon, near each switch or circuit-breaker, the name of the feeder or apparatus controlled by such switch or circuit-breaker.

32-06. (1) Except in the cases mentioned in the next succeeding clause, isolating-switches shall be fitted in the leads of each panel of all high pressure or extra-high pressure switchboards so that the panel can be made dead when necessary.

(2) The last preceding clause shall not apply—

- (a) Where the circuit-breaker can be withdrawn from a sources of supply; or
- (b) Where the switchboard consists of one panel and it can be made dead by opening a switch outside and adjacent to the substation; or
- (c) Where the switchboard consists of one panel supplied from one generator.

32-07. (1) Every power-house or substation switchboard shall be erected in such a position as to provide in front and behind the switchboard the clear unobstructed spaces herein-after mentioned namely:—

- (a) Low pressure and medium pressure switchboards: An overhead clearance (except in enclosed spaces dealt with in paragraph (c) of this clause) of not less than 7 ft. from the floor to any conductor under which it is necessary to pass, and a passage-way in front of the switchboard with at least 3 ft. horizontal clearance from the face of the switchboard or any bare live metal affixed thereto.
- (b) High pressure and extra-high pressure switchboards (not exceeding 11,000 volts between phases), other than operating desks or panels working solely at medium pressure or any lower pressure: An overhead clearance (except in enclosed spaces dealt with in paragraph (c) of this clause) of not less than 8 ft. from the floor to any conductor under which it is necessary to pass, and a passage-way in front of the switchboard with at least 3 ft. 6 in. horizontal clearance from the face of the switchboard.

(c) In every enclosed space behind any switchboard where only skilled men would be employed when the switchboard is alive (unless all live metal other than that being worked on is suitably screened)—

- (i) An overhead clearance of not less than 7 ft. from the floor to any bare conductor under which it is necessary to pass:
- (ii) A horizontal clearance of not less than 6 ft. for high pressure or extra-high pressure, and not less than 4 ft. for medium pressure or any lower pressure where it is possible to pass between any live conductors less than 7 ft. above the floor:
- (iii) A horizontal clearance of not less than 3 ft. between any live conductor less than 7 ft. above the floor and any wall, screen, or other similar object:
- (iv) For all pressures in excess of 11,000 volts, such clearances as are approved.

(2) When a passage-way is provided behind any switchboard the horizontal clearance shall be the same as that specified for the front of the switchboard, and shall be measured from any screen erected at the back of the switchboard.

32-08. (1) Every passage-way and enclosed space shall have a firm and even floor.

(2) Adequate means of access, free from danger, shall be provided for every enclosed space or passage-way, and such means of access, enclosed space, and passage-way shall be adequately lighted to prevent danger.

(3) All space at the back of switchboards shall be kept free of rubbish, and shall not be used for storage purposes.

CIRCUIT-BREAKERS AND SWITCHES.

32-21. (1) Every switch, switch-fuse, circuit-breaker, and isolating-switch shall be:—

- (a) So constructed, placed, or protected as to prevent electrical hazard; and
- (b) So constructed and adjusted as accurately to make and maintain good contact; and
- (c) Provided with an efficient handle or other means of operating insulated from the system, and so arranged that the hand of the operator cannot inadvertently touch live metal; and
- (d) So constructed or arranged that it cannot, with proper care, be left in partial contact or accidentally fall or move into contact when left out of contact.

(2) Upon every isolating-switch that is so mounted that the force of gravity, or magnetic forces due to short-circuits, tend to open it, there shall be provided a suitable safety-catch to counteract the effect of such forces.

(3) Every high pressure and extra-high pressure circuit-breaker shall be provided with suitable means by which it can be safely isolated from all live conductors.

32-22. Every switch intended to be used for breaking under load, and every circuit-breaker, shall be so constructed that an arc cannot accidentally be maintained under normal operating conditions.

32-23. Every circuit-breaker shall be capable of breaking the undermentioned currents without undue arcing and without injury to the operator: In the case of direct current it shall be capable of breaking twice the normal full-load current of the circuit on which it is installed, and in the case of alternating current it shall be capable of rupturing the maximum short-circuit current to which it may be subjected.

32-24. Every enclosed switch and circuit-breaker shall have an external device to indicate clearly whether the switch or circuit-breaker is open or closed.

32-25. All metal handles of high pressure or extra-high pressure switches and circuit-breakers, and (where necessary to prevent electrical hazard) all metal not normally alive, shall be earthed.

32-26. Where practicable, switches shall be so connected that the blades will be dead when the switch is in the "off" position.

CUT-OUTS.

32-31. Every cut-out shall be either of such construction or so protected by a switch that the fuse-link may be readily renewed without electrical hazard.

PART 33.—POWER-HOUSES, SUBSTATIONS, AND TRANSFORMERS.

POWER-HOUSES AND SUBSTATIONS.

33-01. All power-houses and substations shall be so designed and all apparatus therein shall be so secured that they will withstand a horizontal acceleration of one-sixth of the acceleration due to gravity.

33-02. The apparatus of all power-houses and substations shall be so arranged as to be inaccessible to all unauthorized persons.

33-03. Reasonable working-space and means of access shall be provided in respect of all electrical apparatus which has to be operated or attended to by any person in any power-house or substation.

33-04. Every high pressure or extra-high pressure conductor situated within reach of any working-platform or in any switchboard passage-way in any power-house or substation shall be so placed, or protected as adequately to prevent electrical hazard.

33-05. Where necessary to prevent electrical hazard, adequate precautions shall be taken, either by earthing or by other suitable means, to ensure that no metal, other than the conductor, shall become electrically charged in any power-house or substation.

33-06. Adequate precautions shall be taken to prevent any conductor or apparatus in any power-house or substation from becoming accidentally or inadvertently electrically charged when any person is working thereon.

33-07. Where necessary in any power-house or substation to prevent electrical hazard, insulating-stands and screens shall be provided and kept permanently available, and shall be maintained in a sound condition.

33-08. (1) Every ladder stored in the vicinity of a pole-substation shall be securely padlocked or otherwise made inaccessible to unauthorized persons.

(2) Every ladder fixed to a pole-substation shall either be of the shut-up type, and kept securely closed and padlocked when not in use, or of such a type that it cannot be used by any unauthorized person.

33-09. (1) Where platform type of construction is used for a pole-substation and space sufficient for any person to stand on the platform is provided, a substantial handrail shall be built around the platform.

(2) If the handrail is of metal it shall not be connected with earth.

(3) Earthed metal—*e.g.*, pipes containing cables—shall not be attached to metal handrails, and when attached to handrails other than metal shall be so placed or protected that any person on the platform cannot accidentally be in contact with live metal and such earthed metal at the same time.

(4) Handrails shall be fitted at a height not less than 3 ft. or more than 4 ft. above the platform.

(5) Metal screens fitted to handrails shall not be connected with earth.

33-10. Fire-buckets filled with clean dry sand and ready for immediate use in extinguishing fires, or suitable fire-extinguishers filled with a non-conducting fluid, shall be kept in all power-houses and substations, other than pole-substations, in a convenient situation adjacent to the electrical apparatus and shall be conspicuously marked.

33-11. (1) The licensee if a vendor of electrical energy shall install suitable meters for recording the electrical energy generated, or purchased in bulk (as the case may be), by the licensee, and for recording the half-hourly maximum demand:

Provided that it shall be sufficient compliance with this clause if such meters as are hereby prescribed are installed by the authority or person from whom the electrical energy is purchased by the licensee.

(2) The units generated and/or purchased shall be recorded in a book or similar register on the last day of each calendar month, and the maximum demand shall be recorded on a chart, or on the last day of every quarter in a book or similar register, and the maximum demand instrument shall be reset on such day. Such chart, book, or register (as the case may be) shall be available for inspection at all reasonable times by any person authorized in that behalf by the Minister, and shall be retained by the licensee for such inspection for a period of two years after the date of the last entry therein.

TRANSFORMERS.

33-21. (1) Every transformer exposed to the weather shall be fitted with a weatherproof case, and when fixed to a pole shall be either thoroughly protected against interference or attached to the pole at such a height as to make it inaccessible except by means of a ladder or other special appliance.

(2) No pole-step shall be placed at a less height than 9 ft. above the ground-level.

33-22. Every transformer placed within a building or enclosure shall be inaccessible to unauthorized persons, and all high pressure or extra-high pressure conductors in such buildings or enclosures shall be screened and protected so that no person can make accidental contact therewith.

33-23. Every transformer (or bank of transformers), other than a step-up transformer directly connected to a generator, shall be protected on the primary side by cut-outs, overload circuit-breakers, or other approved protection located within 4 chains thereof.

33-24. The cases of all transformers shall be earthed by a copper conductor in accordance with Regulations 31-31, 31-32, 31-33, 31-37, and 31-38 hereof.

33-25. All transformers erected on poles shall be securely bolted thereto.

CONDENSERS.

33-31. Means shall be provided for the immediate automatic discharge of every static condenser on disconnection of the supply.

PART 34.—PROTECTIVE APPARATUS AND SAFEGUARDS.

LIGHTNING-ARRESTERS.

34-01. Where an electric line is erected in a locality in which lightning is to be apprehended efficient protection shall be provided.

FEEDER AND DISTRIBUTION PROTECTION.

34-11. (1) Except as provided in Regulations 34-12 and 34-14 hereof, each outgoing feeder or distributor from any power-house or substation shall be protected by cut-outs, or an automatic circuit-breaker equipped with overload inverse time-limit, or other approved tripping-device.

(2) Such cut-out or circuit-breaker shall be located in each conductor, except a conductor which is in contact with earth, and in the case of three-phase circuits one overload inverse time-limit trip-coil may be replaced by an earth-leakage trip-coil.

34-12. In transformer substations not exceeding 100 kilovolt-ampere capacity only the high pressure or primary side of the transformers need be protected by cut-outs or circuit-breakers, and special precautions shall be taken in the adjustment of these to the capacity of the transformers.

34-13. (1) All overload devices shall be set to operate within three seconds at a current not exceeding twice the full-load of the feeder or distributor, except that in the case of fuse-links the time stated may be one minute. Where twice the normal full-load is not in excess of 2 amperes a fuse-link to blow at 2 amperes may be used.

(2) In the case of feeders or distributors which supply further sub-feeders or sub-distributors through automatic circuit-breakers, and where selective operation of circuit-breakers is desired, the time-setting of the main feeder circuit-breakers may be increased to fifteen seconds.

(3) Where an automatic reclosing circuit-breaker is used it shall be so constructed that in the event of three successive openings during a total period not exceeding sixty seconds the lockout device shall prevent any further automatic reclosing until reset by hand, and this shall not be done until the fault has been cleared.

The interval between the automatic opening and reclosing shall not exceed thirty seconds.

34-14. (1) No fuse-link or circuit-breaker shall be inserted on any distribution-line fed from the medium pressure (or any lower pressure) side of any transformer where lines are erected in accordance with Regulation 42-51 hereof unless such fuse-link or circuit-breaker (as the case may be) is set to open such medium pressure (or lower pressure) circuit at a current not less than 25 per cent. greater than that required to operate (by overload, earth-leakage, or otherwise) the fuse-link or circuit-breaker (as the case may be) at the source of supply of any higher pressure electric line carried on the same poles or supports.

(2) Every fuse-link inserted on such medium pressure (or lower pressure) circuit shall be renewed at intervals of not more than six months unless it is of a type approved for such purpose, in which case it shall be renewed at such longer intervals as the Chief Electrical Engineer may prescribe from time to time.

34-15. Z connections between current transformers and two trip-coils shall not be used on a star-connected system with earthed neutral.

34-16. Every series street-lighting circuit shall be provided with protective apparatus of an approved type set to operate in the event of a break occurring in the secondary circuit.

GLOVES, SAFETY-BELTS, AND OTHER SAFEGUARDS.

34-21. Insulating-gloves, boots, goloshes, and stands, rubber protective-covers, and mats, safety-belts, and hand-lines of non-conducting material, and such other safeguards as the Chief Electrical Engineer may deem necessary in the circumstances as a reasonable protection against electrical hazard, shall be provided by the licensee for use, when necessary, by persons employed by him.

34-22. It shall be the duty of every person working on the lines or apparatus:—

- (a) To use in a proper manner the safeguards provided; and
- (b) To satisfy himself that such safeguards are in good physical and mechanical order and condition.

34-23. Such instructions as the Minister may from time to time approve as to the treatment of persons receiving electric shocks shall be affixed by the licensee in a conspicuous place on the wall of every power-house, substation, store, and workshop used by the licensee and in every construction and maintenance truck used by the licensee.

WORKING ON CONDUCTORS, APPARATUS, AND SWITCHBOARDS.

34-31. No person except an authorized and competent person shall undertake any work on any live electric line or apparatus where practical knowledge or experience is required in order adequately to avoid danger.

34-32. Except in case of emergency due to breakdown or other accident, no person shall work on any live high pressure or extra-high pressure conductor or apparatus unless accompanied by a person competent to assist him.

34-33. No person shall work on any live electric line or apparatus, and no person shall assist such person on such work, unless he is competent to apply the treatment prescribed by Regulation 34-23 hereof. Every such person shall give a practical demonstration of such treatment at any time when so requested by an Inspecting Engineer.

34-34. While any high pressure or bare medium pressure or bare low pressure conductor (other than an earthed neutral or middle conductor) is alive no person shall carry out any work on such conductor unless insulating-gloves, a safety-belt, an insulating-stand, rubber protective covers, or other means approved by the Chief Electrical Engineer, are used as required to render work on such conductor safe, or unless the conductor to be worked on and all other electric conductors within 3 ft. 6 in. thereof are disconnected from the source of supply and earthed.

34-35. Where any conductor is disconnected from the source of supply and is in proximity to any live high pressure or extra-high pressure conductor, every person working on such first-named conductor shall cause the same to be earthed after disconnection and before work commences in order to discharge electrostatic induction and to remain earthed until all work thereon has been completed.

34-36. (1) Every person before working on any high pressure or extra-high pressure conductor and/or apparatus disconnected from the source of supply (and liable to become alive) shall cause such conductor and/or apparatus to be earthed and to remain earthed until all work thereon has been completed.

(2) Such conductor shall be so earthed on each side of the point where the work is being carried out and which, in the case of an aerial conductor, shall be at a distance of not more than two normal spans from such point.

(3) When such conductor is controlled by a circuit-breaker it shall be placed in the "off" position and be isolated by the means prescribed by clause (3) of Regulation 32-21 hereof before the conductor is earthed.

34-37. Where any new line is being erected on poles or other supports carrying any bare live conductor, then:—

- (a) Every person engaged in such erection shall either cause the live conductors to be made dead and to be earthed or shall not handle the new line unless insulating-gloves and boots or goloshes are used; and
- (b) No person shall be on any crossarm on which the new line is to be erected while such line is being pulled up; and
- (c) Every person engaged in such erection shall cause the new line to be earthed before erection and to remain earthed until all work on it has been completed.

34-38. (1) All switches and circuit-breakers controlling conductors or equipment made dead for working on shall have a suitable tag affixed to the operating handle. Such tag shall have marked thereon "Men at Work" or wording of a similar nature, and the tag shall not be removed until the switch or circuit-breaker (as the case may be) is again closed by or at the instructions of the person carrying out such work:

Provided that where the switch or circuit-breaker is under the sole control of and in sight of the person working on the conductors or apparatus such tag may be omitted.

(2) Such switches or circuit-breakers when located out of doors shall always be locked when in the open position.

34-39. Properly designed clips attached to insulated sticks shall be used for the temporary earthing of conductors. Chains shall not be used for earthing purposes.

34-40. Every communication-wire supported on poles carrying high pressure or extra-high pressure electric lines shall for the purpose of working thereon be deemed to be a high pressure electric line, and every person working on such communication-wire shall take similar precautions to those provided in Regulations 34-34 or 34-35 hereof.

34-41. When work has to be carried out on any high pressure or extra-high pressure switchboard, then, unless the switchboard is otherwise so arranged as to secure that the work may be carried out without undue risk either,—

- (a) The switchboard shall be made dead; or
- (b) If the switchboard is so arranged that the conductors thereof can be made dead in sections, and such sections are separated by permanent or removable divisions or screens from all adjoining sections of which the conductors are alive so that work on any section may be carried out without undue risk, the section on which work has to be done shall be made dead.

DIVISION IV.—ERECTION, CONSTRUCTION, AND USE OF CONDUCTORS AND INSTALLATIONS.

PART 41.—OVERHEAD CONDUCTORS I.

MATERIAL, STRANDING, AND MINIMUM SIZE.

41-01. All aerial lines shall be of copper, galvanized-steel, galvanized-iron, copper-covered steel, steel-core aluminium, steel-reinforced aluminium, or such other types of material as may, from time to time, be approved for that purpose.

41-02. In all aerial lines—

- (a) Copper conductors used for medium pressure or any lower pressure may be either solid or stranded; and
- (b) Copper conductors used for high pressure or extra-high pressure shall be stranded, except when used for trolley wires for electric traction purposes; and
- (c) Galvanized-iron, galvanized-steel, or copper-covered steel conductors for all pressures may be either solid or stranded:

41-03. (1) The cross-sectional area of any aerial conductor other than a conductor used as a communication-line, shall be not less than that of the respective kinds of conductor shown in the following table, namely:—

Material.	Medium Pressure or any Lower Pressure.		High Pressure or Extra-high Pressure.
	Service-lines.	Other than Service Lines.	
Copper	Stranded wire, 7/044 in. or 7/18 S.W.G. Solid wire, 1/160 in. or No. 8 S.W.G.	Stranded wire, 7/052 in. or 7/17 S.W.G. Solid wire, 1/160 in. or No. 8 S.W.G.	7/064 in. or 7/16 S.W.G.
(b) Galvanized-iron, galvanized-steel or copper-covered steel	Same as for copper	Same as for copper	Stranded wire, 7/064 in. or 7/16 S.W.G. Solid wire, 1/160 in. or No. 8 S.W.G.
(c) Steel-core aluminium ..	7/0586 in. ..	7/0586 in. ..	7/0743 in.
(d) Steel-reinforced aluminium (4 steel, 3 aluminium)	7/0661 in. ..	7/0661 in. ..	7/0661 in.

(2) The cross-sectional area of every aerial conductor where crossing a railway line shall not be less than that prescribed by Regulation 46-13 hereof.

(3) Earthing-leads shall be of the sizes prescribed by Regulation 31-31 hereof.

(4) The cross-sectional area of every aerial communication-line (other than that of the Post and Telegraph Department) supported on poles or other supports carrying an electric line shall be not less than that prescribed by Regulation 42-61 hereof.

41-04. (1) Joints between aerial conductors shall be soldered or made with suitable clamps or metal sleeves. A dry splice may be made only in stranded conductors which are in tension.

(2) Every joint made in an aerial conductor having a cross-sectional area not less than 0.035 square inches (7/080 in. or 7/14 S.W.G.) shall have an ultimate strength of not less than 90 per cent. of that of the conductor.

(3) No joint shall be made at any street crossing or in the adjacent spans in any aerial stranded conductor having a cross-sectional area less than 0.035 square inches (7/080 in. or 7/14 S.W.G.) or in any solid conductor of any size.

(4) Where crossing a railway no joint shall be made in any aerial conductor in the crossing span or in either of the approach spans.

MAXIMUM STRESSES.

41-11. (1) The lines shall be so designed and constructed that the stress in any aerial conductor when subjected simultaneously to a minimum temperature of 20° F. (or such other temperature as may be specified in the license) and to a wind-pressure of 18 lb. per square foot of diametral plane (in the case of lines erected outside borough, town district, and township limits) or 12 lb. per square foot of diametral plane (in the case of lines erected within such limits) shall not exceed—

- 25,000 lb. per square inch for hard-drawn copper, or
 - 14,000 lb. per square inch for annealed copper, or
 - 12,500 lb. per square inch for hard-drawn aluminium, or
 - 34,000 lb. per square inch for steel of not less than 30 ton quality, or
 - 45,000 lb. per square inch for steel of not less than 40 ton quality, or
 - 22,500 lb. per square inch for iron.
- (g) And in any case 50 per cent. of the ultimate strength of the conductor.

(2) In the case of a composite conductor with a steel core, the maximum load in the circumstances mentioned in the last preceding clause shall not exceed 40 per cent. of the ultimate strength of the conductor if the steel core has an area of 0.02 square inches or less, and 50 per cent. if the area of the steel core exceeds 0.02 square inches.

(3) Where in the opinion of the Minister the electric lines are liable to be subjected to ice or snow loading the conductors shall be designed to withstand a wind-pressure of 8 lb. per square foot of diametral plane with a radial thickness of ½ in. of ice, or, with the approval of the Minister, to withstand such other conditions as may be more prevalent in the particular locality.

41-12. Dynamometers for measuring the tension in the aerial wires, or gauges for measuring the sag thereof, and thermometers for measuring air-temperature during erection, shall be used and maintained by the licensee.

41-13. All overhead wires shall be strung and pulled up in such a manner that the metal or covering (if any) is not damaged thereby, and when come-alongs or draw-vices are used for pulling up the wires they shall be of the parallel-jaw type.

CLEARANCES ABOVE GROUND.

41-21. No aerial electric line erected across a street at its intersection or junction with another street shall at any part thereof over such intersection or junction be at a less height than 21 ft. above ground-level, and, if so required by the Telegraph Engineer, shall be erected at such height greater than 21 ft. as he specifies in writing.

41-22. No aerial electric line at medium pressure or any lower pressure (including service-lines) shall at any part thereof be erected and maintained along or across any street at a less height than 18 ft. above ground-level, save that lines crossing a footpath at the side of any street or over any place used by the general public for pedestrian traffic only may be at a less height than 18 ft., but not less than 14 ft. above ground-level.

41-23. (1) No aerial electric line at medium pressure or any lower pressure erected elsewhere than along or across any street, footpath, or other place mentioned in the last preceding regulation shall be erected and maintained at a height of less than 16 ft. (if bare) or 14 ft. (if covered) above ground-level, save that in the case of an electric service-line erected in such a situation the height above ground-level in the span between the building and the nearest pole thereto may be not less than—

- 14 ft. in that part of the span which crosses any way open to the public.
- 12 ft. in that part of the span which crosses any private way used by vehicles having a height (including their loads) greater than 8 ft.
- 9 ft. in any other part of the span.

(2) For the purposes of the last preceding clause a bare neutral, if earthed, shall be deemed to be a covered line.

(3) Every aerial electric service-line shall be so attached to the building that it is impossible to touch it without the use of a ladder or other climbing-appliance.

(4) Where an extension-piece is necessary on a consumer's building to provide the necessary clearance, it shall be of substantial construction and perfectly rigid, and the leading-in conduit shall be taken up such extension-piece to a point near the attachment of the electric service-lines.

(5) In the case of an electric trolley-wire in any tunnel and in and about any mine or other place, the Chief Electrical Engineer may grant exemption from the provisions of this regulation subject to such conditions as he may impose on the grounds of freedom from electrical hazard.

41-24. No aerial electric line at high pressure shall at any part thereof be erected and maintained along or across any street, or footpath, or any place used by vehicles having a height (including their loads) greater than 10 ft. at a less height than 20 ft. above ground-level, and no such line erected elsewhere shall be erected and maintained at a less height above ground-level than 18 ft. (if bare) or 16 ft. (if covered).

This regulation does not apply to any overhead electric contact-wire on any railway.

41-25. No aerial electric line at extra-high pressure shall at any part thereof be erected and maintained at a less height above ground-level than 22 ft.:

Provided that in the case of any such line operating at a pressure not exceeding 11,000 volts between phases the height above ground-level at which it may be so erected and maintained may be reduced to:—

- 20 ft. along or across any road or footway in any place outside a borough, town district, or township:
- 18 ft. in any other place outside a borough, town district, or township, not being a place used by vehicles having a height (including their loads) greater than 10 ft.

This regulation does not apply to any overhead electric contact-wire on any railway.

41-26. (1) Where any low pressure or medium pressure aerial electric line and any high pressure or extra-high pressure aerial electric line are carried on the same pole or other support, then to allow telegraph-lines to be carried beneath such lines there shall be maintained between ground-level and the lowest of the lines so carried a space of 20 ft.:

Provided that the foregoing shall apply in any place outside a borough, town district, or township only at the pole or other support nearest to any building to which an electric line or telegraph-line is carried.

(2) Where in any locality lines of such pressures as aforesaid are carried on the same poles or other supports along tramway routes having overhead electric trolley-wires, the medium pressure or low pressure lines shall be at such a height above ground-level as may be necessary to allow telegraph-lines to cross beneath them and to pass above the trolley-wire of the tramway.

41-27. The minimum height above rail-level for an overhead electric line where crossing a railway line shall be not less than that prescribed by Regulation 46-12 hereof.

CLEARANCES BETWEEN LINES.

41-31. Every overhead electric line crossing a tramway system having overhead electric trolley-wires shall have the following minimum clearances above any trolley-wire, namely : 4 ft. in the case of lines operating at a pressure not exceeding 11,000 volts ; 6 ft. in any other case.

41-32. No aerial electric line at medium pressure or any lower pressure shall come within 2 ft. of any other separately owned aerial line or cable except at a pole, and then only by arrangement between the respective owners of the wires.

41-33. No aerial electric line at high pressure or extra-high pressure shall cross any other separately owned aerial electric line or cable except pursuant to an agreement between the respective owners, and in every case shall have the following clearances between lines, measured horizontally or vertically, at all temperatures :—

- (a) Medium pressure or any lower pressure and high pressure—
 - (i) If all covered (except neutral) .. 2 ft.
 - (ii) If any bare (except neutral) .. 4 ft.
- (b) Medium pressure or any lower pressure and extra-high pressure not over 11,000 volts .. 4 ft.
- (c) Medium pressure or any lower pressure and extra-high pressure over 11,000 volts .. 6 ft.
- (d) High pressure and extra-high pressure not over 11,000 volts .. 4 ft.
- (e) High pressure and extra-high pressure over 11,000 .. 6 ft.
- (f) Extra-high pressure not over 11,000 volts and extra-high pressure not over 35,000 volts .. 4 ft.
- (g) Extra-high pressure and extra-high pressure over 35,000 volts .. 6 ft.

41-34. (1) An aerial electric line crossing below another aerial line at a point between two poles or other supports carrying the upper line shall have not less than the following clearance between such lower line and the nearest of the said poles or other supports thereto, according to the pressure at which such lower line is alive :—

- (a) Medium pressure or any lower pressure—
 - If covered (except neutral) .. 2 ft.
 - If bare (except neutral) .. 4 ft.
- (b) High pressure—
 - If covered .. 4 ft.
 - If bare .. 6 ft.
- (c) Extra-high pressure .. 6 ft.

(2) An aerial electric line crossing below another aerial line at a pole or other support carrying the upper line shall be attached to an insulator fixed on a crossarm fitted to the pole or other support.

41-35. Where any guard-wire is used it shall, for the purposes of Regulations 41-33 and 41-34 hereof, be deemed to be a medium pressure electric line, and the clearances specified in the aforementioned regulations with respect to medium pressure lines shall be observed.

41-36. (1) Where aerial electric lines of more than one pressure are carried on the same pole or other support such lines shall have the following clearances measured at the pole or other support :—

- (a) Medium pressure and any lower pressure, or low pressure and extra-low pressure—
 - (i) If all covered (except neutral)—vertical or horizontal .. 2 ft.
 - (ii) If any bare (except neutral)—vertical or horizontal .. 4 ft.
- (b) Medium pressure or any lower pressure and high pressure :—
 - (i) If all covered (except neutral)—vertical or horizontal .. 2 ft.
 - (ii) If any bare (except neutral)—vertical or horizontal .. 4 ft.
- (c) Medium pressure or any lower pressure and extra-high pressure not over 11,000 volts—vertical .. 4 ft.
- (d) Medium pressure or any lower pressure and extra-high pressure over 11,000 volts—vertical .. 6 ft.
- (e) High pressure and extra-high pressure not over 11,000 volts—
 - (i) Vertical .. 4 ft.
 - (ii) Horizontal .. 3 ft.
- (f) High pressure and extra-high pressure over 11,000 volts—vertical or horizontal .. 4 ft.
- (g) Extra-high pressure and extra-high pressure—
 - (i) Vertical .. 4 ft.
 - (ii) Horizontal .. 3 ft.

(2) Under any of the conditions of wind-pressure and temperature referred to in the license or these regulations, the separation between wires at the centre of the span shall not be less than one-half of the distances specified in the last preceding clause.

41-37. (1) Where aerial electric lines of the same pressure are carried on the same pole or other support the circuits shall have the following clearances, measured at the pole or other support :—

- (a) Medium pressure or any lower pressure—
 - vertical or horizontal .. 1 ft.
- (b) High pressure—vertical or horizontal .. 2 ft.
- (c) Extra-high pressure not over 11,000 volts—
 - (i) Vertical .. 2 ft.
 - (ii) Horizontal .. 2½ ft.

(2) For pressures exceeding 11,000 volts the clearances shall be such as are approved.

(3) Under any of the conditions of wind-pressure and temperature referred to in the license or these regulations, the separation between wires at the centre of the span shall not be less than one-half of the distances specified in clause (1) of this regulation.

41-38. Where aerial electric lines of different pressures are taken down a pole or other support to a transformer or other apparatus, unless the lines are enclosed in pipes or lead-covered cables are used, they shall be supported vertically by insulators spaced not more than 8 ft. apart or by strain insulators fitted at top and bottom, and the following clearances between lines of different pressures shall be provided :—

- (a) Medium pressure or any lower pressure and high pressure .. 1 ft.
- (b) Medium pressure or any lower pressure and extra-high pressure not over 11,000 volts .. 2 ft.
- (c) High pressure and extra-high pressure not over 11,000 volts .. 2 ft.

41-39. (1) Where it is possible for any aerial conductor to be alive on any crossarm below the top crossarm while any conductors above are dead, either the following climbing-spaces between conductors through which it may be necessary to climb shall be provided at the pole or other support, or all conductors through which it is necessary to climb shall be made dead before any work is undertaken on the aerial lines, or else every conductor below the top crossarm shall be enclosed in an earthed pipe or be protected by an approved protective cover while work is being carried out :—

- (a) Medium pressure or any lower pressure covered (except neutral) .. 2½ ft.
- (b) Medium pressure or any lower pressure bare (except neutral) .. 3 ft.
- (c) High pressure, covered .. 3 ft.
- (d) High pressure, bare .. 4 ft.
- (e) Extra-high pressure not over 11,000 volts .. 5 ft.

Provided that where vertical-rack construction is used for medium pressure or any lower pressure electric lines the above clearances need not be provided ; but, if not so provided, pole-steps shall not be used.

(2) Where climbing-space is provided between lines of different pressure the clearance allowed shall be that provided for the higher pressure.

41-40. The minimum clearance between any aerial electric line and any telegraph-line or between any aerial electric line and any railway communication or signal-wire shall be not less than that prescribed by Regulations 45-04, 45-05, and 46-12 hereof.

CLEARANCES FROM BUILDINGS.

41-51. (1) Where a medium pressure or any lower pressure aerial electric line passes above any building the following minimum clearances, shall be provided—

- (a) A vertical clearance of 7 ft. 6 in. above the highest point of any flat roof, open balcony, veranda roof, and lean-to roof, except as provided in clause (2) of this regulation ; and
- (b) A vertical clearance of 7 ft. 6 in. immediately under such lines, and a horizontal clearance of 4 ft. in the case of any pitched roof except where the line is attached to the building as provided in Regulation 41-71 hereof, and except where the line crosses the ridge of the roof, in which case there shall be a vertical clearance of 2 ft. above such ridge.

(2) When such line is a service-line and it is not practicable to terminate it on a building otherwise than immediately above the attachment of a veranda roof or lean-to roof the vertical clearance may be reduced to 6 in. above the highest point of such roof.

(3) Every such wire (other than an earthed neutral or middle conductor, or a wire having a clearance of not less than 7 ft. 6 in.) shall be covered.

41-52. (1) Where a high pressure or extra-high pressure aerial electric line passes above any building or part of a building it shall have a vertical clearance of not less than 8 ft. above the highest part of the building immediately under such line, and a horizontal clearance of not less than 4 ft. between such line and any part of such building.

(2) The horizontal clearance shall be measured when the line is at a maximum deflection from the vertical, due to wind-pressure, as specified in clause (1) of Regulation 41-11 hereof.

(3) A conspicuous notice of the words "Danger—Live Wires" shall be fixed to a part of the building nearest to the lines, where it will be readily seen by any person on the building near the wires, and shall be permanently maintained in a legible condition.

(4) Where it is not possible to fix such notice in a conspicuous place, then a notice, with the word "Danger" in letters not less than 2 in. high, shall be fixed to one of the aerial conductors immediately over the highest part of the building, and the clearance hereinbefore prescribed shall be allowed between the building and the bottom part of this notice.

41-53. Where a high pressure or extra-high pressure aerial electric line passes above any building with metal sides and roof, the roof shall be bonded effectively to the sides of the building, and such sides shall be earthed to ensure the operation of the protective devices in the event of contact being made between the electric line and any metal part of the building.

CLEARANCES IN GENERAL.

41-61. If any tree, or part of a tree, is likely to cause damage to an electric line the licensee shall take steps to have it removed in accordance with section 324 of the Public Works Act, 1928.

41-62. Every aerial electric conductor shall be so erected as to be inaccessible to any person without the use of a ladder or other climbing-appliance.

41-63. For the purpose of computing any clearance for an aerial electric line the maximum sag of any conductor shall be assumed to occur at a temperature of 120° F.

41-64. Where an overhead electric line crosses a navigable waterway, such clearances as the Minister of Marine directs shall be provided.

41-65. The minimum clearance between any electric line pole or other support and a railway track shall be not less than that prescribed by Regulation 46-11 hereof.

41-66. Overhead lines shall be located as far as practicable from aerodromes; and where it is essential to erect any overhead line in the vicinity of an aerodrome such line shall be so located as to minimize interference with air traffic.

SUPPORTS.

41-71. (1) Every support for overhead electric lines shall be so located as to avoid any undue obstruction of pedestrian or vehicular traffic.

(2) Where any aerial electric line is erected substantially parallel to a wire fence the supports, where practicable, shall be at such a distance from the fence that a vertical line taken from the end of the crossarm nearest the fence will touch the ground at a distance of not less than 5 ft. from the fence.

41-72. (1) Every support for an overhead electric line shall be of durable material, and of sufficient strength to withstand forces due to wind-pressure, change of direction of line, and unequal length of span and, in those cases where clause (3) of Regulation 41-11 hereof applies, due to ice or snow loading.

(2) The factor of safety of each support shall be not less than 2 in the case of iron, steel, or concrete, and not less than 4 in the case of wood, calculated on the crippling-load of the structure.

(3) All concrete poles shall have clearly and permanently marked thereon the designed position of the ground-line, and, immediately above this, in ton-feet units, the ultimate transverse bending moment for which the pole has been designed. Half of such bending moment shall be taken for the purpose of calculating the permissible load.

(4) In computing the applied moments for the strength of supports a wind-pressure of 30 lb. per square feet of plane surface and 18 lb. per square feet of diametral plane of a cylindrical surface shall be assumed.

(5) In no case shall the strength or stiffness of a support in the direction of the overhead line be less than one-quarter the required strength or stiffness in a direction transverse to the line.

(6) In the case of every lattice steel structure or compound structure, including "A" or "H" poles, the wind-pressure on the leeward-side members shall be taken as one-half of the wind-pressure on the windward-side members, and the factor of safety shall be calculated on the crippling-load of struts and the elastic limit of tension members.

41-73. (1) In the case of high pressure or any lower pressure aerial electric line where crossarm construction and pin-type insulators are used and the span exceeds 3 chains, double crossarms, each fitted with insulators, shall be provided

at all angles where the direction of the line changes more than 45°, and, as far as possible, the forces due to the angle shall be divided equally between the insulators.

(2) Where lines of any pressure are subject to ice or snow loading, the crossarms shall be designed to provide additional strength to withstand the extra loading.

41-74. (1) In computing the strength of wooden supports the following working-stresses, based on heartwood measurements, shall be used:—

Common Name.	Botanical Name.	Country where grown.	Working Stresses in Pounds per Square Inch.
(a) Pole and Crossarm Timbers.			
Black beech	<i>Nothofagus Solandri</i>	New Zealand	2,400
Bloodwood	<i>E. corymbosa</i>	Australia	3,000
Dense Douglas fir	<i>Pseudo. taatifolia</i>	North America	2,000*
Dense southern yellow-pine	<i>Pinus Caribaea</i>	"	2,200*
"	<i>echinata</i>	"	2,200*
"	<i>palustris</i>	"	2,200*
"	<i>taeda</i>	"	2,200*
Eastern white cedar	<i>Thuja occidentalis</i>	"	1,200
Grey box	<i>E. hemephloia</i>	Australia	3,000
Grey gum	<i>E. propinqua</i>	"	3,000
"	<i>E. punctata</i>	"	3,000
Hard beech	<i>Nothofagus truncata</i>	New Zealand	2,400
Hinau	<i>Elaeocarpus dentatus</i>	"	2,200
Ironbark	<i>E. Crebra</i>	Australia	3,500
"	<i>E. paniculata</i>	"	3,500
"	<i>E. siderophloia</i>	"	3,500
Jarrah	<i>E. marginata</i>	"	2,600
Kaikawaka	<i>Librocedrus bidwillii</i>	New Zealand	1,400
Larch	<i>Larix decidua</i>	"	1,900
Macrocarpa	<i>Cupressus macrocarpa</i>	"	2,000
Red beech	<i>Nothofagus fusca</i>	"	1,400
Red gum	<i>E. rostrata</i>	Australia	1,700
"	<i>E. tereteornis</i>	"	3,000
Silver pine	<i>Dacrydium Colensoi</i>	New Zealand	1,500
Tallowwood	<i>E. microcorys</i>	Australia	3,000
Totara	<i>Podocarpus totara</i>	New Zealand	1,600
Western red cedar	<i>Thuja plicata</i>	North America	1,700
White mahogany	<i>B. aemonioides</i>	Australia	3,000
(b) Crossarm Timbers only.			
Blackbutt	<i>E. pilularis</i>	Australia	2,300
Black maire	<i>Olea Cunninghamii</i>	New Zealand	3,000
Karrl	<i>E. diversicolor</i>	Australia	2,800
Mangoao	<i>Litsea calicaris</i>	New Zealand	1,900
Puriri	<i>Vitex lucens</i>	"	2,500
Rata	<i>Metrosideros lucida</i>	"	2,800
"	<i>robusta</i>	"	2,800
Spotted gum	<i>E. maculata</i>	Australia	3,000
Turpentine	<i>Syncarpia lauriflora</i>	"	2,600

* Applies to creosoted timber only.

(2) The working-stress assigned in computation to any timber not mentioned in the last preceding clause shall be subject to the approval of the Chief Electrical Engineer.

41-75. No pole-step shall be placed at a less height than 9 ft. above ground-level.

41-76. (1) All aerial electric lines shall, except as provided in Regulation 42-33 hereof, be attached to suitable insulators carried on crossarms or brackets of suitable material and cross-section, and, except in the case of strain or suspension insulators, they shall be so attached to the insulators or guarded that they cannot fall away from the supports in case they become detached from the insulator, but will fall on the cross-arm or insulator support. Where the loading on the cross-arm is unbalanced the crossarm shall be braced or so fixed that it is kept in a permanent position.

(2) Every line at an angle shall be so attached to the insulator that the insulator takes the stress directly and not by means of the binder.

(3) All high pressure and extra-high pressure aerial electric lines at angles shall be provided with guard-hooks, except—

- (a) In cases where the line in becoming detached from any support will not reduce the clearance, on the consequent span to less than 14 ft. above the ground-level; or
- (b) When shackle insulators are used and the line is on the inside of the shackle; or
- (c) When strain insulators or suspension insulators are used in which the electric line is attached to the insulator by means of a clamp of an approved design; or
- (d) When double crossarms to comply with Regulation 41-73 (1) hereof are used.

(4) No guard-hook need be earthed.

(5) No pin for a pole-top insulator shall be inserted in the end of the pole-top, but shall be attached to the side of the pole.

(6) All aerial electric lines (other than service-lines) shall terminate on shackle insulators or strain insulators, or on two pin-type insulators fitted in tandem.

41-77. Where an uplift occurs at a pole or other support :—

- (a) Every high pressure or extra-high pressure aerial electric line shall be secured to a shackle insulator or other suitable insulator so that it cannot become detached, or it shall be protected by a stirrup fitted over the line and fastened at both ends to the cross-arm or by means of a suitable clamp attached to the insulator, except in those cases where any such line in becoming detached from its support will not reduce the standard clearance between conductors or otherwise be dangerous.
- (b) Every medium pressure or any lower pressure aerial electric line erected on the same pole or other support as lines at other pressures shall be secured to a shackle insulator or other suitable insulator, except in those cases where any such line when detached from its support will not decrease the clearance between it and the lines above by more than one-half the clearances specified in Regulation 41-36 hereof.

41-78. Any crossarm carrying a high pressure overhead electric line which is erected on a pole carrying a telegraph-line shall have a distinctive red marking thereon.

41-79. (1) Where covered electric lines of any pressure are used they shall be so attached to the insulators that their covering is not thereby impaired or likely to become impaired.

(2) Bare binding-wire shall not be used on covered wire unless at least two layers of compounded weatherproof tape are first wrapped round the outside of the covering of the wire.

(3) Where marline is used it shall be not less than three-ply, tightly wound and of first quality.

41-80. Every crossarm on terminal poles or pull-offs shall be so fixed that the pull on the wires will draw the crossarm towards the pole, and not away from it.

41-81. Aerial electric lines at medium pressure or any lower pressure may be carried on brackets attached to buildings, provided they are inaccessible from any portion of the building without the use of a ladder or other special appliance, and provided also that they are secured in such a manner that they cannot fall away from the insulator-support or make contact with the building.

STAYS, STRUTS, AND TRUSSES.

41-91. (1) Except where it is erected alongside a substantial fence or hedge, every stay, strut, or truss used within borough, town district, or township limits shall not be less than 9 ft. above ground-level.

(2) Outside such limits as aforesaid, a stay-wire may be attached to a stub-pole or a log of durable wood, or other form of "deadman" buried at least 4 ft. below ground-level, and it shall be attached to the "deadman" by means of a galvanized-iron bolt at least $\frac{3}{8}$ in. in diameter, and the wire itself shall not, at any part thereof, be in contact with the ground.

(3) Where any stay less than 9 ft. above ground-level is not erected alongside a substantial fence or hedge it shall be guarded by—

- (a) A substantial post-and-rail fence erected round the stay ; or
- (b) Two posts in line with and immediately against the stay, provided with a rail fitted between or on top of the posts ; or
- (c) A galvanized-iron pipe not less than 2 in. in diameter enclosing the stay ; or
- (d) A double wooden batten (each batten being not less than 2 in. by 1 in.) securely fastened, with the stay between the battens ; or
- (e) Some other approved device ; and the guard shall extend from the point where the stay-bolt enters the ground to a point where the stay is not less than 9 ft. above ground-level :

Provided that where a stay is elsewhere than in a street, and there is no danger of any person being injured by coming in contact therewith, the guard may be omitted.

- (4) All guards shall be painted white.
- (5) All stay-wires shall be stranded with a minimum of three strands.
- (6) The height of every stay, and the like, over a street shall not be less than 18 ft. above ground-level.
- (7) When used to stay any pole carrying a high pressure or extra-high pressure electric line within borough, town district, or township limits, every metal stay, strut, or truss shall be earthed. Outside such limits, such stay, strut, or truss shall be earthed when any part thereof is erected at a less height than 9 ft. above ground-level.

(8) Every stay-wire made from steel having an ultimate strength of not less than 80,000 lb. per square inch shall have a factor of safety of not less than 2.25. All other stay-wires shall have a factor of safety of not less than 3.

41-92. (1) In those cases where the stay, strut, or truss is required by these regulations to be earthed, and where the resistance in accordance with Regulation 51-01 hereof cannot be obtained, the stay when used to stay poles other than metal, shall have, in addition to earthing, a strain insulator (or

insulators) of the interlocking type, or some other approved type, inserted therein not less than 9 ft. vertically above ground-level.

(2) Each insulator used shall have a mechanical strength at least equal to that of the stay in which it is installed, and for pressures not exceeding 35,000 volts shall also have a minimum flash-over voltage in accordance with Regulation 51-22 hereof. Where the pressure exceeds 35,000 volts the stay shall be insulated in an approved manner.

41-93. Every metal stay, strut, or truss with which a telegraph linesman is likely to make contact when attending to telegraph-lines shall be earthed.

PART 42.—OVERHEAD CONDUCTORS II.

PRECAUTIONS WITH METAL.

42-01. All live metal less than 14 ft. above ground-level, and attached to any pole or other support, shall be protected in such a manner that unauthorized persons cannot make accidental contact therewith.

42-02. All metal attached to any pole or other support, and not connected to the circuit, and which may become charged by accident or otherwise, shall be earthed or otherwise adequately protected if placed less than 9 ft. above ground-level.

42-03. Every metal tower and pole shall be earthed.

MAXIMUM SPAN.

42-11. (1) The distance between supports carrying an aerial electric line within borough or town district limits, or within such other limits as may be specified in the license, shall not exceed $2\frac{1}{2}$ chains (165 ft.) unless the Minister otherwise approves in writing.

(2) Where poles are erected on both sides of a street they shall, where practicable, be placed opposite each other.

42-12. The maximum span of any aerial electric line where crossing a railway-line shall not exceed that prescribed by clause (2) of Regulation 46-11 hereof.

42-13. The maximum span of any aerial electric line where crossing a telegraph-line shall not exceed that prescribed by paragraph (g) of Regulation 45-05 hereof.

STREET CROSSINGS.

42-21. Where an aerial electric line crosses any street within which it is erected, no angle formed by the street and the line crossing the street shall be less than 45°.

This regulation shall not apply to street intersections where the electric line does not change its direction.

COVERING OF AERIAL ELECTRIC LINES AND USE OF BARE WIRE.

42-31. (1) Every aerial electric line at medium pressure or any lower pressure within a borough, town district, or township, or within such other limits as may be specified in the license, shall, except as provided in Regulation 42-33 hereof, be covered throughout with good quality triple-braiding, thoroughly impregnated with weatherproof compound or other approved covering.

This covering shall not be deemed to be an insulating covering for making the line safe to handle when alive. All joints shall be effectively covered with compounded weatherproof tape.

(2) Every aerial electric line at high pressure within a borough, town district, or township, or within such other limits as may be specified in the license, shall be covered with vulcanized-rubber of at least 600 megohm grade.

This covering shall not be deemed to be an insulating covering for making the line safe to handle when alive. All joints shall be effectively covered with rubber and compounded weatherproof tape.

(3) Notwithstanding anything to the contrary in the foregoing provisions of this regulation, bare wires may be erected within borough, town district, or township limits in such places as are approved in writing by the Minister.

(4) Every aerial electric line at extra-high pressure shall be bare.

(5) Except as prescribed in Regulation 45-05 hereof, an aerial electric line at any pressure may be bare when erected outside the limits aforesaid.

42-32. (1) Every aerial electric line at medium pressure or any lower pressure which is attached to a building shall, except as provided in Regulation 42-33 hereof, be covered with good quality triple-braiding thoroughly impregnated with weather-proof compound or other approved covering :—

- (a) In the case of every residence—
- (i) For the whole length of such line where the length is 60 ft. or less ;
- (ii) For not less than 60 ft. from the residence where such line exceeds 60 ft.
- (b) In all other cases for a distance of not less than 6 ft. from the building.

(2) Where a pole is located adjacent to the building the wires between the top of the pole and the inside of the building shall be enclosed in galvanized conduit, which shall be earthed, turned down outside at least 45° and fitted with a bell-mouth.

(3) Every aerial electric line at high pressure which is outside of and attached to a building shall be effectively covered with vulcanized-rubber of not less than 600 megohm grade in the whole of the span between the building and the nearest pole.

42-33. Every aerial earthed neutral or middle conductor may be bare, and the earthed neutral of a star-connected medium pressure or any lower pressure system may, without the use of an insulator be attached to its support, other than a building, by a clamp of an approved type.

42-34. (1) A conspicuous, durable notice, reading, "Danger—Live Wires" or any equivalent suitable approved warning shall be affixed to poles or other supports carrying a high pressure bare conductor, or an extra-high pressure conductor.

(2) Such notice shall be fixed on not less than one pole or other support in five, and on every pole or other support at a telegraph, street, or railway crossing.

42-35. A notice as prescribed by clause (1) of the last preceding regulation shall be affixed to every pole, tower, or other support which carries any bare conductor (at any pressure) other than a bare neutral or middle conductor where such pole, tower, or other support is capable of being readily climbed without a special appliance.

42-36. The notices prescribed by Regulations 42-34 and 42-35 hereof shall:—

(a) Where the line is erected on the side of a street be so fixed that they are plainly visible from the street; and

(b) Be fixed at a uniform height of not less than 6 ft. or more than 12 ft. from the ground-level.

42-37. The erection and use of a bare high pressure or any lower pressure electric lines shall be subject to the following conditions:—

(a) When in the opinion of the Minister it is necessary in the interests of the public safety that the use in any place of a bare electric line shall be discontinued, the licensee shall, upon receiving notice from the Minister and within such time as he may fix, substitute therefor an electric line covered in the manner prescribed by Regulations 42-31 and 42-32 hereof; and

(b) Where a telegraph-line is affected the bare electric line shall also be subject to the conditions prescribed by Regulation 45-05 hereof with respect to the protection of telegraph wires; and

(c) The licensee shall observe such special conditions as the Minister may see fit to impose.

42-38. Where a railway communication-line or signal-wire is affected the electric line shall comply with the conditions prescribed by Regulation 46-15 hereof.

MEDIUM PRESSURE OR ANY LOWER PRESSURE, HIGH PRESSURE, AND EXTRA-HIGH PRESSURE ON SAME POLES.

42-51. Where medium pressure or any lower pressure and high pressure aerial electric lines; or medium pressure or any lower pressure and extra-high pressure aerial electric lines; or high pressure and extra-high pressure aerial electric lines; or all three systems are carried on the same poles, or supports, the following conditions shall apply:—

(a) The extra-high pressure shall not exceed 35,000 volts between phases; and

(b) Each earth-connection for the neutral point of high pressure or extra-high pressure systems shall consist of two independent leads to separate sets of earth-plates or earth-pipes connected in parallel; or, if town water-supply pipes are used for earthing purposes, the two independent leads shall be connected to such pipes at two points not less than 12 in. apart; and

(c) The resistance of each earth-connection shall comply with the requirements of Regulation 51-01 hereof; and

(d) The wires shall be placed as follows:—

(i) No medium pressure or lower pressure wire shall be above the level of any high pressure or extra-high pressure wire; and

(ii) No high pressure wire shall be above the level of any extra-high pressure wire; and

(iii) No medium pressure or any lower pressure wire shall be on the same level as any extra-high pressure wire.

Provided that where aerial lines cross any other separately owned aerial line, in accordance with Regulation 41-33 hereof the whole sets of lines of each owner shall be kept together, and shall pass as a whole either over or under the other owner's sets of lines.

COMMUNICATION-LINES ON ELECTRIC LINE POLES.

42-61. Every aerial communication-line (other than that of the Post and Telegraph Department) supported on poles or other supports carrying an electric line shall be of wire having a cross-sectional area of not less than 0.007 square inch (1/104 in. No. 12 S.W.G. 7/036 in. or 7/20 S.W.G.).

42-62. Where the induced pressure on the communication-line exceeds 650 volts such line shall for the purpose of clearance be deemed to be a high pressure electric line, and the clearance from other lines and ground-level shall be provided in accordance with the relevant requirements of Regulations 41-21 to 41-65 (both inclusive) hereof.

42-63. The minimum clearance between ground-level and any point of the span of the communication-line supported on poles or other supports carrying electric lines shall, subject to the requirements of the last preceding regulation, be 18 ft. on any street and 16 ft. in any other place.

42-64. Every telephone used on a communication-line supported on poles or other supports carrying an electric line shall be suitably guarded against lightning and shall be protected by cut-outs.

42-65. Where the communication-line is supported on poles or other supports carrying a high pressure or extra-high pressure electric line such arrangement shall be made as will prevent the possibility of any person using the telephone being injured as the result of any such electric line coming into contact with the communication-line or as the result of leakage or induction.

REMOVAL OF LINES.

42-71. Every aerial electric line (including a communication-line) shall be dismantled and removed within six months after it has ceased to be used for the supply of electrical energy or for communication purposes (as the case may be), unless written permission is obtained from the Chief Electrical Engineer for it to remain. The Chief Electrical Engineer, in giving permission, may lay down such conditions as he thinks necessary to secure the safety of employees and of the public from personal injury by reason of such lines.

42-72. If at any time it is deemed by the Minister to be detrimental to the public safety for overhead conductors, or any particular class of conductors, or any particular conductor to remain, the licensee shall, at his own expense, upon receipt of a notification to that effect from the Minister and within such time as the Minister specifies in such notification, replace such conductors by underground conductors.

PART 43.—UNDERGROUND CONDUCTORS.

CONDUCTORS.

43-01. Underground electric lines shall be thoroughly insulated, and shall be protected from mechanical injury by steel-armouring, wooden boxing, or earthenware, stoneware, concrete, iron, or fibre conduits or pipes. They shall be laid, wherever possible, under footpaths, and when so laid shall be not less than 9 in. underground. Where laid under any place used by vehicles they shall be laid not less than 2 ft. underground or be otherwise suitably protected.

43-02. Except by permission of the Minister of Telegraphs, all underground electric lines shall be placed on the same side of the street as aerial electric lines, and on the opposite side of the street to that on which underground or aerial telegraph-lines exist.

43-03. All conduits, pipes, casings, and street-boxes used as receptacles for underground electric lines shall be constructed of durable material, and shall be of ample strength to prevent injury from heavy traffic; and reasonable means shall be taken to prevent the accumulation of gas in such receptacles.

43-04. Where any underground electric line crosses or is in proximity to any metallic substance, special precautions shall be taken by the licensee against the possibility of any electric charging of the metallic substance from the electric line, or from any metallic conduit, pipe, or casing enclosing such line.

43-05. Where any underground electric line is brought through the surface of the ground and is accessible to any unauthorized person it shall, unless steel-armoured, be completely enclosed in a protecting pipe or be boxed in as approved by the Inspecting Engineer for a height of at least 8 ft. above the ground-level.

43-06. Every underground electric line placed in a tunnel or subway not in the sole occupation of the licensee shall be insulated, and, where necessary, protected by an earthed metallic sheath or enclosed in an earthed metal pipe.

43-07. Where any high pressure or extra-high pressure electric line is laid beneath the surface of the ground efficient means shall be taken to render it impossible that the surface of the ground or any other electric line or conductor shall become charged by leakage from the high pressure or extra-high pressure electric line.

43-08. Where an electric line passes under a railway line it shall comply with the requirements of Regulations 46-21 to 46-24 (both inclusive) hereof.

43-09. No underground electric line shall be used for the supply of electrical energy before it has been completely laid, properly jointed, examined, and tested in accordance with Regulation 51-21 hereof.

STREET-BOXES.

43-21. The cover of every street-box shall be so secured that it cannot be opened except by means of a special appliance, and such boxes shall be inspected by the licensee from time to time for the presence of gas, and suitable action shall be taken to check the influx and accumulation of gas.

43-22. No extra-high pressure electric line shall pass through the same street-box as any other electric line unless it is enclosed in strong earthed metal casing.

43-23. No street-box containing an extra-high pressure electric line shall contain water, gas, or other service pipes.

43-24. Every street-box shall comply with Regulation 43-03 hereof.

EARTHING.

43-31. All metal conduits, pipes, or casings containing high pressure and/or extra-high pressure electric lines shall be earthed and shall be so jointed and connected across all street-boxes and other openings as to make good electrical contact throughout their whole length.

PART 44.—INSULATION OF ELECTRIC LINES.

44-01. If the insulation of any circuit of any system is faulty, immediate steps shall be taken to make good the insulation before the circuit is again placed in service.

PART 45.—PROTECTION OF TELEGRAPH-LINES AND TELEGRAPH APPARATUS.

45-01. The licensee shall take all reasonable precautions in constructing, laying down, placing, and using the electric lines so as not injuriously to affect, whether by induction or otherwise, any telegraph-line.

45-02. All apparatus shall be designed to avoid harmonics liable to cause interference to telegraph-lines, but where such harmonics cannot be avoided, then additional apparatus shall be installed to reduce the interference to a minimum.

45-03. Where one or more extra-high pressure circuits run substantially parallel with telegraph-lines or railway communication-lines or signal-wires the circuits shall, if required by the Minister, be transposed, revolved, or so arranged as to reduce inductive interference to a minimum.

45-04. Except at a crossing-place the minimum separation between a telegraph-line and a high pressure or extra-high pressure aerial electric line shall be equal to the height of the tallest pole, unless otherwise approved in writing by the Minister of Telegraphs.

45-05. Where an electric line intersects or menaces a telegraph line the following conditions shall apply:—

- (a) Every high pressure aerial electric line shall be covered with vulcanized rubber of not less than 600 megohm grade, unless the electric lines are bare, in which case the special conditions of paragraphs (l) to (o) (both inclusive) of this regulation shall apply.
- (b) Every medium pressure or any lower pressure aerial electric line (except neutral) shall be covered with good quality triple-braiding, thoroughly impregnated with waterproof compound or other approved covering, unless the electric lines are bare, in which case the special conditions of paragraphs (l) to (o) (both inclusive) of this regulation shall apply.
- (c) Where any lead-covered telegraph cable and high pressure or any lower pressure aerial electric line intersect, the high pressure electric line shall be covered with vulcanized rubber of not less than 600 megohm grade, and the lower pressure electric line (except neutral) shall be covered with good quality triple-braiding, thoroughly impregnated with weatherproof compound, or other approved covering.
- (d) The clearance at any time between a high pressure aerial electric line and a telegraph-line at any point shall not be less than 4 ft., and between a lower pressure aerial electric line and a telegraph-line shall not be less than 2 ft., except as provided in paragraph (e) of this regulation. At any intersection the minimum distance between a telegraph-line and an extra-high pressure aerial electric line up to 11,000 volts shall be 4 ft., and over 11,000 volts 8 ft. No provision as regards clearances need be made for guard-wires for telegraph-lines.

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(e) Where a high pressure or any lower pressure overhead electric line and a telegraph-line intersect, the electric line shall cross above or below the telegraph-lines as may be decided by the Minister of Telegraphs, provided that a medium pressure or lower pressure overhead electric service-line, if enclosed in a pipe which is earthed or enclosed in an insulating casing approved by the Chief Engineer of the Post and Telegraph Department may cross on the same crossarm as a telephone-wire.

(f) Where a high pressure or any lower pressure aerial electric line and a telegraph-line intersect, the electric line shall, wherever practicable, cross at a pole or other support; but where crossing at a pole or other support is not practicable the crossing may, subject to the approval of the Minister of Telegraphs be made in the span.

(g) Where any aerial electric line and a telegraph-line (other than a telephone service-line) intersect, whether at a pole or in the span, such electric line shall be erected and maintained in accordance with the requirements of Regulations 41-78 and 41-93 hereof and of the following table:—

	Medium Pressure and any Lower Pressure.	High Pressure.	Extra-high Pressure.
(i) Covering	T.B. or other approved covering	V.I.R. in boroughs, town districts, and townships; bare outside these limits	Bare.
(ii) Vertical clearance to telegraph-line (minimum)	2 ft. (or as provided in paragraph (e) of this regulation)	4ft.	4 ft. 11,000 volts; 8 ft. over 11,000 volts.
(iii) Length of span at crossing	..	Not greater than normal span of the line.	
(iv) Length of adjoining spans	Not greater than normal span of the line	Not greater than one and a half times normal span of the line.	
(v) Construction to be provided against conductor breakage	..	(A) Strength of supports and binders to withstand one broken wire. (B) Where stranded wire is used there shall be provided at the crossing double cross-arms, each fitted with pin, strain or approved shackle insulators save that where suspension insulators are used the crossarms may be single. (C) No joint in any stranded wire having an area less than 0.085 sq. in. (7/080 in. or 7/14 S.W.G.) or in any solid wire of any size.	Same as high pressure, but no shackle insulators.
(vi) Protection to be provided against damage by broken wires	T.B. or other approved covering	(A) Earthing-guards for all solid wires. (B) V.I.R. covering in boroughs, town districts, and townships	Same as high pressure, except V.I.R. requirements.

(h) In any case where an overhead electric line is erected before the telegraph-line, the licensee, on receipt of notice from the Minister of Telegraphs that it is proposed to run a telegraph-line along or across the route, shall forthwith make all alterations necessary for the protection of telegraph-lines, and shall have the option of:—

(i) Altering the construction of the electric line to conform to the requirements of Regulation 41-01 to 41-03 (both inclusive) hereof and of the last preceding paragraph of this regulation; or

(ii) Providing earthing-guards under the high pressure or extra-high pressure electric line where alteration of the existing construction is not considered desirable.

This sub-paragraph shall be read in conjunction with the drawings shown on Folders Nos. 1 and 2, in Appendix III hereto.

(i) In the case of an overhead electric service-line crossing to that side of a street which is reserved for telegraph-lines, the licensee shall bear the cost of any alterations necessary to provide clearances and protection for any telegraph-line erected subsequent to the electric service-line. Conversely, in the case of a telegraph-line crossing to that side of a street which is reserved for the licensee's electric lines, the cost of any alterations necessary to the telegraph-line to provide regulation clearances will be borne by the Minister of Telegraphs.

- (j) Where an aerial electric line covered with triple-braiding or other approved covering is erected along a route and at any time thereafter it is proposed to intersect such electric line by a telegraph-line, the cost of protecting the telegraph-line or of any alterations to the electric line required by the Minister of Telegraphs will be borne by that Minister.
- (k) Where an aerial electric line, covered with triple-braiding or other approved covering is erected subsequent to a telegraph-line, and intersects or menaces such telegraph-line, the cost of protection or of any alterations considered necessary by the Minister of Telegraphs to make any such line conform to the requirements of these regulations shall be borne by the licensee.
- (l) Where a bare aerial electric line outside borough, town district, or township limits is erected subsequent to a telegraph-line and intersects or menaces such telegraph-line, the cost of all protection or of any alteration necessary to make any such line conform to the requirements of these regulations shall be borne by the licensee.
- (m) Where a bare aerial electric line intersects or menaces a telegraph-line within borough, town district, or township limits, the licensee shall bear the cost of protecting all telegraph-lines erected before or after the bare electric line.
- (n) Where it is proposed to intersect a bare aerial electric line outside borough, town district, or township limits by a telegraph-line erected subsequent to such electric line, and whether such electric line has been erected before or after the coming into force of these regulations, then :—
 - (i) If the said electric line at the proposed intersection is not in accordance with the requirements of these regulations, the cost of any alterations required under these regulations for the protection of the telegraph-line shall be borne by the licensee.
 - (ii) If the said electric line at the proposed intersection is in accordance with the requirements of these regulations, then the cost of any alterations considered necessary by the Minister of Telegraphs will be borne by that Minister.
- (o) Where a telephone service-line and any extra-high pressure or bare high pressure aerial electric line intersect, the following conditions shall apply :—
 - (i) If the conductors of the electric line are of stranded wire of a size smaller than that specified in Regulation 41-03 hereof or are of solid wire of any size, the telephone service-line shall be protected by earthing-guards approved by the Chief Engineer of the Post and Telegraph Department.
This sub-paragraph shall be read in conjunction with the drawing shown in Folder No. 3 in Appendix III hereto.
 - (ii) If the said electric line is erected subsequent to the telephone service-line the cost of providing the earthing-guards shall be borne by the licensee.
 - (iii) If the said telephone service-line is erected subsequent to the electric line the cost of providing the earthing-guards will be borne by the Minister of Telegraphs.

45-06. Where a metal extension-piece is used for fixing medium pressure or any lower pressure electric line to the top of a telegraph pole the insulator pin or metal work shall not make contact with the metal extension-piece, and a wooden crossarm shall be used, provided that, where the system is three-phase, four-wire, star-connected, the pins and metal work may be earthed to the neutral and the wooden crossarm may be omitted.

45-07. No lamp-bracket or span-wire shall be fixed to a telegraph pole without the consent of the Minister of Telegraphs. Where span-wire construction is used for supporting a street-lamp the span-wire shall have a suitable strain insulator inserted between the lamp and the telegraph pole at a distance of not less than 6 ft. from such pole.

45-08. When work on any telegraph-line is being carried out by the authority of the Minister of Telegraphs in the proximity of a bare aerial electric line, such electric line shall, at a time when it will cause the least inconvenience to the licensee, be temporarily disconnected from the source of supply if the Telegraph Engineer so requests.

45-09. The licensee shall accept as final any decision given by the Chief Electrical Engineer as to the interpretation or application in any particular case of the regulations contained in Part 45 hereof.

45-10. Any crossarm carrying a high pressure electric line which is erected on a pole carrying a telegraph-line shall comply with the requirements of Regulation 41-78 hereof,

45-11. Any stay, strut, or truss with which a telegraph linesman is likely to make contact when attending to a telegraph-line shall comply with the requirements of Regulation 41-93 hereof.

PART 46.—RAILWAY CROSSINGS.

CONSENT OF RAILWAYS BOARD.

46-01. No work of any nature authorized by the license shall be erected or constructed upon, over, or under any part of the Government Railways until the licensee has first obtained the consent of the Railways Board thereto.

46-02. When a licensee proposes to make any alteration or addition involving structural alterations and/or additional risks at a crossing the Railways Board may require that the complete construction be brought into conformity with the requirements of Regulations 46-11 to 46-31 (both inclusive) hereof.

OVERHEAD CONDUCTORS.

46-11. (1) No pole or other support shall be erected nearer to the railway track than specified in the undermentioned clearances, the distances given being measured from the centre of the nearest railway track to the near face of the pole or other support :—

On sidings	9 ft.
In all other cases	12 ft.

At loading sidings, sufficient clearance shall be left between the rail and the pole or other support to allow for a driveway for vehicles.

(2) The span where the licensee's overhead line crosses the railway shall not exceed 110 ft., except that where the contour of the land or other circumstances makes it desirable that this maximum be exceeded the Railways Board may at its discretion allow a longer span or require another route to be chosen where this limit may be obtained.

(3) Where the licensee's overhead line crosses the railway, the pole at each side of the crossing span shall be embedded in concrete for a minimum depth of 12 in. below ground-level and with a minimum radial thickness of concrete of 12 in. or, alternatively, each pole shall be blocked at heel and surface with hardwood, totara, or concrete blocks of at least 24 in. by 9 in. by 6 in. in size to prevent the pole from falling towards the railway-line. The poles at the crossing shall, when required by the Railways Board, be stayed by means of a stranded steel stay-wire.

46-12. (1) Except when the Signal and Electrical Engineer may require in writing a greater clearance, the minimum clearances above rail-level at the crossing for all aerial wires when at maximum sag shall be as follows :—

Electric lines at extra-high pressure ..	27 ft.
Electric lines at any lower pressure ..	24 ft.
Telephone lines on electric line supports ..	22 ft.
Telephone lines not on electric line supports	18 ft.
Stays	18 ft.
Earthing-leads	18 ft.

(2) The minimum clearances of all aerial wires when at maximum sag from the railway communication-lines or signal-wires shall be as hereunder, the licensee's wires in all cases being above the railway communication-lines or signal-wires :—

Electric lines at extra-high pressure—	
Not exceeding 11,000 volts	6 ft.
Exceeding 11,000 volts	8 ft.
Electric lines at high pressure	4 ft.
Electric lines at medium pressure or any lower pressure	2 ft.
Stays	2 ft.
Earthing-leads	2 ft.

46-13. (1) All aerial wires in the crossing span and for a full span on each side of the crossing shall be of dimensions not less respectively than those shown in the following table :—

Material.	Medium Pressure or any Lower Pressure.	High Pressure or Extra-high Pressure
(a) Copper	7/·064 in. or 7/16 S.W.G.	7/·064 in. or 7 S.W.G.
(b) Galvanized-iron, galvanized-steel, or copper-covered steel	Stranded wire 7/·064 in. or 7/16 S.W.G.; Solid wire 1/·160 in. or No. 8 S.W.G.	Stranded wire 7/·1 in. or 7/16 S.W.G. Solid wire 1/· in. or No. 8 S.W.G.
(c) Steel-core aluminium	7/·0586 in. ..	7/·0743 in.
(d) Steel-reinforced aluminium (4 steel, 3 aluminium)	7/·0661 in. ..	7/·0661 in.

(2) No joint shall be made in any aerial conductor in a crossing span or in either of the approach spans.

(3) Double crossarms each fitted with insulators shall be erected on each pole or other support of the crossing span.

(4) The licensee shall, if required by the Signal and Electrical Engineer at the time when the application is granted, erect one pole or other support of the crossing in the run of the railway wires, and such pole or other support shall then be side-armed to carry the railway wires. The licensee shall pay all charges incidental to attaching the railway wires to the side-arms.

46-14. Where an aerial conductor crosses the railway, earthing-guards of a type approved by the Signal and Electrical Engineer shall be provided in the following positions:—

(a) Where all angles of intersection of the railway wires and the electric line are 45 degrees or over:—

(i) With railway wires attached to the electric line pole One earthing-guard on each side of such pole.

(ii) With railway wires in the span and free of the electric line pole One earthing-guard on the railway side of the electric line pole on each side of the crossing span.

(b) Where any angle of intersection of the railway wires and the electric line is less than 45°:—

In all cases, whether railway wires are attached to electric line pole or not One earthing-guard on each side of the electric line pole nearest the railway wires, and one on the railway side of each pole on either side of the aforesaid pole.

The term "pole" includes any other support.

The foregoing regulation shall be read in conjunction with the drawing shown on Folder No. 4 in Appendix III hereto.

46-15. (1) All aerial conductors in the crossing span and in the approach spans shall be bare, except:—

(a) In borough, town district, or township limits, in which case Regulation 42-31 hereof shall apply; or

(b) Within such other limits as may be specified in the license, in which case Regulation 42-31 hereof shall apply; or

(c) Where the electric lines cross the Post and Telegraph Department's lines, in which case Regulation 45-05 hereof shall apply.

(2) Where covered wire is used, the covering shall be removed for a distance of 3 ft. over the earthing-guard so that in the event of a line falling it will make metallic contact with such guard.

46-16. If guard-wires are required to meet special conditions, they shall be erected by the Railway Department over the railway wire at the expense of the licensee wherever they may be deemed to be necessary by the Signal and Electrical Engineer.

46-17. Where electric traction is in use on a railway all electric lines crossing the railway shall be taken underground except when the pressure of the electric line is 33,000 volts or over, in which case the crossing shall be subject to special arrangements with the Signal and Electrical Engineer.

UNDERGROUND CONDUCTORS.

46-21. Where any underground electric line is required to cross a railway, it shall be laid as near to a right angle to the railway track as is practicable. It shall be laid at a minimum depth of 2 ft. 6 in. below the base of the rails, and within the confines of the railway reserve shall be not less than 2 ft. below normal ground-level.

46-22. A protective covering as required by the Signal and Electrical Engineer shall be laid above all underground electric lines on railway property.

46-23. To indicate clearly the position of every underground electric line on railway property, a marker board shall be erected on each side of the railway and shall bear the following words in clear print:—

"Danger [state pressure] volt cable crosses here."

46-24. In all cases a detailed scale plan of the licensee's proposals shall be forwarded to the Signal and Electrical Engineer for his approval.

GENERAL.

46-31. Wherever the words "Minister" or "Minister of Telegraphs" appear in any of Regulations 45-01 to 46-31 (both inclusive) hereof the same shall in addition be read as "Railways Board" in all cases where the interests of the Railways Board are affected.

PART 47.—ELECTRIC SERVICES.

ELECTRIC SERVICE-LINES.

47-01. All overhead electric service-lines connected to aerial lines shall be taken direct from insulators on poles or other supports.

47-02. All aerial electric service-lines shall be led as directly as possible to insulators firmly attached to a position on the building on the consumer's premises which is not accessible to any person without the use of a ladder or other special appliance.

47-03. No aerial electric service-line shall be run on a bobbin or similar insulator attached to the exterior of a building. It may be carried on brackets attached to a building, provided that it is inaccessible from any portion of the building without the use of a ladder or other special appliance, and further provided that it is secured in such a manner that it cannot fall away from the insulator-support or make contact with the building.

47-04. (1) The distance between the last point of attachment of the aerial electric service-lines on the building and the point of entry into the building shall not exceed 30 in.

(2) Service-mains shall enter the building as near as practicable to the point at which the aerial electric service lines are first attached to the building.

SERVICE CONNECTIONS.

47-11. Before giving supply to any premises, the licensee shall satisfy himself that all electric lines, wires, fittings, and apparatus belonging to him or under his control which may be upon a consumer's premises on the licensee's side of the main switch of the consumer's installation are in a safe condition and in all respects fit for supplying electrical energy; but nothing in this regulation shall relieve the consumer of responsibility for the condition of his installation and of every appliance and electric service-line which may be on such consumer's premises other than any apparatus or service-line belonging to the licensee.

47-12. The position of the entrance point for service-mains and the position of meters and main switchboard on the consumer's premises shall be to the approval of the electrical supply authority.

47-13. For the protection of tradesmen the licensee shall, on request by any consumer, and on receipt of an undertaking to pay the cost, cut off the supply to any building on such consumer's premises or otherwise render the electric service-lines safe where any work has to be carried out in close proximity to such lines.

47-14. Where the supply has been disconnected at the request of the consumer or by reason of his default, the licensee may, before reconnecting the supply, charge a reconnection fee (not exceeding 10s.), together with a mileage charge (not exceeding 6d. a mile) each way between the address for business purposes of the servant of the licensee who is to make such reconnection and the premises to be reconnected.

47-15. All service cut-outs shall comply with the following requirements:—

(a) A suitable cut-out or automatic circuit-breaker shall be inserted in each electric service-line other than an earthed conductor.

(b) Outdoor cut-outs shall be used wherever practicable in order to protect the service-mains. They should, wherever possible, be fitted on the pole outside the building, so that the electric service-lines may be easily disconnected when work is being carried on outside the building, and to prevent unauthorized persons from replacing blown fuse-links or overfusing the service.

(c) All outdoor cut-outs shall be weatherproof, and if enclosed in a metal case such case shall not be earthed.

(d) All indoor cut-outs shall be contained within a suitable locked or sealed receptacle of fireproof construction.

(e) Where the pressure between conductors exceeds 250 volts the phase conductor, or outer conductor, fuse-links shall be separated by an insulating partition, and shall be so arranged that any two conductors cannot be accidentally touched simultaneously.

47-16. Where any tree is in contact with, or reasonably likely to cause injury to, any overhead electric service-line the licensee shall discontinue to supply electrical energy through such service-line until either such tree has been removed or so trimmed as to be no longer in contact with such service-line and be unlikely to cause injury thereto or the service-line has been adequately protected.

PART 48.—CONSUMERS INSTALLATIONS.

48-01. The licensee shall be exempt from the provisions of Regulations 48-03, 51-41, 51-42, 51-43, and 52-02 hereof in so far as supply to any Government railway station, Government railway workshop, or to any apparatus on any Government railway line is concerned.

48-02. For the purpose of ensuring that the requirements of these regulations and of the Electrical Wiring Regulations, 1935, are being complied with it shall be a condition precedent to supply, or continued supply, in every instance that the consumer shall serve upon the licensee twenty-four hours notice of:—

- (a) The consumer's intention to install or have installed any electric line, wire, fitting, apparatus, and appliance on any premises; and
- (b) The consumer's intention to make or have made any addition or alteration to his installation.

48-03. The licensee shall not supply electrical energy to any person whose installation does not comply with the requirements of these regulations and of the Electrical Wiring Regulations, 1935, and of the Electrical Wiremen's Registration Act.

48-04. In the case of any electrical installation already supplied by a private plant or by some other electrical supply authority, the electrical supply authority may connect such installation to its electric lines subject to the requirements of Regulation 12-03 of the Electrical Wiring Regulations, 1935, being complied with.

48-05. A licensee declining to connect a consumer's installation to the licensee's electric lines shall, on request, serve upon the consumer notice in writing stating the reasons for so declining.

48-06. Such instructions as the Minister may from time to time issue or approve as to the treatment of persons receiving electric shocks shall be delivered to consumers to be affixed in consumers' premises at all places where electrical energy is generated, transformed, or used above medium pressure, and at such other places in such premises as the Minister may direct.

48-07. The electrical supply authority shall at least once in each year, by means of a separate printed leaflet, notify every consumer within the area of supply to the following effect:—

- “(a) Do not permit any one except a person registered or licensed under the Electrical Wiremen's Registration Act, 1925, and its amendments, to repair, alter, or make addition to your electrical installation. (Penalty under above Act £50.)
- “(b) You must notify [*Name of licensee*] of all proposed alterations and additions to the installation, and no such alteration or addition is to be effected until approved by [*Name of licensee*]. You should ascertain that your contractor has received the necessary permit.
- “(c) Any deterioration of, defect in, or damage to, electrical equipment, flexible cords, or wiring should be remedied immediately by a duly qualified person. Your co-operation in this will tend to remove any danger from fire or shock.
- “(d) Building alterations or repairs likely to affect any part of the electrical installation or require its temporary removal must be notified to [*Name of licensee*].
- “(e) Any person who, without lawful authority, tampers with electric lines or other apparatus the property of [*Name of licensee*] is liable to a fine of £20.
- “(f) You are warned against using any portable hand-lamp which does not comply with the requirements of the Electrical Wiring Regulations, 1935.
- “(g) Do not use any portable apparatus in any position where you may make contact with earthed metal or other conducting material, or in damp situations, unless the apparatus is specially protected to prevent danger from shock. Earthed metal consists of water-pipes, baths, gas-pipes, &c.; conducting material consists of damp concrete floors, brick walls, &c.”

DIVISION V.—TESTING, MAINTENANCE, AND INSPECTION.

PART 51.—INSPECTION AND TESTING.

EARTHS.

51-01. All earthing-leads and earth-connections shall, before the electric lines, electrical apparatus, or other devices are lived up, be tested for electrical resistance, and if such resistance exceeds 10 ohms the licensee shall not, save with

the consent in writing of the Minister, use the electric line, electrical apparatus, or other device so earthed until the resistance has been reduced to 10 ohms or less.

51-02. (1) All earthing-leads and earth-connections, except those specified in Regulation 45-06, shall be tested not less than once every twelve months.

(2) All earthing-leads and earth-connections to which Regulations 31-34, 32-02, and 42-51 (b) hereof apply shall be tested at regular intervals of not more than six months.

(3) The tests required by this regulation shall be made by the licensee during dry months as far as possible, to ensure that all earthing-leads are intact and that the earth-connections are effective.

(4) Where the neutral of a low pressure star-connected system or the middle conductor of a low pressure three-wire single-phase system is connected to earth on the consumer's premises the aforesaid tests may be omitted on such connection.

(5) Where the resistance to earth exceeds 10 ohms, or such greater resistance as may from time to time be approved in writing by the Minister for any particular case, the necessary steps shall be taken to reduce the resistance to the required value.

51-03. A record of every earth test made and the results thereof shall be kept by the licensee for a period of not less than two years after the date of testing, and shall be available for inspection by the Inspecting Engineer and other officers of the Public Works Department and officers of the Post and Telegraph Department and Government Railways Department when required.

51-04. Not later than the 30th day of June in every year, in respect of the period of twelve months ending on the 31st day of March then last past, there shall be forwarded—

- (a) To the Chief Electrical Engineer, a certified copy of the record of all earth tests made; and
- (b) To the Telegraph Engineer, a certified copy of the record of all tests made on guards erected over telegraph wires and on all earthed metal at telegraph crossings; and
- (c) To the Signal and Electrical Engineer, a certified copy of the record of all tests made on guards and earthed metal at railway crossings.

51-05. Each earth-connection shall be given a designation number for identification purposes, and such number shall be used in all records. Should the number be changed for any reason, then both the old and new designation numbers shall be entered in the first certified copies of records forwarded pursuant to the last preceding regulation after such change.

51-06. Additional tests of any earthing-lead or earth-connection shall be made if and when required by the Minister.

CONCRETE POLES.

51-11. The Minister shall have the right of testing any concrete pole which in his opinion may not have the requisite strength and factor of safety, and the cost of such test shall be borne by the licensee, and the Minister shall not be liable for any damage to, or destruction of, a pole arising in connection with such test.

51-12. For testing purposes the portion of the concrete pole taken as the lever-arm shall be that portion above ground-line where a ground-line is defined on the pole, otherwise it shall be the upper 85 per cent. of the overall length of the pole. The test-load shall be applied at a point one foot from the top of the pole.

INSULATION AND SAFEGUARDS.

51-21. No electric line shall be brought into use until it has been tested for insulation by the continuous application for half an hour of the maximum pressure for which such line is to be used, and has withstood such application to the satisfaction of the Inspecting Engineer.

51-22. Every insulator used in any stay as required by clause (2) of Regulation 41-92 hereof shall have a minimum flashover voltage (when tested with a sphere gap), in accordance with the following table:—

Maximum Voltage (between Phases) of Lines on Support to which Stay is attached.	Minimum Dry Flashover Voltage.	Minimum Wet Flashover Voltage, 0.2 in. Rain per Minute.
650 volts	5,000	3,500
3,300 volts	10,000	6,000
6,600 volts	14,000	7,000
11,000 volts	20,000	11,000
22,000 volts	35,000	22,000
35,000 volts	50,000	35,000

51-23. (1) All insulating-gloves, boots, goloshes, and stands, rubber protective-covers and mats, and safety-belts shall be inspected immediately before use, and any found to be physically damaged, or substantially deteriorated, shall be destroyed immediately, or placed, pending repair, in a receptacle from which they cannot be inadvertently taken for use.

(2) All insulating-gloves, boots and goloshes, and rubber protective-covers shall be tested for insulation once in every two months or after fourteen days use, whichever is the lesser period, and no such equipment shall be used unless it has been so tested and found to be an effective insulant at any pressure at which it is likely to be used.

(3) All safety-belts shall be tested at intervals of not more than six months up to a tension of 500 lb.

(4) A record of every test made on protective equipment, and the results thereof, shall be kept by the licensee for a period of not less than two years after the date of test, and shall be available for inspection by the Inspecting Engineer when required.

51-24. It shall be the duty of every person working on the lines or apparatus to satisfy himself that such safeguards are in good physical and mechanical order and condition.

METERS.

51-31. (1) Before any meter used for the purpose of ascertaining the amount to be paid by the consumer for electrical energy is connected for that purpose, it shall be tested by the licensee, and shall not be installed unless it records within 2½ per cent. above or below the true value :

Provided that meters may for a period of six months after the date of commencement of first supply pursuant to a license issued or taking effect, under the Public Works Act, 1928, to consumers within any area, and if no supply to consumers within that area has previously been given pursuant to any such license, be installed before being tested, but every such meter shall be tested within six months after the date of installation thereof.

(2) If any meter installed pursuant to the foregoing proviso before being tested is found on testing to have an error exceeding 2½ per cent. as aforesaid, it shall be adjusted immediately to within such margin of error or be replaced by a meter which has passed such test as aforesaid, and the licensee shall adjust the consumer's account for electrical energy for the whole period during which such defective meter was installed.

51-32. (1) If any consumer considers that the meter installed in accordance with clause (1) of the last preceding regulation is recording in excess of the amount of electrical energy used, the licensee shall, on receipt of notice to that effect (accompanied by a deposit of 10s.), from the consumer, cause the meter to be tested and a certificate issued showing the result of such test.

(2) In the event of the meter recording in excess of the amount of electrical energy used to the extent of more than 2½ per cent. over the range of load on which it has been used it shall be adjusted immediately to within 2½ per cent. or be replaced by another meter which has been duly tested and found to be accurate within such limits, the deposit of 10s. shall be returned to the consumer, and the licensee shall adjust the consumer's account for electrical energy for the period for which the consumer is charged, on the last account form rendered prior to the notice aforesaid being served on the licensee.

(3) In the event of the consumer being dissatisfied with the licensee's test of the meter he may appeal to the Chief Electrical Engineer, whose decision shall be final and binding. The cost of any test made for the purpose of deciding such appeal shall be borne by the licensee or the consumer, as the Chief Electrical Engineer directs, and shall constitute a debt due to the Crown.

CONSUMERS' INSTALLATIONS.

51-41. The electrical supply authority shall make it a condition of supply in every case that the consumer shall render it every reasonable facility for inspecting and testing any electric line, wire fitting, apparatus, and appliance, which may be on the consumer's premises, during the progress of installation, alteration or addition, and at any time after its completion.

51-42. The electrical supply authority shall inspect and test every installation, and every alteration thereof or addition thereto, free of cost, provided that if after the contractor has notified the licensee that the installation is completed it is found necessary to reinspect or retest the new work the licensee may charge the contractor a fee not exceeding 10s. for each reinspection or retest.

51-43. For the purpose of ascertaining that a consumer's installation and every appliance connected therewith is free

from electrical hazard the electrical supply authority shall make periodical inspections and tests of such installation at intervals of not more than five years.

51-44. The licensee shall, at any time on request by the consumer and on receipt of an undertaking to pay the cost thereof, inspect and test the consumer's installation.

51-45. If any consumer is dissatisfied with the action of the licensee in refusing to give, or in discontinuing, or in not recommencing, the supply of electrical energy to his premises upon the ground only that the installation or any appliance connected therewith constitutes an electrical hazard, such installation and/or appliance may, on his application to the Minister and on payment of the cost, be inspected and tested by an Inspecting Engineer. If the Inspecting Engineer is satisfied that such installation and every appliance connected therewith is free from electrical hazard, the licensee shall not, after receipt of notice to that effect from the Inspecting Engineer, be entitled to refuse to supply the consumer with electrical energy only upon the ground aforesaid.

LICENSEE'S LINES AND WORKS.

51-51. (1) The licensee shall make inspections of the whole of the electric lines and works belonging to him or under his control at such intervals as may be necessary to comply with the requirements of Regulations 52-02 and 52-11 hereof.

(2) A record of every inspection made shall be kept by the licensee for a period of not less than two years after the date of inspection, and shall be available for inspection by the Inspecting Engineer when required.

51-52. The Minister may, at the expense of the licensee and at any time and from time to time, order an inspection to be made by an Inspecting Engineer of the whole or any part of the electric lines and works carried out, erected, or maintained by the licensee under the license.

51-53. For the purpose of facilitating any inspection the licensee shall—

- (a) Provide any necessary transport for the Inspecting Engineer within the area to which the license relates; and
- (b) Lend to the Inspecting Engineer necessary available instruments required by him for the purpose of making any test; and
- (c) Render every reasonable assistance to the Inspecting Engineer; and
- (d) Arrange for an officer to accompany the Inspecting Engineer when necessary.

51-54. (1) Fees in respect of any such inspection by the Inspecting Engineer shall be paid by the licensee as follows :—

(a) For any installation up to and including	£	s.	d.
100 kilowatts	2	2	0
(b) For any installation over 100 kilowatts and not exceeding 500 kilowatts ..	3	3	0
(c) For any installation over 500 kilowatts and not exceeding 1,000 kilowatts ..	4	4	0
(d) For any installation over 1,000 kilowatts	5	5	0
(e) For maintenance of and extensions to plant or lines, per inspection ..	2	2	0
(f) For any inspection exceeding two days, extra fee for each day after first two days	1	1	0

(2) For the purposes of this regulation an extension to lines means any new line erected in a portion of the district already inspected.

(3) For the purposes of this regulation the rating in kilowatts of any installation shall be deemed to be the capacity of the generating or main transforming plant.

PART 52.—MAINTENANCE.

CONSUMERS' INSTALLATIONS.

52-01. Every consumer shall maintain free from electrical hazard the installation and every appliance and electric service-line connected therewith which may be on such consumer's premises, save that this regulation shall not apply to any apparatus or service-line belonging to the licensee.

52-02. If as the result of an inspection made in compliance with Regulation 51-51 hereof any defect is found in any electric service-line not belonging to the licensee, he shall immediately notify the consumer of such defect and require him to have it remedied forthwith.

52-03. If a consumer fails so to maintain his installation and every appliance connected therewith, the licensee shall (subject always to the provisions of Regulation 51-45 hereof)—

- (a) In the case where the installation or appliance is in a dangerous condition, forthwith discontinue to supply from the electric lines of the licensee.

(b) In all cases discontinue to supply from the electric lines of the licensee after a reasonable period has been allowed in which to effect repairs and such repairs have not been effected.

(c) Not recommence supply from the electric lines of the licensee until the defects, on account of which supply was discontinued, have been remedied.

52-04. No consumer shall use, or continue to use, any apparatus or appliance which will unduly interfere with satisfactory supply to any other consumer.

LICENSEES' LINES AND WORKS.

52-11. The licensee shall maintain all electric lines and works belonging to him in good order and condition, and shall take all reasonable precautions to secure at all times continuity of service and immunity from danger.

52-12. If as the result of an inspection made in compliance with Regulation 51-52 hereof any defect is found to exist, it shall be remedied forthwith; and if in the opinion of the Inspecting Engineer such defect is serious the Minister may, on receipt of a report to that effect, direct the licensee forthwith to cease using any defective electric line, wire, fitting, accessory, apparatus, or appliance (as the case may be) until such defect is repaired or remedied to the satisfaction of the Inspecting Engineer.

52-13. Where the licensee neglects to remedy all defects within sixty days after a written notification thereof from the Chief Electrical Engineer and continues to operate the electric line, wire, fitting, accessory, apparatus, or appliance, the subject of the notification, the Minister may:—

- (a) Notify the licensee in writing to discontinue operation until such time as the necessary steps have been taken to bring the electric lines or other works into conformity with the requirements of the regulations, and the licensee shall forthwith comply with any notification of the Minister given under this regulation; or
- (b) Carry out or cause to be carried out such alterations or repairs as may be necessary to bring the electric lines or other works into conformity with the requirements of the regulations, and the cost of such work shall be recoverable from the licensee as a debt due to the Crown.

PART 53.—RIGHT OF ENTRY.

53-01. It shall be lawful for the Chief Electrical Engineer, or any person authorized by him in writing, or for any Inspecting Engineer at all times after the grant of the license, whether during or after the construction of any works, to enter upon and inspect such works for the purpose of ascertaining whether the conditions of the license and the regulations are being faithfully complied with, and for that purpose to require that any motive machinery be set in motion and to take specimens of material, make tests and measurements, and do all other things reasonably necessary or convenient for the purposes of such inspection, and the licensee shall at all times comply with the reasonable requirements of any such person in the premises.

53-02. (1) Any person authorized in writing in that behalf by the Minister may at any time, between the hours of 9 a.m. and 5 p.m. on any day of the week other than Sunday, demand admission to the premises of any consumer for the purpose of ascertaining whether the requirements of these regulations or of the Electrical Wiring Regulations, 1935, have been complied with.

(2) If any consumer refuses to admit such person during such hours the electrical supply authority shall, on demand in writing by the Chief Electrical Engineer, discontinue to supply electrical energy to such consumer.

53-03. (1) Any officer appointed by the electrical supply authority may at all reasonable times, upon producing proof of his authority (if required), enter upon any premises to—

- (a) Inspect and test any electrical wiring work or electrical apparatus therein, if such wiring or apparatus is, or is intended to be, or has been within a reasonable period, connected, directly or indirectly, with the electrical supply authority's electric lines; and
- (b) Ascertain the quantity of electrical energy supplied or used; and
- (c) Remove any electric line or apparatus belonging to the electrical supply authority where authorized so to do.

(2) If any person, without reasonable cause, refuses to admit such officer the electrical supply authority may disconnect the consumer's installation from the source of supply.

(3) Every person who wilfully hinders or obstructs any such officer in the exercise of any powers conferred by these regulations commits an offence against the regulations.

DIVISION VI.—REMOVAL OR ALTERATION OF HAZARDOUS AND DANGEROUS LINES AND APPARATUS.

PART 61.—HAZARDOUS LINES AND HAZARDOUS APPARATUS.

HAZARDOUS LINES.

61-01. The following electric lines erected before the coming into force of these regulations shall be deemed to be hazardous lines for the purpose of Regulations 61-21 and 61-22 hereof.

- (a) Any overhead electric line not having the minimum clearance above ground-level prescribed with respect to such line by Regulations 41-22 to 41-27 (both inclusive) hereof, if the Chief Electrical Engineer considers that the existing clearance is not sufficient to ensure safety, and such clearance is not altered to such height as he prescribes;
- (b) Any overhead electric line not having the minimum clearance prescribed with respect to such line by Regulations 41-31 to 41-64 (both inclusive) hereof;
- (c) Any aerial electric line normally accessible to any person from any building or part of a building, or from any post, fence, or bank;
- (d) Any electric line which, owing to defective binders, insulators, crossarms, poles, or other supports, is insecurely supported;
- (e) Any electric line which, owing to deterioration or removal of, or damage to, any protective covering or insulator, is not sufficiently protected or insulated;
- (f) Any line which does not comply with the requirements of these regulations as to mechanical strength;
- (g) Any neutral conductor of a three-phase system, and any middle wire of a three-wire system which is normally earthed and has at any point along its length a resistance to earth of more than 25 ohms;
- (h) Any electric line with a tension greater than is permitted by these regulations;
- (i) Any earthing-lead which is not actually connected to earth or which, being connected to earth, has a resistance to earth of more than 25 ohms;
- (j) Any high pressure overhead electric line erected on a pole carrying telegraph wires and not supported on a crossarm marked with distinctive red marking;
- (k) Any circuit supplied from a generating-station or substation which is not continuously attended and which, in the opinion of the Inspecting Engineer, is not satisfactorily provided with means for immediately interrupting the circuit or automatically and immediately earthing the faulty conductor in the event of any line forming part of the circuit becoming earthed;
- (l) Any circuit supplied from a continuously attended generating-station or substation which, in the opinion of the Inspecting Engineer, is not satisfactorily provided with the means mentioned in the last preceding paragraph or equipped with a visual and audible signal to indicate a leakage to earth;
- (m) Any high pressure or extra-high pressure star-connected system with the neutral point earthed which is not equipped with earth-leakage relays as required by Regulation 31-02 hereof.
- (n) Any electric line which is not marked with a warning notice as prescribed with respect to such line by Regulations 41-52, 42-34, 42-35, 42-36, and 46-23 hereof.

HAZARDOUS APPARATUS.

61-11. The following electrical apparatus installed before the coming into force of these regulations shall be deemed to be hazardous apparatus for the purpose of the next succeeding regulation:—

- (a) Every switchboard which does not comply with the requirements of Regulations 32-01 to 32-08 (both inclusive) hereof, unless such steps as the Chief Electrical Engineer directs are taken to render it reasonably safe;
- (b) Any high pressure or extra-high pressure transformer accessible to any unauthorized person;
- (c) Any enclosed switch or circuit-breaker which has no external device to indicate clearly whether it is open or closed;
- (d) Any unearthed metal (except handrails or metal screens attached thereto of pole-substations) which is not normally connected to a circuit and which may become alive.

HAZARDOUS LINES AND APPARATUS TO BE MADE SAFE.

61-21. On receipt of a written notice from the Minister to the effect:—

- (a) That any electric line is a hazardous line within the meaning of these regulations; or
- (b) That any electrical apparatus is hazardous apparatus within the meaning of these regulations; or
- (c) That any electric line is a dangerous line within the meaning of the Public Works Act, 1928;

the licensee or other proprietor of such line or apparatus shall immediately either cease to use it for, or in connection with, generating, transforming, converting, conveying, consuming, or utilizing electrical energy, or else render it safe and make it comply with these regulations.

61-22. If within ten days after receipt of the notice prescribed by the last preceding regulation such line or apparatus is still in use and has not been rendered safe and made to comply with these regulations, it shall be lawful for any person authorized by the Minister in that behalf to remove such line or apparatus, or to do all things which in his opinion may be necessary to render it safe and make it comply with these regulations, and for that purpose to enter upon any land with workmen, plant, tools, and machinery and to use any plant, tools, and/or machinery of the licensee, or other proprietor of such line or apparatus, and to interrupt, divert, or disconnect any supply of electrical energy, and to take any other steps which such person may deem expedient in the premises; and the cost of any such removal or alteration and of any steps incidental thereto shall be borne by the licensee or other proprietor of such line or apparatus, and shall be recoverable as a debt due to the Crown:

Provided that the powers conferred by this regulation are without prejudice to the liability of the licensee for a breach of the last preceding regulation.

61-23. It shall be lawful for any person authorized by the Minister in that behalf to remove any electric line laid or erected in breach of section 319 of the Public Works Act, 1928, to which such authorization may refer, and in such case the provisions of the last preceding regulation shall apply to such removal and cost thereof.

DIVISION VII.—PENALTIES.

PART 71.—PENALTIES FOR BREACHES OF LICENSES AND REGULATIONS.

LICENSEE.

71-01. If any licensee—

- (a) Fails to use and maintain the electric lines and works constructed pursuant to his license in such a manner as to secure to the area of supply the full benefit of the undertaking; or
- (b) Fails to observe, perform, fulfil, or keep any of the requirements, conditions, and provisions of the Public Works Act, 1928, and its amendments, with respect to his license; or
- (c) Fails to observe any of the requirements of these regulations,

he commits an offence against these regulations.

71-02. Every licensee who commits an offence against these regulations is liable for each such offence to a fine of £20.

71-03. (1) Every licensee shall at all times during continuance of the license comply with the requirements of the undermentioned provisions of these regulations, and any licensee failing to comply therewith commits an offence against these regulations.

(2) The following are the provisions referred to in the last preceding clause hereof:—

Regulations 21-12, 21-21, and 21-22, 21-31, to 21-44. (both inclusive), 21-46, and 21-48 to 21-51 (both inclusive).

All the regulations in Part 22 hereof.

All the regulations in Part 23 hereof.

Regulations 24-02, 24-03, and 24-21.

All regulations in Parts 31, 32, and 33 hereof.

Regulations 34-01 to 34-21 (both inclusive), 34-23, 34-38, 34-39, and 34-41.

All the regulations in Parts 41, 42, 43, 44, and 45 hereof.

All the regulations in Part 46 hereof.

Regulations 47-01 to 47-13 (both inclusive), 47-15, and 47-16.

All the regulations in Part 48 hereof.

Regulations 51-01 to 51-23 (both inclusive), 51-31, 51-32, and 51-42 to 51-44 (both inclusive).

Regulations 51-51, 51-53, 52-02, 52-03, and 52-11 to 52-13 (both inclusive).

Clause (2) of Regulation 53-02.

(3) The regulations referred to in the last preceding clause hereof shall, for the purposes of this regulation, be read together with and subject to Regulations 11-03, 11-04, 25-01, and every other provision hereof that may be applicable to the regulations referred to in the last preceding clause hereof, notwithstanding that they are not cited therein.

71-04. Where the Governor-General in Council is of opinion that any offence by a licensee against these regulations is sufficiently serious to warrant the revocation of the license he may direct that a notice specifying such offence and requiring the licensee to take such steps as may be necessary to prevent a continuance of the offence be served upon the licensee, and if at the expiration of ninety days after such service the Governor-General is satisfied that such steps have not been taken he may, by Order in Council notified to the licensee, revoke any license issued by the Governor-General in Council and vested in the licensee:

Provided that the power of revocation hereby conferred is in addition to the powers conferred by section 326 of the Public Works Act, 1928.

71-05. Where a license is revoked as aforesaid the licensee shall not be liable to prosecution for the offence in respect of which the license is so revoked.

71-06. The infliction of any penalty, whether by way of fine or revocation as aforesaid, shall not relieve the licensee from any liability to pay compensation in respect of damage arising out of the commission of the offence in respect of which such penalty is inflicted.

PERSONS OTHER THAN A LICENSEE.

71-11. Every person, other than a licensee, who commits an offence against these regulations is liable to a fine of £20.

71-12. Every person who, without lawful authority, tampers with any electric line or apparatus subject to these regulations commits an offence against the regulations and is liable to a fine of £20.

DIVISION VIII.—TABLES.

STILL-AIR SAG AND TENSION TABLES FOR ELECTRICAL CONDUCTORS.

MAXIMUM TENSION AND MINIMUM SAG ALLOWABLE.

TABLE I.—BARE (H.D.) COPPER.

Wind, 12 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 9.45×10^{-6} per degree Fahrenheit; maximum allowable stress = 25,000 lb. per square inch; modulus of elasticity = 18×10^6 lb. per square inch.

(A.) 7/044 in.

Constants.—Area, 0.01064 sq. in.; diameter, 0.132 in.; loading factor, 3.308; maximum tension in conductor, 266 lb.; weight, 0.0418 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	239	0 3½	203	0 4½	169	0 5½	137	0 6½	108	0 8½	83	0 11
140 ..	229	0 5½	195	0 6½	162	0 7½	131	0 9½	104	1 0	83	1 3
160 ..	218	0 7½	185	0 8½	154	0 10½	125	1 1	101	1 4	83	1 8
180 ..	207	0 10	175	0 11½	145	1 2	120	1 5	99	1 8	82	2 1

(B.) 7/052 in.

Constants.—Area, 0.01483 sq. in.; diameter, 0.156 in.; loading factor, 2.852; maximum tension in conductor, 371 lb.; weight, 0.0583 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	344	0 3½	287	0 4½	243	0 5½	200	0 6½	159	0 8	122	0 10
140 ..	334	0 5½	282	0 6½	229	0 7½	187	0 9	158	0 11	123	1 2
160 ..	323	0 7	268	0 8½	225	0 10	185	1 0	157	1 2	124	1 6
180 ..	311	0 9	263	0 11	221	1 1	181	1 3	155	1 6	125	1 11

(C.) 7/064 in. (7/16 S.W.G.).

Constants.—Area, 0.0225 sq. in.; diameter, 0.192 in.; loading factor, 2.39; maximum tension in conductor, 562 lb.; weight, 0.0885 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	534	0 3½	460	0 4½	387	0 5	317	0 6	252	0 7½	195	0 10
140 ..	524	0 5	451	0 5½	380	0 7	312	0 8½	250	0 10½	199	1 1
160 ..	515	0 6½	441	0 7½	372	0 9	307	0 11	249	1 2	202	1 5
180 ..	502	0 8½	431	0 10	364	1 0	302	1 2	248	1 5	204	1 9

(D.) 7/092 in. (7/13 S.W.G.).

Constants.—Area, 0.0465 sq. in.; diameter, 0.276 in.; loading factor, 1.81; maximum tension in conductor, 1,163 lb.; weight, 0.1824 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	1135	0 3½	981	0 4	830	0 4½	684	0 5½	546	0 7	425	0 9½
140 ..	1126	0 5	974	0 5½	825	0 6½	683	0 8	551	0 9½	437	1 0
160 ..	1115	0 6½	965	0 7	819	0 8½	681	0 10	555	1 0½	448	1 4
180 ..	1103	0 8	955	0 9½	813	0 11	679	1 1	560	1 4	460	1 7

BARE COPPER—continued.

(E.) 19/052 in.

Constants.—Area, 0.0403 sq. in.; diameter, 0.260 in.; loading factor, 1.923; maximum tension in conductor, 1,008 lb.; weight, 0.1582 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	979 0	3 1/2	846 0	4	716 0	4 3/4	589 0	5 3/4	469 0	7 1/2	364 0	9 1/2
140 ..	970 0	4 3/4	838 0	5 1/2	709 0	6 1/2	586 0	8	472 0	10	374 1	0
160 ..	958 0	6 1/2	828 0	7 1/2	702 0	8 1/2	583 0	10 1/2	475 1	1	383 1	4
180 ..	946 0	8	817 0	9 1/2	696 0	11	580 1	1	478 1	4	392 1	8

(F.) 19/064 in. (19/16 S.W.G.)

Constants.—Area, 0.0611 sq. in.; diameter, 0.320 in.; loading factor, 1.667; maximum tension in conductor, 1,528 lb.; weight, 0.2400 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	1500 0	3 1/2	1298 0	4	1098 0	4 3/4	905 0	5 3/4	724 0	7 1/2	563 0	9 1/2
140 ..	1489 0	4 3/4	1289 0	5 1/2	1093 0	6 1/2	905 0	7 3/4	731 0	9 3/4	580 1	0 1/2
160 ..	1479 0	6 1/4	1281 0	7 1/4	1089 0	8 1/2	906 0	10 1/4	740 1	0 1/2	597 1	3 1/2
180 ..	1466 0	8	1271 0	9 1/4	1083 0	10 3/4	906 1	0 1/2	747 1	3 1/2	611 1	7

TABLE II.—TRIPLE-BRAIDED (H.D.) COPPER.

Wind, 12 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 9.45×10^{-6} per degree Fahrenheit; minimum allowable stress = 25,000 lb. per square inch; modulus of elasticity = 18×10^6 lb. per square inch.

NOTE.—In computing the loading factor for this table the weight and diameter of the covered wire only has been used.

(A.) 7/044 in.

Constants.—Area (copper), 0.01064 sq. in.; diameter (covered), 0.280 in.; loading factor, 4.19; maximum tension in conductor, 266 lb.; weight of covered conductor, 0.0687 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	154 0	9 1/2	128 0	11 1/2	106 1	2	90 1	5	77 1	7	68 1	10
140 ..	127 1	4	108 1	7	94 1	10	82 2	1	73 2	4	67 2	6
160 ..	108 2	0	96 2	4	85 2	7	77 2	10	71 3	1	66 3	4
180 ..	96 2	11	87 3	2	80 3	6	74 3	9	70 4	0	65 4	3

(B.) 7/052 in.

Constants.—Area (copper), 0.01483 sq. in.; diameter (covered), 0.327 in.; loading factor, 3.58; maximum tension in conductor, 371 lb.; weight of covered conductor, 0.0882 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	271 0	7	227 0	8 1/2	188 0	10	155 1	0	128 1	3	108 1	6
140 ..	241 0	11	203 1	1	169 1	3	143 1	6	123 1	9	107 2	0
160 ..	213 1	4	181 1	7	155 1	10	135 2	1	119 2	4	107 2	8
180 ..	188 1	11	163 2	2	144 2	6	128 2	9	116 3	1	106 3	4

TRIPLE-BRAIDED COPPER—continued.

(C.) 7/064 in. (7/16 S.W.G.).

Constants.—Area (copper), 0.0225 sq. in.; diameter (covered), 0.388 in.; loading factor, 2.97; maximum tension in conductor, 562 lb.; weight of covered conductor, 0.1387 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	455 0	6½	387 0	8	323 0	9½	268 0	11	221 1	2	185 1	4
140 ..	421 0	10	358 0	11	301 1	2	254 1	4	215 1	7	186 1	10
160 ..	386 1	2	329 1	4	282 1	7	242 1	10	210 2	1	186 2	5
180 ..	353 1	7	305 1	10	265 2	1	233 2	5	207 2	8	187 3	0

(D.) 7/083 in.

Constants.—Area (copper), 0.03787 sq. in.; diameter (covered), 0.429 in.; loading factor, 3.180; maximum tension in conductor, 947 lb.; weight of covered conductor, 0.1973 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	866 0	5	745 0	5½	627 0	6½	517 0	8½	420 0	10	339 1	0½
140 ..	840 0	7	722 0	8	609 0	9½	507 0	11½	418 1	2	346 1	4
160 ..	809 0	9½	695 0	11	589 1	1	495 1	3½	415 1	6	351 1	9
180 ..	777 1	0½	669 1	2½	570 1	5	484 1	8	413 1	11	356 2	3

(E.) 19/052 in.

Constants.—Area (copper), 0.0403 sq. in.; diameter (covered), 0.482 in.; loading factor, 2.31; maximum tension in conductor, 1,008 lb.; weight of covered conductor, 0.2324 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	912 0	5½	785 0	6½	663 0	7½	551 0	9	451 0	11	371 1	1
140 ..	880 0	8	759 0	9	642 0	11	538 1	1	449 1	3	378 1	6
160 ..	846 0	10	729 1	0	622 1	2	527 1	5	447 1	8	384 1	11
180 ..	810 1	2	700 1	4	601 1	7	516 1	10	446 2	1	390 2	5

(F.) 19/064 in. (19/16 S.W.G.).

Constants.—Area (copper), 0.0610 sq. in.; diameter (covered), 0.598 in.; loading factor, 2.03; maximum tension in conductor, 1,525 lb.; weight of covered conductor, 0.3378 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	1429 0	5	1235 0	6	1047 0	7	871 0	8½	712 0	10	581 1	0
140 ..	1397 0	7	1207 0	8	1027 0	9½	861 0	11	716 1	2	597 1	5
160 ..	1361 0	9½	1178 0	11	1007 1	1	852 1	3	719 1	6	612 1	9
180 ..	1322 1	0	1148 1	2	986 1	5	843 1	8	722 1	11	625 2	2

TRIPLE-BRAIDED COPPER—continued.

(G.) 19/072 in. (19/15 S.W.G.).

Constants.—Area (copper), 0.0774 sq. in.; diameter (covered), 0.642 in.; loading factor, 1.85; maximum tension in conductor, 1,935 lb.; weight of covered conductor, 0.4131 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	1894	0 4 $\frac{3}{4}$	1600	0 5 $\frac{1}{2}$	1360	0 6 $\frac{1}{2}$	1127	0 8	928	0 9 $\frac{1}{2}$	754	1 0
140 ..	1816	0 6 $\frac{1}{2}$	1573	0 7 $\frac{1}{2}$	1339	0 8 $\frac{1}{2}$	1122	0 10 $\frac{1}{2}$	930	1 1	770	1 4
160 ..	1783	0 9	1546	0 10	1322	1 0	1117	1 2	939	1 5	792	1 8
180 ..	1747	0 11	1517	1 1	1303	1 3	1111	1 6	947	1 9	812	2 1

(H.) 19/083 in.

Constants.—Area (copper), 0.1028 sq. in.; diameter (covered), 0.698 in.; loading factor, 1.65; maximum tension in conductor, 2,570 lb.; weight of covered conductor, 0.5276 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	2493	0 4 $\frac{1}{2}$	2160	0 5 $\frac{1}{2}$	1836	0 6 $\frac{1}{2}$	1528	0 7 $\frac{1}{2}$	1245	0 9	1003	0 11
140 ..	2466	0 6 $\frac{1}{2}$	2140	0 7	1825	0 8 $\frac{1}{2}$	1529	0 10	1263	1 0	1039	1 3
160 ..	2436	0 8 $\frac{1}{2}$	2116	0 9 $\frac{1}{2}$	1811	0 11	1529	1 1	1279	1 4	1071	1 7
180 ..	2403	0 11	2093	1 0	1800	1 2	1530	1 5	1298	1 8	1105	1 11

TABLE III.—V.I.R. (H.D.) COPPER.

Wind, 12 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 9.45×10^{-6} per degree Fahrenheit; maximum allowable stress = 25,000 lb. per square inch; modulus of elasticity = 18×10^6 lb. per square inch.

NOTE.—In computing the loading factor for this table the weight and diameter of the covered wire only has been used.

(A.) 7/044 in.

Constants.—Area (copper), 0.01064 sq. in.; diameter (covered), 0.287 in.; loading factor, 4.13; maximum tension in conductor, 266 lb.; weight of covered conductor, 0.0717 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	150	0 10	125	1 0	105	1 3	90	1 5	78	1 8	69	1 11
140 ..	125	1 5	107	1 8	93	1 11	83	2 2	74	2 4	68	2 7
160 ..	106	2 2	95	2 5	85	2 8	78	2 11	72	3 2	67	3 5
180 ..	95	3 1	87	3 4	80	3 7	75	3 11	70	4 2	67	4 4

(B.) 7/052 in.

Constants.—Area (copper), 0.01483 sq. in.; diameter (covered), 0.317 in.; loading factor, 3.51; maximum tension in conductor, 371 lb.; weight of covered conductor, 0.0945 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	264	0 7 $\frac{1}{2}$	221	0 9	183	0 11	152	1 1	127	1 4	110	1 7
140 ..	233	0 11	196	1 2	166	1 5	141	1 8	122	1 11	108	2 2
160 ..	204	1 6	175	1 9	152	2 0	133	2 3	119	2 6	108	2 9
180 ..	181	2 1	160	2 5	141	2 8	128	3 0	116	3 3	107	3 7

V.I.R. COPPER—continued.

(C.) 7/064 in. (7/16 S.W.G.).

Constants.—Area (copper), 0.0225 sq. in.; diameter (covered), 0.359 in.; loading factor, 2.88; maximum tension in conductor, 562 lb.; weight of covered conductor, 0.1328 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	468	0 6	399	0 7	333	0 8½	275	0 10	225	1 1	186	1 3
140 ..	438	0 9	373	0 10	313	1 0	262	1 3	220	1 6	188	1 9
160 ..	407	1 1	347	1 3	295	1 6	251	1 9	216	2 1	189	2 4
180 ..	376	1 6	323	1 9	278	2 0	242	2 4	213	2 8	190	2 11

(D.) 19/052 in.

Constants.—Area (copper), 0.0403 sq. in.; diameter (covered), 0.441 in.; loading factor, 2.18; maximum tension in conductor, 1,008 lb.; weight of covered conductor, 0.2278 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	928	0 5½	800	0 6	677	0 7	562	0 8½	460	0 11	376	1 1
140 ..	902	0 7½	778	0 8½	661	0 10	553	1 0	461	1 2	386	1 5
160 ..	873	0 10	754	1 0	643	1 2	544	1 4	461	1 7	394	1 10
180 ..	842	1 1	729	1 3	626	1 6	536	1 9	461	2 0	401	2 4

(E.) 19/064 in. (19/16 S.W.G.).

Constants.—Area (copper), 0.0611 sq. in.; diameter (covered), 0.513 in.; loading factor, 1.85; maximum tension in conductor, 1,525 lb.; weight of covered conductor, 0.3285 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	1453	0 5	1258	0 5½	1068	0 6½	889	0 8	726	0 10	589	1 0
140 ..	1429	0 7	1238	0 8	1055	0 9	884	0 11	733	1 1	608	1 4
160 ..	1403	0 9	1217	0 10	1041	1 0	881	1 2	741	1 5	626	1 8
180 ..	1373	1 0	1194	1 1	1026	1 4	876	1 6	747	1 9	642	2 1

(F.) 19/072 in. (19/15 S.W.G.).

Constants.—Area (copper), 0.0774 sq. in.; diameter (covered), 0.596 in.; loading factor, 1.78; maximum tension in conductor, 1,935 lb.; weight of covered conductor, 0.409 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	1858	0 4½	1608	0 5½	1366	0 6½	1136	0 8	928	0 9½	751	1 0
140 ..	1831	0 6½	1586	0 7½	1352	0 9	1133	0 10½	938	1 1	775	1 3
160 ..	1802	0 8½	1564	0 10	1338	1 0	1130	1 2	949	1 4	799	1 8
180 ..	1769	0 11	1539	1 1	1322	1 3	1127	1 5	960	1 9	821	2 0

V.I.R. COPPER—continued.

(G.) 19/083 in.

Constants.—Area (copper), 0.1028 sq. in.; diameter (covered), 0.663 in.; loading factor, 1.6; maximum tension in conductor, 2,570 lb.; weight of covered conductor, 0.533 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
120 ..	2498	0 4 $\frac{1}{2}$	2165	0 5 $\frac{1}{4}$	1842	0 6 $\frac{1}{4}$	1534	0 7 $\frac{1}{2}$	1252	0 9	1016	0 11
140 ..	2473	0 6 $\frac{1}{2}$	2147	0 7 $\frac{1}{2}$	1833	0 8 $\frac{1}{2}$	1537	0 10	1272	1 0	1048	1 3
160 ..	2445	0 8 $\frac{1}{2}$	2126	0 9 $\frac{1}{2}$	1822	0 11	1541	1 1	1291	1 4	1083	1 7
180 ..	2415	0 11	2105	1 0	1812	1 2	1544	1 5	1311	1 8	1117	1 11

TABLE IV.—BARE (H.D.) COPPER.

Wind, 18 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 9.45×10^{-6} per degree Fahrenheit; maximum allowable stress = 25,000 lb. per square inch; modulus of elasticity = 18×10^6 lb. per square inch.

(A.) 1/160 in. (8 S.W.G.).

Constants.—Area, 0.02011 sq. in.; diameter, 0.160 in.; loading factor, 3.25; maximum tension in conductor, 503 lb.; weight, 0.0775 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	398	0 9 $\frac{1}{2}$	337	0 11	279	1 1	228	1 4	188	1 8	157	2 0
220 ..	354	1 4	299	1 7	251	1 10	211	2 3	180	2 7	156	3 0
260 ..	310	2 0	264	2 6	227	2 11	197	3 4	174	3 9	156	4 2
300 ..	271	3 3	237	3 8	209	4 2	187	4 8	170	5 2	156	5 7
340 ..	242	4 8	217	5 2	197	5 8	180	6 2	167	6 8	155	7 2
380 ..	221	6 4	203	6 11	188	7 5	175	8 0	164	8 6	155	9 0

(B.) 7/044 in.

Constants.—Area, 0.01064 sq. in.; diameter, 0.132 in.; loading factor, 4.86; maximum tension in conductor, 266 lb.; weight, 0.0418 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	139	1 2	114	1 6	94	1 10	79	2 2	68	2 6	60	2 10
220 ..	104	2 5	91	2 9	79	3 2	70	3 7	63	4 0	58	4 4
260 ..	84	4 2	76	4 8	70	5 0	64	5 6	60	5 11	57	6 2
300 ..	75	6 3	70	6 9	66	7 2	62	7 7	58	8 1	56	8 4
340 ..	70	8 7	66	9 2	63	9 7	60	10 0	58	10 5	56	10 11
380 ..	66	11 5	63	12 0	61	12 4	59	12 9	57	13 3	55	13 8

(C.) 7/052 in.

Constants.—Area, 0.01483 sq. in.; diameter, 0.156 in.; loading factor, 4.17; maximum tension in conductor, 371 lb.; weight, 0.0583 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	237	1 0	197	1 2	161	1 5	133	1 9	112	2 1	96	2 5
220 ..	190	1 10	160	2 2	136	2 7	119	3 0	105	3 4	94	3 9
260 ..	155	3 2	136	3 7	121	4 1	110	4 6	101	4 10	93	5 4
300 ..	133	4 11	121	5 5	112	5 10	104	6 4	98	6 8	92	7 2
340 ..	120	7 0	113	7 5	106	7 11	100	8 5	96	8 9	91	9 3
380 ..	112	9 4	107	9 10	102	10 4	98	10 9	94	11 2	91	11 7

BARE COPPER—continued.

(D.) 7/064 in. (7/16 S.W.G.).

Constants.—Area, 0.0225 sq. in.; diameter, 0.192 in.; loading factor, 3.42; maximum tension in conductor, 562 lb.; weight, 0.0885 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.		
180 ..	425	0 10	360	1 0	298	1 2	245	1 5	202	1 9	170	2 1		
220 ..	371	1 5	313	1 8	263	2 0	225	2 5	192	2 10	169	3 2		
260 ..	319	2 4	273	2 9	237	3 2	206	3 7	186	4 0	167	4 6		
300 ..	276	3 7	244	4 1	218	4 7	197	5 1	180	5 6	167	6 0		
340 ..	248	5 2	225	5 8	206	6 2	190	6 9	178	7 2	167	7 8		
380 ..	228	7 0	211	7 7	197	8 1	185	8 8	175	9 1	167	9 7		

(E.) 7/080 in. (7/14 S.W.G.).

Constants.—Area, 0.0352 sq. in.; diameter, 0.240 in.; loading factor, 2.795; maximum tension in conductor, 880 lb.; weight, 0.1379 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.		
180 ..	745	0 9	636	0 10½	534	1 0½	441	1 3	362	1 6½	299	1 10½		
220 ..	687	1 2½	586	1 5	495	1 8	416	2 0	352	2 4½	302	2 9		
260 ..	625	1 10½	536	2 2	460	2 6	396	2 11	345	3 4½	305	3 10		
300 ..	565	2 9	491	3 2	430	3 7	379	4 1	339	4 7	306	5 1		
340 ..	514	3 10½	455	4 4½	407	4 11	367	5 5	335	5 11½	308	6 6		
380 ..	473	5 3	427	5 10	389	6 5	357	7 0	331	7 6	309	8 1		

(F.) 7/092 in. (7/13 S.W.G.).

Constants.—Area, 0.0465 sq. in.; diameter, 0.276 in.; loading factor, 2.48; maximum tension in conductor, 1,163 lb.; weight, 0.1824 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.		
180 ..	1028	0 8½	882	0 10	744	1 0	617	1 2	506	1 6	417	1 9		
220 ..	967	1 2	830	1 4	704	1 7	592	1 10	499	2 3	426	2 7		
260 ..	902	1 9	778	2 0	666	2 4	572	2 8	495	3 1	433	3 7		
300 ..	837	2 5	728	2 10	633	3 3	554	3 8	491	4 2	439	4 8		
340 ..	775	3 5	682	3 10	604	4 4	539	4 11	487	5 5	444	5 11		
380 ..	722	4 8	645	5 1	581	5 8	528	6 3	484	6 10	447	7 4		

(G.) 7/104 in. (7/12 S.W.G.).

Constants.—Area, 0.0595 sq. in.; diameter, 0.312 in.; loading factor, 2.243; maximum tension in conductor, 1,487 lb.; weight, 0.2331 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.		
180 ..	1351	0 8	1165	0 10	984	1 0	818	1 2	672	1 5	553	1 8		
220 ..	1290	1 1	1114	1 3	946	1 6	798	1 9	671	2 1	570	2 6		
260 ..	1223	1 7	1059	1 10	908	2 2	778	2 6	670	2 11	583	3 5		
300 ..	1155	2 3	1005	2 7	872	3 0	761	3 5	669	3 11	595	4 5		
340 ..	1087	3 1	956	3 6	841	4 0	747	4 6	668	5 0	609	5 7		
380 ..	1024	4 1	911	4 7	814	5 2	734	5 9	667	6 4	612	6 9		

BARE COPPER—continued.

(H.) 19/052 in.

Constants.—Area, 0.0403 sq. in.; diameter, 0.260 in.; loading factor, 2.66; maximum tension in conductor, 1,008 lb.; weight, 0.1582 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	869	0 9	743	0 10	625	1 0	517	1 3	425	1 6	350	1 10
220 ..	807	1 2	691	1 5	584	1 8	491	2 0	415	2 4	356	2 8
260 ..	743	1 10	638	2 1	547	2 5	470	2 10	408	3 3	360	3 9
300 ..	679	2 7	590	3 0	515	3 5	453	3 11	403	4 5	364	4 11
340 ..	622	3 8	549	4 2	488	4 8	439	5 2	399	5 9	366	6 3
380 ..	575	5 0	517	5 6	469	6 1	429	6 8	396	7 3	368	7 9

(I.) 19/064 in. (19/16 S.W.G.).

Constants.—Area, 0.0611 sq. in.; diameter, 0.320 in.; loading factor, 2.2; maximum tension in conductor, 1,525 lb.; weight, 0.2395 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	1392	0 8½	1200	0 9½	1016	0 11	846	1 2	696	1 5	572	1 8
220 ..	1333	1 1	1150	1 3	980	1 6	826	1 9	696	2 1	591	2 5
260 ..	1266	1 7	1095	1 10	941	2 2	807	2 6	695	2 11	605	3 4
300 ..	1192	2 3	1038	2 7	902	3 0	787	3 5	694	3 11	615	4 5
340 ..	1130	3 1	993	3 6	875	3 11	776	4 6	694	5 0	627	5 7
380 ..	1067	4 1	949	4 7	848	5 1	764	5 8	694	6 3	636	6 10

TABLE V.—TRIPLE-BRAIDED (H.D.) COPPER.

Wind, 18 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 9.45×10^{-6} per degree Fahrenheit; maximum allowable stress = 25,000 lb. per square inch; modulus of elasticity = 18×10^6 lb. per square inch.

NOTE.—In computing the loading factor for this table the weight and diameter of the covered wire only has been used.

(A.) 7/044 in.

Constants.—Area (copper), 0.01064 sq. in.; diameter (covered), 0.280 in.; loading factor, 6.2; maximum tension in conductor, 266 lb.; weight of covered conductor, 0.0687 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	53	5 3	51	5 6	49	5 8	47	5 11	45	6 1	44	6 3
220 ..	49	8 6	48	8 8	47	8 11	46	9 1	45	9 3	44	9 6
260 ..	47	12 4	46	12 6	45	12 9	45	12 11	44	13 1	43	13 4
300 ..	46	16 10	45	17 0	45	17 2	44	17 5	44	17 7	43	17 10
340 ..	45	22 0	45	22 2	44	22 5	44	22 7	43	22 9	43	22 11
380 ..	44	27 9	44	27 11	44	28 1	44	28 4	43	28 6	43	28 8

TRIPLE-BRAIDED COPPER—continued.

(B.) 7/052 in.

Constants.—Area (copper), 0·01483 sq. in. ; diameter (covered), 0·327 in. ; loading factor, 5·65 ; maximum tension in conductor, 371 lb. ; weight of covered conductor, 0·0882 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	87	4 1	82	4 4	78	4 7	74	4 9	71	5 0	68	5 3
220 ..	78	6 10	76	7 0	73	7 3	71	7 6	69	7 8	67	7 11
260 ..	74	10 0	73	10 3	71	10 6	70	10 8	68	10 11	67	11 2
300 ..	72	13 10	71	14 0	70	14 3	68	14 5	67	14 8	66	14 11
340 ..	70	18 2	69	18 4	68	18 6	68	18 9	67	18 11	66	19 2
380 ..	69	22 11	68	23 1	68	23 4	67	23 7	67	23 9	66	23 11

(C.) 7/064 in. (7/16 S.W.G.).

Constants.—Area (copper), 0·0225 sq. in. ; diameter (covered), 0·388 in. ; loading factor, 4·31 ; maximum tension in conductor, 562 lb. ; weight of covered conductor, 0·1387 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	175	3 2	165	3 5	155	3 7	147	3 10	139	4 0	133	4 3
220 ..	157	5 4	151	5 6	146	5 9	141	5 11	136	6 2	132	6 4
260 ..	148	7 11	144	8 1	141	8 4	137	8 6	134	8 9	131	8 11
300 ..	143	10 10	140	11 1	138	11 3	136	11 6	133	11 8	131	11 11
340 ..	140	14 4	138	14 6	136	14 8	134	14 11	132	15 1	131	15 4
380 ..	138	18 2	136	18 4	135	18 6	133	18 9	132	18 11	131	19 1

(D.) 7/083 in.

Constants.—Area (copper), 0·03787 sq. in. ; diameter (covered), 0·429 ; loading factor, 4·530 ; maximum tension in conductor, 947 lb. ; weight of covered conductor, 0·1973 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	587	1 4	498	1 7	424	1 11	365	2 2	319	2 6	284	2 10
220 ..	483	2 6	423	2 10	375	3 2	337	3 7	307	3 11	282	4 3
260 ..	414	4 0	377	4 5	345	4 10	320	5 3	299	5 7	281	5 11
300 ..	373	5 11	348	6 4	327	6 9	309	7 2	294	7 7	280	7 11
340 ..	348	8 2	331	8 7	316	9 0	302	9 5	290	9 10	280	10 2
380 ..	332	10 9	319	11 2	307	11 7	297	12 0	288	12 5	279	12 9

(E.) 19/052 in.

Constants.—Area (copper), 0·0403 sq. in. ; diameter (covered), 0·482 in. ; loading factor, 3·27 ; maximum tension in conductor, 1,008 lb. ; weight of covered conductor, 0·2324 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	595	1 7	509	1 10	442	2 1	390	2 5	347	2 8	311	3 0
220 ..	497	2 10	442	3 2	399	3 6	363	3 10	334	4 2	310	4 6
260 ..	434	4 6	401	4 11	374	5 3	347	5 8	327	6 0	310	6 4
300 ..	396	6 7	374	7 0	355	7 4	337	7 9	322	8 1	309	8 6
340 ..	373	9 0	357	9 5	343	9 10	331	10 2	320	10 6	309	10 11
380 ..	357	11 8	347	12 1	335	12 6	326	12 10	317	13 2	308	13 7

TRIPLE-BRAIDED COPPER—continued.

(F.) 19/064 in. (19/16 S.W.G.).

Constants.—Area (copper), 0.0611 sq. in.; diameter (covered), 0.598 in.; loading factor, 2.84; maximum tension in conductor, 1,525 lb.; weight of covered conductor, 0.3378 lb. per foot.

Span	Datum		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	1259	1 0	1070	1 3	900	1 6	744	1 10	616	2 3	517	2 8
220 ..	1141	1 9	974	2 1	824	2 6	699	2 11	599	3 5	522	3 11
260 ..	1021	2 10	882	3 3	763	3 9	666	4 3	586	4 10	524	5 5
300 ..	919	4 2	806	4 9	713	5 4	637	6 0	576	6 7	526	7 3
340 ..	834	5 10	747	6 6	676	7 3	616	7 11	569	8 7	528	9 3
380 ..	770	7 11	703	8 8	648	9 5	602	10 1	563	10 10	530	11 6

TABLE VI.—V.I.R. (H.D.) COPPER.

Wind, 18 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 9.45×10^{-6} per degree Fahrenheit; maximum allowable stress = 25,000 lb. per square inch; modulus of elasticity = 18×10^6 lb. per square inch.

NOTE.—In computing the loading factor for this table the weight and diameter of the covered wire only has been used.

(A.) 7/044 in.

Constants.—Area (copper), 0.01064 sq. in.; diameter (covered), 0.287 in.; loading factor, 6.09; maximum tension in conductor, 266 lb.; weight of covered conductor, 0.0717 lb. per foot.

Span	Datum		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	52	5 7	50	5 9	49	5 11	47	6 2	46	6 4	45	6 6
220 ..	49	8 10	48	9 0	47	9 3	46	9 5	45	9 7	44	9 9
260 ..	47	12 10	46	13 0	46	13 2	45	13 4	45	13 6	44	13 8
300 ..	46	17 5	46	17 7	45	17 9	45	17 11	44	18 1	44	18 3
340 ..	46	22 8	45	22 10	45	23 0	44	23 2	44	23 4	44	23 6
380 ..	45	28 6	45	28 8	44	28 11	44	29 1	44	29 3	44	29 5

(B.) 7/052 in.

Constants.—Area (copper), 0.01483 sq. in.; diameter (covered), 0.317 in.; loading factor, 5.14; maximum tension in conductor, 371 lb.; weight of covered conductor, 0.0945 lb. per foot.

Span	Datum		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	97	3 11	92	4 2	86	4 5	83	4 7	78	4 10	75	5 1
220 ..	87	6 7	84	6 10	82	7 0	77	7 3	76	7 6	74	7 9
260 ..	82	9 9	80	10 0	78	10 2	76	10 5	75	10 8	73	10 11
300 ..	79	13 5	78	13 7	76	13 10	75	14 1	74	14 4	73	14 6
340 ..	77	17 7	76	17 9	75	18 0	74	18 3	74	18 6	73	18 8
380 ..	76	22 3	75	22 5	75	22 8	74	22 11	73	23 1	73	23 4

V.I.R. COPPER—continued.

(C.) 7/064 in. (7/16 S.W.G.).

Constants.—Area (copper), 0.0225 sq. in.; diameter (covered), 0.359 in.; loading factor, 4.18; maximum tension in conductor, 562 lb.; weight of covered conductor, 0.1328 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	224	2 5	199	2 8	179	3 0	163	3 4	151	3 7	140	3 10
220 ..	186	4 4	173	4 8	162	5 0	153	5 3	145	5 6	138	5 10
260 ..	168	6 8	160	7 0	153	7 4	148	7 7	142	7 11	137	8 2
300 ..	158	9 5	153	9 9	148	10 0	144	10 4	140	10 8	137	10 11
340 ..	152	12 7	148	12 11	145	13 3	142	13 6	139	13 9	136	14 1
380 ..	148	16 1	145	16 5	143	16 9	140	17 0	138	17 4	136	17 7

(D.) 19/052 in.

Constants.—Area (copper), 0.0403 sq. in.; diameter (covered), 0.441 in.; loading factor, 3.07; maximum tension in conductor, 1,008 lb.; weight of covered conductor, 0.2278 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	653	1 5	552	1 8	482	1 11	416	2 3	365	2 7	327	2 10
220 ..	552	2 6	487	2 10	434	3 2	391	3 6	356	3 10	327	4 3
260 ..	482	4 0	438	4 5	403	4 9	374	5 2	349	5 6	327	5 11
300 ..	437	5 10	409	6 3	384	6 8	362	7 1	344	7 5	327	7 10
340 ..	410	8 0	390	8 5	372	8 10	355	9 3	341	9 8	327	10 1
380 ..	391	10 6	376	10 11	362	11 4	350	11 9	338	12 1	328	12 6

(E.) 19/064 in. (19/16 S.W.G.).

Constants.—Area (copper), 0.0611 sq. in.; diameter (covered), 0.513 in.; loading factor, 2.55; maximum tension in conductor, 1,525 lb.; weight of covered conductor, 0.3295 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	1191	1 0	1026	1 3	875	1 6	746	1 9	641	2 1	555	2 5
220 ..	1069	1 10	928	2 2	818	2 5	710	2 10	631	3 2	566	3 6
260 ..	962	2 11	850	3 3	759	3 8	686	4 0	625	4 5	575	4 10
300 ..	872	4 3	791	4 8	724	5 1	666	5 6	618	6 0	578	6 5
340 ..	809	5 10	748	6 4	696	6 10	653	7 3	614	7 9	581	8 2
380 ..	764	7 9	717	8 3	677	8 9	642	9 3	611	9 9	584	10 2

TABLE VII.—BARE STEEL-CORED ALUMINIUM (1 STEEL 6 ALUMINIUM).

Wind, 18 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 10.55×10^{-6} per degree Fahrenheit; modulus of elasticity = 12.5×10^6 lb. per square inch.

NOTE.—This table is for use with conductors having a breaking-strength not less than that stated for each size of conductor.

(A.) 7/0536 in.

Constants.—Area, 0.01888 sq. in.; breaking-strength, 820 lb.; diameter, 0.176 in.; loading factor, 9.317; maximum tension in conductor, 328 lb.; weight, 0.0285 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	140	0 10	104	1 1	76	1 6	59	2 0	48	2 5	41	2 10
220 ..	83	2 1	66	2 8	55	3 2	48	3 7	43	4 0	39	4 5
260 ..	59	4 1	52	4 8	47	5 2	44	5 7	40	6 0	38	6 4
300 ..	50	6 5	46	6 11	43	7 5	41	7 10	39	8 3	37	8 8
340 ..	45	9 1	43	9 7	41	10 0	40	10 5	38	10 10	37	11 3
380 ..	43	12 0	41	12 5	40	12 11	39	13 4	37	13 10	36	14 3

STEEL-CORED ALUMINIUM—continued.

(B.) 7/066 in.

Constants.—Area, 0.02395 sq. in.; breaking-strength, 1,185 lb.; diameter, 0.198 in.; loading factor, 8.312; maximum tension in conductor, 474 lb.; weight, 0.036 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	318	0 5½	258	0 7	200	0 9	147	1 0	106	1 5	80	1 10
220 ..	247	0 10½	191	1 2	144	1 6	110	2 0	86	2 6	72	3 1
260 ..	174	1 9	135	2 3	107	2 10	88	3 5	76	4 0	67	4 7
300 ..	123	3 3	102	3 11	88	4 7	78	5 2	70	5 9	64	6 4
340 ..	97	5 4	86	6 0	79	6 7	72	7 3	67	7 10	63	8 4
380 ..	85	7 8	78	8 4	73	8 11	68	9 7	65	10 1	61	10 7

(C.) 7/074 in.

Constants.—Area, 0.03011 sq. in.; breaking-strength, 1,464 lb.; diameter, 0.222 in.; loading factor, 7.413 lb.; maximum tension in conductor, 585.6 lb.; weight, 0.04533 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	424	0 5½	348	0 6½	273	0 8	205	0 10½	148	1 3	109	1 8
220 ..	348	0 9½	277	1 0	212	1 4	160	1 9	122	2 3	99	2 9
260 ..	265	1 5	205	1 10	160	2 5	129	3 0	108	3 7	93	4 1
300 ..	196	2 7	158	3 3	131	3 11	113	4 6	99	5 2	85	5 9
340 ..	152	4 4	130	5 0	115	5 9	102	6 5	94	7 0	87	7 6
380 ..	127	6 5	115	7 2	105	7 10	97	8 5	91	9 1	85	9 8

(D.) 7/083 in.

Constants.—Area, 0.03787 sq. in.; breaking-strength, 1,718 lb.; diameter, 0.249 in.; loading factor, 6.627; maximum tension in conductor, 687.2 lb.; weight, 0.057 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	503	0 5½	407	0 7	315	0 9	232	1 0	168	1 5	126	1 10
220 ..	415	0 10	327	1 1	249	1 5	188	1 10	146	2 4	119	2 11
260 ..	325	1 6	253	1 11	197	2 5	158	3 0	133	3 7	115	4 2
300 ..	248	2 7	198	3 3	165	3 11	141	4 7	124	5 2	113	5 8
340 ..	194	4 3	166	4 11	146	5 8	131	6 3	120	6 11	110	7 6
380 ..	165	6 3	148	6 11	136	7 7	125	8 3	116	8 10	108	9 6

(E.) 7/0935 in.

Constants.—Area, 0.048 sq. in.; breaking-strength, 2,181 lb.; diameter, 0.281 in.; loading factor, 5.757; maximum tension in conductor, 872.4 lb.; weight, 0.07266 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	696	0 5	574	0 6	454	0 8	343	0 10½	249	1 2	184	1 7
220 ..	612	0 8½	493	0 10½	384	1 2	290	1 6	220	2 0	173	2 7
260 ..	518	1 2	411	1 6	318	1 11	249	2 6	201	3 1	168	3 8
300 ..	422	1 11	335	2 5	268	3 1	221	3 8	187	4 4	164	5 0
340 ..	340	3 1	278	3 9	234	4 6	202	5 2	179	5 10	161	6 6
380 ..	282	4 8	243	5 5	212	6 2	190	6 11	174	7 6	160	8 2

STEEL-CORED ALUMINIUM—continued.

(F.) 7/102 in.

Constants.—Area, 0.05720 sq. in.; breaking-strength, 2,548 lb.; diameter, 0.306 in.; loading factor, 5.409; maximum tension in conductor, 1,019.2 lb.; weight, 0.08633 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	829	0 5	681	0 6	539	0 8	406	0 10½	294	1 2	216	1 7		
220 ..	736	0 8½	596	0 10½	464	1 2	351	1 6	265	2 0	208	2 6		
260 ..	635	1 2	504	1 5	391	1 10	304	2 5	246	3 0	204	3 7		
300 ..	528	1 10	419	2 4	334	2 11	273	3 7	230	4 3	200	4 10		
340 ..	432	2 11	351	3 7	292	4 3	251	5 0	221	5 8	198	6 4		
380 ..	362	4 4	307	5 1	267	5 10	237	6 7	215	7 3	197	7 11		

(G.) 7/118 in.

Constants.—Area, 0.07655 sq. in.; breaking-strength, 3,410 lb.; diameter, 0.354 in.; loading factor, 4.698; maximum tension in conductor, 1,363.8 lb.; weight, 0.11566 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	1178	0 4½	975	0 5½	784	0 7	600	0 9½	442	1 1	318	1 6		
220 ..	1078	0 8	887	0 9½	705	1 0	541	1 4	407	1 9	312	2 3		
260 ..	973	1 0	792	1 3	624	1 7	484	2 0	379	2 7	307	3 2		
300 ..	858	1 6	693	1 11	550	2 4	437	3 0	359	3 8	304	4 3		
340 ..	748	2 3	606	2 9	491	3 5	405	4 2	345	4 10	302	5 6		
380 ..	638	3 3	526	4 0	442	4 9	379	5 6	333	6 3	299	7 0		

(H.) 7/132 in.

Constants.—Area, 0.09579 sq. in.; breaking-strength, 4,106 lb.; diameter, 0.396 in.; loading factor, 4.227; maximum tension in conductor, 1,642.4 lb.; weight, 0.1446 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	1436	0 5	1191	0 6	951	0 7½	727	0 9½	530	1 1	382	1 6		
220 ..	1337	0 8	1097	0 9½	869	1 0	665	1 4	499	1 9	383	2 3		
260 ..	1223	1 0	992	1 3	785	1 7	608	2 0	476	2 7	384	3 2		
300 ..	1100	1 6	887	1 10	703	2 4	560	2 11	457	3 7	385	4 3		
340 ..	972	2 2	786	2 8	636	3 3	524	4 0	444	4 9	386	5 5		
380 ..	851	3 1	698	3 9	583	4 6	497	5 3	433	6 0	386	6 9		

(I.) 7/144 in.

Constants.—Area, 0.1140 sq. in.; breaking-strength, 4,886 lb.; diameter, 0.432 in.; loading factor, 3.892; maximum tension in conductor, 1,954.4 lb.; weight, 0.1723 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	1744	0 5	1456	0 5½	1167	0 7	896	0 9½	658	1 1	477	1 6		
220 ..	1644	0 7½	1362	0 9	1089	0 11½	837	1 3	629	1 8	482	2 2		
260 ..	1531	0 11½	1260	1 2	1000	1 6	776	1 11	605	2 5	486	3 0		
300 ..	1407	1 5	1147	1 8	916	2 1	723	2 8	535	3 4	488	4 0		
340 ..	1272	2 0	1034	2 5	837	3 0	683	3 8	570	4 5	489	5 1		
380 ..	1140	2 9	935	3 4	772	4 0	650	4 9	559	5 7	492	6 4		

STEEL-CORED ALUMINIUM—continued.

(J.) 7/157 in.

Constants.—Area, 0.1355 sq. in.; breaking-strength, 5,586 lb.; diameter, 0.471 in.; loading factor, 3.595; maximum tension in conductor, 2,234.4 lb.; weight, 0.2046 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	2011	0 5	1664	0 6	1328	0 7½	1008	0 10	735	1 2	536	1 7
220 ..	1905	0 8	1566	0 9½	1243	1 0	952	1 4	713	1 9	551	2 3
260 ..	1780	1 0	1457	1 2	1153	1 6	895	1 11	698	2 6	564	3 1
300 ..	1644	1 5	1339	1 9	1068	2 2	846	2 9	684	3 4	572	4 0
340 ..	1503	2 0	1222	2 5	988	3 0	806	3 8	675	4 5	580	5 1
380 ..	1361	2 9	1118	3 4	921	4 0	773	4 9	664	5 7	585	6 4

(K.) 7/161 in.

Constants.—Area, 0.1425 sq. in.; breaking-strength, 5,874 lb.; diameter, 0.483 in.; loading factor, 3.511; maximum tension in conductor, 2,349.6 lb.; weight, 0.2152 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	2127	0 5	1760	0 6	1404	0 7½	1072	0 10	779	1 1	563	1 7
220 ..	2018	0 8	1663	0 9	1323	1 0	1014	1 3	760	1 9	583	2 3
260 ..	1910	0 11	1552	1 2	1229	1 6	956	1 11	744	2 5	598	3 1
300 ..	1759	1 5	1434	1 8	1140	2 2	906	2 8	733	3 4	608	4 0
340 ..	1616	1 11	1318	2 4	1064	2 11	865	3 7	723	4 4	619	5 1
380 ..	1470	2 8	1204	3 3	993	3 11	832	4 8	713	5 6	626	6 3

(L.) 7/166 in.

Constants.—Area, 0.1515 sq. in.; breaking-strength, 6,061 lb.; diameter, 0.498 in.; loading factor, 3.413; maximum tension in conductor, 3,030.5 lb.; weight, 0.229 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	2878	0 3½	2485	0 4½	2093	0 5½	1707	0 6½	1336	0 8½	997	0 11
220 ..	2802	0 6	2410	0 7	2029	0 8	1651	0 10	1296	1 1	983	1 5
260 ..	2714	0 8½	2328	0 10	1954	1 0	1588	1 3	1255	1 7	973	2 0
300 ..	2614	1 0	2229	1 2	1868	1 5	1522	1 8	1212	2 2	963	2 8
340 ..	2500	1 4	2132	1 7	1778	1 10	1453	2 3	1170	2 10	954	3 6
380 ..	2372	1 9	2025	2 1	1685	2 5	1385	3 0	1138	3 8	945	4 5

(M.) 7/177 in.

Constants.—Area, 0.17224 sq. in.; breaking-strength, 6,819 lb.; diameter, 0.531 in.; loading factor, 3.219; maximum tension in conductor, 3,409.5 lb.; weight, 0.2603 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	3251	0 4	2808	0 4½	2363	0 5½	1920	0 6½	1506	0 8½	1118	0 11½
220 ..	3180	0 6	2735	0 7	2298	0 8½	1869	0 10	1468	1 1	1112	1 5
260 ..	3085	0 8½	2649	0 10	2218	1 0	1805	1 3	1427	1 7	1107	2 0
300 ..	2985	1 0	2553	1 2	2132	1 4	1738	1 8	1389	2 1	1100	2 8
340 ..	2873	1 4	2450	1 6	2044	1 10	1672	2 3	1350	2 9	1096	3 5
380 ..	2749	1 9	2332	2 0	1950	2 5	1605	2 11	1315	3 7	1093	4 4

**TABLE VIII.—STEEL-REINFORCED ALUMINIUM (4 STEEL
3 ALUMINIUM).**

Wind, 18 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 7.74×10^{-6} per degree Fahrenheit; modulus of elasticity = 20.2×10^6 lb. per square inch.

NOTE.—This table is for use with conductors having a breaking-strength not less than that stated.

7/0834 in.

Constants.—Area, 0.03824 sq. in.; breaking-strength, 4,180 lb.; diameter, 0.250 sq. in.; loading factor, 4.134; maximum tension in conductor, 1,672 lb.; weight, 0.0936 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	1619	0 5½	1500	0 6	1381	0 6½	1263	0 7½	1144	0 8	1026	0 8½	908	0 9
220 ..	1594	0 8½	1474	0 9½	1355	0 10	1238	0 11	1120	1 0	1003	1 1½	886	1 2
260 ..	1562	1 0½	1443	1 1½	1325	1 2½	1208	1 3½	1090	1 5½	974	1 7½	864	1 9
300 ..	1528	1 4½	1410	1 6	1292	1 7½	1176	1 9½	1061	2 0	946	2 3	842	2 6
340 ..	1487	1 10	1369	2 0	1253	2 2	1138	2 4½	1024	2 7½	912	2 11½	798	2 15
380 ..	1443	2 4	1326	2 6½	1211	2 9½	1098	3 1	986	3 5	877	3 10	773	3 15

TABLE IX.—BARE COPPER-COVERED STEEL.

Wind, 18 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 7.2×10^{-6} per degree Fahrenheit; modulus of elasticity = 20×10^6 lb. per square inch.

NOTE.—This table is for use with conductors having a breaking-strength not less than that stated for each size of conductor.

(A.) 1/162 in.

Constants.—Area, 0.02062 sq. in.; breaking-strength, 1,800 lb.; diameter, 0.162 in.; loading factor, 3.475; maximum tension in conductor, 720 lb.; weight, 0.073 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	658	0 5½	600	0 6	543	0 6½	485	0 7½	430	0 8½	376	0 9½	324	0 10½
220 ..	629	0 8½	572	0 9½	516	0 10½	460	0 11½	406	1 1	355	1 3	306	1 6
260 ..	594	1 0	538	1 2	484	1 3	432	1 5	381	1 7	334	1 10	292	1 14
300 ..	556	1 6	502	1 8	450	1 10	402	2 1	356	2 4	315	2 7	276	2 11
340 ..	514	2 1	464	2 3	417	2 6	373	2 10	332	3 2	297	3 7	264	3 12
380 ..	472	2 9	426	3 1	384	3 5	344	3 10	312	4 3	282	4 8	252	4 14

(B.) 1/204 in.

Constants.—Area, 0.03278 sq. in.; breaking-strength, 2,650 lb.; diameter, 0.204 in.; loading factor, 2.821; maximum tension in conductor, 1,060 lb.; weight, 0.116 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.											
	0.		20.		40.		60.		80.		100.			
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.		
Ft.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.	lb.	Ft. in.
180 ..	987	0 5½	896	0 6½	806	0 7	715	0 8	629	0 9	544	0 10½	464	0 12
220 ..	953	0 9	863	0 10	776	0 11	689	1 0	605	1 2	526	1 4	452	1 7
260 ..	914	1 1	827	1 2	740	1 4	657	1 6	580	1 8	509	1 11	442	1 15
300 ..	869	1 6	785	1 8	704	1 10	627	2 1	556	2 4	492	2 8	432	2 13
340 ..	823	2 0	744	2 3	668	2 6	596	2 10	532	3 2	476	3 6	424	3 12
380 ..	773	2 9	698	3 0	630	3 4	566	3 8	510	4 1	461	4 6	416	4 13

TABLE X.—BARE GALVANIZED IRON.

Wind, 18 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 6.8×10^{-6} per degree Fahrenheit; maximum allowable stress = 22,500 lb. per square inch; modulus of elasticity = 26×10^6 lb. per square inch.

1/160 in. (8 S.W.G.).

Constants.—Area, 0.02011 sq. in.; diameter, 0.160 in.; loading factor, 3.670; maximum tension in conductor, 453 lb.; weight, 0.068 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.										
	0.		20.		40.		60.		80.		100.		
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	
	Ft.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
180 ..	280	1 0	230	1 2	190	1 5	158	1 9	134	2 1	118	2 4	
220 ..	227	1 10	193	2 2	166	2 6	147	2 10	132	3 2	119	3 6	
260 ..	192	3 0	171	3 4	154	3 9	140	4 1	130	4 5	120	4 9	
300 ..	171	4 6	157	4 11	145	5 3	136	5 7	128	6 0	121	6 4	
340 ..	158	6 3	148	6 8	140	7 0	133	7 4	127	7 9	121	8 1	
380 ..	149	8 3	143	8 7	137	8 11	132	9 4	127	9 8	122	10 1	

TABLE XI.—BARE GALVANIZED STEEL, 34,000 lb. BASIS.

Wind, 18 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 6.8×10^{-6} per degree Fahrenheit; maximum allowable stress = 34,000 lb. per square inch; modulus of elasticity = 28×10^6 lb. per square inch.

NOTE.—This table is for use with conductors having a breaking-strength not less than that stated for each size of conductor.

34,000 lb. BASIS. (A.) 1/160 in. (8 S.W.G.).

Constants.—Area, 0.02011 sq. in.; breaking-strength, 1,368 lb.; diameter, 0.160 in.; loading factor, 3.652; maximum tension in conductor, 684 lb.; weight, 0.06834 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.										
	0.		20.		40.		60.		80.		100.		
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	
	Chains.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
5 ..	414	2 3	359	2 7	312	3 0	274	3 5	242	3 10	216	4 4	
6 ..	342	3 11	304	4 5	273	4 11	247	5 5	226	5 11	208	6 5	
7 ..	292	6 3	268	6 10	248	7 4	230	7 11	215	8 6	203	9 0	
8 ..	261	9 1	245	9 9	231	10 4	219	10 10	208	11 5	199	12 0	

34,000 lb. BASIS. (B.) 1/192 in. (6 S.W.G.).

Constants.—Area, 0.02895 sq. in.; breaking-strength, 1,968 lb.; diameter, 0.192 in.; loading factor, 3.093; maximum tension in conductor, 984 lb.; weight, 0.09841 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.										
	0.		20.		40.		60.		80.		100.		
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	
	Chains.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
5 ..	704	1 11	616	2 2	535	2 6	465	2 11	406	3 4	358	3 9	
6 ..	613	3 2	542	3 7	480	4 0	427	4 6	384	5 0	349	5 6	
7 ..	535	4 11	482	5 5	436	6 0	398	6 7	367	7 2	340	7 9	
8 ..	479	7 2	441	7 9	408	8 5	380	9 0	357	9 7	336	10 2	

BARE GALVANIZED STEEL—continued.

34,000 lb. BASIS. (C.) 7/064 in. (7/16 S.W.G.).

Constants.—Area, 0.02252 sq. in.; breaking-strength, 1,532 lb.; diameter, 0.192 in.; loading factor, 3.832; maximum tension in conductor, 766 lb.; weight, 0.07785 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
180 ..	6490	5 3/4	5670	6 3/4	4870	7 3/4	4110	9 1/4	3390	11 1/4	2761	1 3/4
220 ..	5950	9 1/4	5160	11	4411	0 1/4	3721	3 1/4	3101	6	2591	10
260 ..	5351	2 1/4	4621	5	3941	8	3361	11 1/2	2862	3 1/2	2462	8
300 ..	4721	10	4082	2	3512	6	3052	10	2663	3	2363	9
340 ..	4132	9	3613	1	3173	7	2814	0	2524	6	2284	11
380 ..	3643	10	3244	4	2914	10	2645	4	2425	10	2236	4

34,000 lb. BASIS. (D.) 5/080 in. (5/14 S.W.G.).

Constants.—Area, 0.02513 sq. in.; breaking-strength, 1,710 lb.; diameter, 0.216 in.; loading factor, 3.865; maximum tension in conductor, 855 lb.; weight, 0.08679 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
180 ..	7230	11 1/2	6311	1 1/4	5421	3 1/2	4561	6 1/2	3771	10 1/2	3072	3 1/2
220 ..	6611	7	5741	10	4902	1 1/2	4132	6	3443	1	2883	8
260 ..	5932	5 1/2	5112	10	4373	4	3713	11	3164	8	2735	4
300 ..	5223	9	4514	4	3895	0	3375	10	2956	7	2617	6
340 ..	4565	6	3986	4	3507	2	3118	1	2799	0	2539	11
380 ..	4027	10	3588	9	3229	9	29210	9	26711	9	24712	8

34,000 lb. BASIS. (E.) 7/080 in. (7/14 S.W.G.).

Constants.—Area, 0.03519 sq. in.; breaking-strength, 2,392 lb.; diameter, 0.240 in.; loading factor, 3.124; maximum tension in conductor, 1,196 lb.; weight, 0.1216 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
180 ..	10790	5 1/2	9500	6 1/2	8230	7 1/2	7500	8 1/2	5840	10 1/2	4781	0 1/2
220 ..	10230	8 1/2	8980	9 1/2	7760	11 1/2	6601	1 1/2	5541	4	4621	7
260 ..	9611	0 1/4	8401	2 3/4	7261	5	6211	8	5281	11 1/2	4492	3 1/2
300 ..	8921	6 1/2	7791	9	6752	0 1/2	5822	4	5032	9	4383	1 1/2
340 ..	8212	1 1/2	7192	5 1/2	6272	10	5483	3	4823	8	4284	1
380 ..	7532	11	6633	4	5853	9	5204	3	4664	9	4225	2 1/2

TABLE XII.—BARE GALVANIZED STEEL, 45,000 lb. BASIS.

Wind, 18 lb. per square foot of diametral plane.

Constants.—Coefficient of thermal expansion = 6.8×10^{-6} per degree Fahrenheit; maximum allowable stress = 45,000 lb. per square inch; modulus of elasticity = 28×10^6 lb. per square inch.

NOTE.—This table is for use with conductors having a breaking-strength not less than that stated for each size of conductor.

45,000 lb. BASIS. (A.) 1/160 in. (8 S.W.G.).

Constants.—Area, 0.02011 sq. in.; breaking-strength, 1,810 lb.; diameter, 0.160 in.; loading factor, 3.652; maximum tension in conductor, 905 lb.; weight, 0.06834 lb. per foot.

Chains.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
5 ..	7321	3 1/4	6611	5	5921	7	5241	9	4612	0	4022	3 1/2
6 ..	6642	0	5962	3	5332	6	4722	10	4183	3	3693	7 1/2
7 ..	5913	1	5303	5	4753	10	4244	4	3804	10	3425	4
8 ..	5204	7	4695	1	4245	7	3846	2 1/2	3506	10	3217	5

BARE GALVANIZED STEEL—continued.

45,000 lb. BASIS. (B.) 1/192 in. (6 S.W.G.).

Constant.—Area, 0.02895 sq. in.; breaking-strength, 2,606 lb.; diameter, 0.192 in.; loading factor, 3.093; maximum tension in conductor, 1,303 lb.; weight, 0.09841 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Chains.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
5 ..	1130	1 2	1026	1 3½	923	1 5½	823	1 7½	727	1 10	638	2 1
6 ..	1060	1 10	960	2 0	862	2 3	770	2 6	683	2 10	604	3 2
7 ..	982	2 8	888	2 11½	798	3 3	716	3 8	640	4 1	572	4 7
8 ..	901	3 10	816	4 3	736	4 8	664	5 2	601	5 9	545	6 4

45,000 lb. BASIS. (C.) 7/064 in. (7/16 S.W.G.).

Constants.—Area, 0.02252 sq. in.; breaking-strength, 2,026 lb.; diameter, 0.192 in.; loading factor, 3.832; maximum tension in conductor, 1,013 lb.; weight, 0.07785 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
180 ..	945	0 4	860	0 4½	776	0 5	693	0 5½	610	0 6½	528	0 7½
220 ..	912	0 6¼	828	0 6¾	745	0 7½	663	0 8½	583	0 9½	504	11¼
260 ..	873	0 9	790	0 10	708	0 11¼	629	1 0½	551	1 2¼	477	1 4½
300 ..	829	1 0¾	748	1 2	668	1 3¾	592	1 5¾	518	1 8¾	450	11¼
340 ..	780	1 5¼	701	1 7½	625	1 9½	553	2 0½	485	2 4	424	2 8
380 ..	727	1 11	652	2 2	580	2 5	514	2 9	453	3 1	399	3 6

45,000 lb. BASIS. (D.) 5/080 in. (5/14 S.W.G.).

Constants.—Area, 0.02513 sq. in.; breaking-strength, 2,262 lb.; diameter, 0.216 in.; loading factor, 3.865; maximum tension in conductor, 1,131 lb.; weight, 0.08679 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum..									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
180 ..	1053	0 8	959	0 8½	866	0 9¾	772	0 11	679	1 0½	590	1 2½
220 ..	1016	1 0½	923	1 1¾	830	1 3¼	739	1 5	648	1 7½	562	1 10½
260 ..	973	1 6	880	1 8	790	1 10½	700	2 1	614	2 4½	532	2 9
300 ..	922	2 1½	832	2 4	744	2 8	658	3 0	576	3 5	500	3 11
340 ..	867	2 11	779	3 3	695	3 7	614	4 1	538	4 8	470	5 4
380 ..	808	3 10½	724	4 4	645	4 10	570	5 6	502	6 3	443	7 1

45,000 lb. BASIS. (E.) 7/080 in. (7/14 S.W.G.).

Constants.—Area, 0.03519 sq. in.; breaking-strength, 3,166 lb.; diameter, 0.240 in.; loading factor, 3.124; maximum tension in conductor, 1,583 lb.; weight, 0.1216 lb. per foot.

Span.	Datum.		Degrees Fahrenheit above Datum.									
	0.		20.		40.		60.		80.		100.	
	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.	Ten.	Sag.
Ft.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.	lb.	Ft.in.
180 ..	1515	0 4	1382	0 4½	1251	0 4¾	1120	0 5¼	990	0 6	862	0 6¾
220 ..	1482	0 6	1351	0 6½	1221	0 7¼	1092	0 8	965	0 9½	841	0 10¾
260 ..	1443	0 8½	1313	0 9½	1184	0 10½	1058	0 11¾	934	1 1	815	1 3¼
300 ..	1398	0 11¾	1270	1 1	1144	1 2¼	1020	1 4	901	1 6	788	1 9
340 ..	1349	1 3½	1223	1 5½	1100	1 7	981	1 9½	867	2 0½	761	2 3½
380 ..	1293	1 8½	1171	1 10½	1052	2 1	938	2 4	832	2 8	731	3 0

NOTE.

The datum temperature referred to in the tables is that defined in clause (1) of Regulation 41-11 hereof as the minimum temperature—*i.e.*, 20° Fahrenheit or such other temperature as may be specified in the license.

Assuming a minimum (or datum) temperature of 12° F., to use the tables in conjunction with a Fahrenheit thermometer it is necessary to add 12 degrees to the degrees stated at the head of each column of a table to obtain the actual working temperature: Thus datum, or 0°, becomes 12° actual temperature, 20° becomes 32°, &c.

Assuming a minimum (or datum) temperature of 20° F., it is necessary to add 20 degrees to the degrees stated: Thus 0° becomes 20°, 20° becomes 40°, &c.

Assuming a minimum (or datum) temperature of 30° F., it is necessary to add 30 degrees to the degrees stated: Thus 0° becomes 30°, 20° becomes 50°, &c.

A. W. MULLIGAN,
Acting Clerk of the Executive Council.

(P.W. 26/218/12.)

Electrical Wiring Regulations, 1935.

GALWAY, Governor-General.
ORDER IN COUNCIL.

At the Government House at Wellington, this 23rd day of July, 1935.

Present:

HIS EXCELLENCY THE GOVERNOR-GENERAL IN COUNCIL.

PURSUANT to the Public Works Act, 1928 (hereinafter called "the said Act"), His Excellency the Governor-General, acting by and with the advice and consent of the Executive Council, doth hereby make the Regulations hereinafter set forth, and doth hereby revoke, as from the coming into force of the Regulations hereby made, the Regulations next hereinafter referred to, and made or enuring under the said Act.

REGULATIONS REVOKED.

Date of Order.	Short Title or Description.	Date of Publication in Gazette.	Page
11 July, 1927..	Electrical Wiring Regulations, 1927	12 July, 1927	2397
1 July, 1929..	Amendments of Electrical Wiring Regulations, 1927	4 July, 1929	1790
25 Sept., 1931	Amendment of Electrical Wiring Regulations, 1927	1 Oct., 1931	2879
31 May, 1932..	Radio Wiring Regulations, 1932	9 June, 1932	1425

REGULATIONS ENACTED.

THESE regulations are divided into Divisions and Parts as follows:—

Division I.—General.

- Part 11. Definitions.
- Part 12. Application.
- Part 13. General.
- Part 14. Penalties.
- Part 15. Permits.

Division II.—Design I.

- Part 21. Electrical Plant.
- Part 22. Switchgear.
- Part 23. Conductors.
- Part 24. Conduit and Casing.
- Part 25. Bells.
- Part 26. Cable Sockets and Other Connections.
- Part 27. Fittings, Appliances, and Accessories.
- Part 28. Motors and Control Gear.
- Part 29. Lifts.

Division III.—Design II.

- Part 31. Heating and Cooking Appliances.
- Part 32. Theatres.
- Part 33. High and Extra-high Pressures.
- Part 34. Earthing.
- Part 35. Radio Apparatus.
- Part 36. Marking of Accessories, Appliances, Lamps, and Switches.
- Part 37. General.

Division IV.—Installation I.

- Part 41. Electrical Plant.
- Part 42. Switchgear.
- Part 43. Circuits and Conductors.
- Part 44. Installing Conductors I.
- Part 45. Installing Conductors II.
- Part 46. Installing Conductors III.
- Part 47. Fittings, Appliances, and Accessories.
- Part 48. Motors and Control Gear.
- Part 49. Electric Lifts.

Division V.—Installation II.

- Part 51. Heating and Cooking.
- Part 52. Theatres.
- Part 53. High and Extra-high Pressures.
- Part 54. Earthing.
- Part 55. Radio Apparatus.
- Part 56. Electric Signs, Outline and Decorative Lighting.
- Part 58. General.
- Part 59. Additions to and Alterations of Installations.

Division VI.—Inspection and Testing.

- Part 61. Inspection.
- Part 62. Tests.
- Part 63. Certification.

Division VII.—Tables.

DIVISION I.—GENERAL.

PART 11.—DEFINITIONS.

11-01. (1) These regulations may be cited as the Electrical Wiring Regulations, 1935.

(2) These regulations shall come into force on the twenty-eighth day following the date of publication hereof in the Gazette.

11-02. In these regulations, unless the context otherwise requires,—

"Accessible" means not permanently closed in by the structure or finish of the building.

"Accessory" means a device such as an adaptor, cut-out, plug, or socket, which is associated with wiring, fittings, switchboards, or appliances; but does not include a switchboard or fitting or appliance as herein defined.

"Adaptor" means a device for electrically connecting a fitting or appliance to a lamp-holder.

"Aerial conductor" means any conductor which is supported above the ground and which, or the covering of which, is directly exposed to the open air.

"All-insulated," in respect of any accessory, appliance, fitting, or other device, means covered with a non-conducting material in such manner that it is impossible when the device is in use for any person to make accidental or unintentional contact with any metal liable to become alive.

"Appliance" means a device in which electrical energy is converted into light, heat, motion, or any other form of energy, or is substantially changed in its electrical character.

"Approved" means approved by the Chief Electrical Engineer.

"Armoured cable" is one provided with a metallic covering of wires or tapes as a protection against mechanical injury.

"Authorized Inspector" means any Inspector registered under the Electrical Wiremen's Registration Act, 1925, and employed as such by the electrical supply authority and includes any person appointed by the Chief Electrical Engineer under the aforementioned Act, save that in any case where the electrical supply authority is also the consumer "Authorized Inspector" shall mean a person appointed for the purpose by the Chief Electrical Engineer.

"Cable" may comprise one or more conductors and may be with or without insulating covering and with or without protective coverings; the term "cable" does not include a "flexible cord" as herein defined, but includes any other wire.

"Chief Electrical Engineer" means the person for the time being holding that office in the Public Works Department.

"Conductor" means any wire, cable, bar, or tube used for conducting electrical energy.

"Consumer" means any body or person supplied, or entitled to be supplied, with electrical energy by an electrical supply authority, and includes any person who being under no disability and being competent to receive a supply is willing to enter into a contract with the electrical supply authority for electrical energy to be supplied to him at a point within the electrical supply authority's area of supply on the terms and subject to the conditions generally prevailing for such contracts within the electrical supply authority's area of supply.

"Cut-out" comprises all the separate parts—*e.g.*, fuse-link, fuse-carrier, fuse-contacts, fuse-extension, and circuit contacts—which, together with their mountings and base, form the complete protecting-device.

"Damp": A situation shall be deemed to be damp when moisture is either permanently present or intermittently present to such an extent as to be likely to impair the effectiveness and/or safety of an installation which conforms to the requirements of these regulations for installations not subject to the presence of moisture as aforesaid.

"Distribution board" means any switchboard arranged for the distribution to, and protection and control of, branch circuits fed from a main circuit.

"**Earthed**" means connected to the general mass of earth in such a manner as will ensure at all times the immediate discharge of electrical energy without electrical hazard.

"**Earthed metal**" means metal directly or indirectly in electrical contact with earth.

"**Earthing-lead**" is the conductor connecting the earthing-system to the metal or apparatus required to be earthed.

"**Electric sign**" means 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 luminous-discharge-tubes, the means of illumination forming an integral part thereof.

"**Electrical hazard**" means danger to life and/or property from electrical energy.

"**Electrical supply authority**" means any person or body licensed or otherwise authorized to generate and/or to supply electrical energy; and in respect of any premises means the electrical supply authority authorized to supply electrical energy for consumption on such premises; and in case more than one such authority is so authorized means the electrical supply authority by whom or which electrical energy is so supplied or intended to be supplied; and in respect of premises where there is no electrical supply authority so authorized means the Chief Electrical Engineer.

"**Extra-high pressure**" means any pressure in excess of 6,600 volts.

"**Extra-low pressure**" means any pressure not exceeding in the case of alternating current 32 volts and in the case of direct current 100 volts.

"**Fitting**" is any device for supporting or containing a lamp, and includes the shade or reflector, if any; for example, a bracket, pendant with ceiling rose, electrolier, or portable standard.

"**Flexible conductor**" means a conductor which comprises a number of wires the diameter of the wires and the character of the insulating material (if any) being such as substantially to ensure flexibility.

"**Flexible cable**" means a flexible conductor the cross-sectional area of the wires of which taken together exceeds 0.007 square inch.

"**Flexible cord**" means a flexible conductor the cross-sectional area of the wires of which taken together does not exceed 0.007 square inch.

"**Fuse-link**" means the actual wire or strip of metal in a cut-out or other device which is intended to be fused by an excessive current.

"**Fuse-switch**" is a switch the moving part of which carries one or more fuse-links.

"**High pressure**" means any pressure exceeding 650 volts but not exceeding 6,600 volts.

"**Horse-power**" means brake horse-power.

"**Inflammable**" means capable of being readily ignited.

"**Isolating-switch**" means a switch suitable for disconnecting a circuit under no-load conditions only.

"**Live**" (alive) is said of a conductor when a potential difference exists between it and earth.

"**Loop-in**" means looped at ceiling-roses, switches, or other outlets.

"**Low pressure**" means any pressure exceeding in the case of alternating current 32 volts and in the case of direct current 100 volts but not exceeding in either case 250 volts.

"**Luminous-discharge-tube**" (L.D. tube) means any tube, or other vessel or device, constructed of translucent material, hermetically sealed, and designed for the emission of light arising from the passage of an electric current through a gas or vapour contained within it; but the term shall not apply to the cathode-glow lamp (in which the greater part of the light is provided by the cathode glow) or to any electric discharge tube designed to operate below 500 volts, provided that if the striking voltage is above 500 volts a high-frequency Tesla coil is used for starting purposes.

"**Master-switch**" means a switch, or circuit-breaker controlling a complete installation, or a self-contained portion of an installation, or controlling or limiting the operation of some other switch or circuit-breaker or group of switches or circuit-breakers.

"**Medium pressure**" means any pressure exceeding 250 volts but not exceeding 650 volts.

"**Multiple-earthed neutral**" (M.E.N.): The neutral conductor of any low or medium pressure alternating-current system is said to be multiple-earthed when it is earthed at the source of supply and at one or more other points along the distribution or service

line, and at each consumer's premises, the resistance between any point of the neutral conductor and earth not exceeding 10 ohms.

"**Non-reversible**," in respect of any accessory device in the nature of an adaptor, or a plug and socket, for connecting apparatus, means so constructed and installed that the respective conductors between such adaptor, or plug, and the device are always connected to the same pole, phase, neutral or earthed conductor, as the case may be.

"**Point**" means a point on the wiring system at which current is taken to supply lamps, heaters, motors, and current-using devices generally.

"**Portable appliance**" means an appliance capable of being readily moved where established practice or the conditions of use make it necessary or convenient for it to be detached by means of a flexible cord and plug or adaptor from any source from which electrical energy is available.

"**Premises**" includes any land owned or occupied by an electrical supply authority or consumer, as the case may be, on which electrical energy is generated, transmitted, or used.

"**Pressure**" means the difference of potential—

(a) In the case of a medium pressure or any lower pressure three-phase or three-wire system of supply—

(i) Between any unearthed conductor and earth if the system of supply is normally earthed without a circuit-breaker and/or added resistance; or

(ii) Between any two unearthed conductors if the system of supply is normally unearthed, or is earthed through a circuit-breaker and/or added resistance; and

(b) In the case of a medium pressure or any lower pressure two-wire system of supply, between conductors; and

(c) In the case of a high pressure or extra-high pressure three-phase system of supply, between any two unearthed conductors; and

(d) In the case of a high pressure or extra-high pressure two-wire system of supply, between conductors.

In the case of high pressure and extra-high pressure the rated difference of potential shall be subject to such additional pressure, not exceeding 10 per cent., as may be necessary for line and transformer regulation.

"**Readily accessible**" means able to be reached quickly and without climbing over or removing obstructions or resorting, for example, to a chair, box, or portable ladder.

"**Service cut-out**" means any device installed by the electrical supply authority for automatically disconnecting the consumer's installation.

"**Service-lift**" means a lift the car of which has a floor area not exceeding 9 sq. ft. and a height not exceeding 4 ft. and which is used to carry goods and/or material only and which is operated from without the lift-well.

"**Service-line**" means a line which connects a consumer's installation with a distribution line of the system of supply.

"**Service-main**" is that portion of the wiring on a consumer's premises between the main switchboard and the service-line from which supply is obtained.

"**Source of supply**" means either the generating-station, the substation, or the transformer, as the case may be, which is the source of the electrical energy at the pressure at which it is delivered to the consumer.

"**Starting-current**" means the maximum current drawn from the line when starting a motor.

"**Subcircuit**" means that portion of a circuit extending beyond the final circuit-breaker or set of cut-outs.

"**Submain**" means a branch main connecting a main switchboard to a distribution board or section board.

"**Switchboard**" means an assemblage of switchgear, with or without instruments, but does not apply to a group of local switches on a subcircuit.

"**Switchgear**" means any apparatus for controlling the distribution of electrical energy, or for controlling or protecting electrical circuits, machines, or other apparatus.

"**System of wiring**" :—

Three-phase four-wire.—A three-phase four-wire system of wiring means a system comprising four conductors, three of which are connected as in a three-phase three-wire system, the fourth being connected to the neutral point of the supply.

Three-phase three-wire.—A three-phase three-wire system of wiring means a system comprising three

conductors between successive pairs of which are maintained alternating differences of potential successively displaced in phase by one-third of a period.

Three-wire.—A three-wire system of wiring means a system comprising three conductors, one of which, known as the "neutral" or "middle," is maintained at a potential midway between the potentials of the other two, referred to as the "outer" conductors. Part of the load may be connected directly between the outer conductors, and the remainder divided as evenly as possible into two parts connected respectively between the middle and each outer conductor.

Two-wire.—A two-wire system of wiring means a system comprising two conductors between which the load may be connected, the wiring being effected by either of the following methods:—

- (a) Two-conductor, insulated: Conductors insulated throughout are provided for all connections to both poles of the supply, the conductors being separate, twin, or concentric.
- (b) Two-conductor, earthed: Conductors are provided throughout for all connections to both poles of the supply, those connected to the one pole being insulated throughout, and those connected to the other being uninsulated throughout and efficiently earthed. The uninsulated conductor, known as the "external" conductor, completely surrounds the whole length of the other, known as the "internal" conductor. (This system is known as earthed concentric wiring.)

"Theatre" means any building or part of a building regularly or frequently used for dramatic, operatic, motion picture, or other performances or shows.

"Tough rubber" means a compound used as a sheathing or protection, or both, of a cable or flexible cord and complying with the requirements of Regulation 23-71 hereof.

"Weatherproof," in respect of fittings, accessories, and current-using devices, means so constructed that, when the same are installed, rain, snow, and splashing are excluded.

11-03. All other terms used in these regulations shall, unless the context otherwise requires, have the meaning given to them in British Standard Specification No. 205.

11-04. The term "British Standard Specification" means a specification issued under that name by the British Standards Institution, and where any such specification is prescribed in these regulations the latest revision thereof or any specification issued in lieu thereof by that Institution prior to the date of enactment of these regulations is implied.

PART 12.—APPLICATION, MODIFICATION, AND EXEMPTION.

APPLICATION.

12-01. (1) These regulations shall apply to all electrical installations connected with any source from which electrical energy is available provided that nothing herein shall apply to any electric line or work—

- (a) Used, or intended to be used, by any electrical supply authority at a voltage exceeding medium pressure; or
- (b) Used, or intended to be used, by any electrical supply authority at medium pressure or any lower pressure elsewhere than on any premises; or
- (c) Used, or intended to be used, at a greater distance than 5 ft. below the surface of any mine or other place which is subject to the provisions of the Coal-mines Act, 1925, and/or the Mining Act, 1926, or any Act or Acts made in substitution therefor; or
- (d) On any vessel or vehicle used for transport purposes.

(2) Every addition to, or alteration of, an existing installation shall be deemed to be a new installation and all the provisions of these regulations shall apply to all work done in connection with such addition or alteration.

12-02. It shall be a condition of every license granted and taking effect under the Public Works Act, 1928, or any other Act (and whether granted before or after the coming into force of these regulations) by which any electrical supply authority is empowered to supply electrical energy to any consumer, that such authority shall not connect with its electric lines or permit any other person to connect with such lines any new installation on a consumer's premises unless and until such installation or any completed part thereof has been inspected and tested and certified pursuant to Regulations 63-01 and 63-02 hereof.

12-03. It shall also be a condition of every such license that the electrical supply authority shall not continue to supply electrical energy to any existing installation connected with such authority's electric lines, or to connect and/or to supply electrical energy to any other existing installation if such installation or any part thereof is not reasonably free from electrical hazard, and such work in accordance with these regulations as such electrical supply authority directs is not done to render such installation or such part reasonably so free: Provided that it shall not be necessary for the electrical supply authority to require strict compliance with these regulations in the doing of any such work if it is satisfied that such compliance would involve unreasonable expenditure and that the installation can otherwise be rendered reasonably free from electrical hazard.

12-04. Where the installation of any person and every appliance connected therewith complies with the requirements of these regulations, the electrical supply authority shall not, without the permission of the Chief Electrical Engineer in writing, refuse to supply such person on the ground that the installation or any appliance connected therewith constitutes an electrical hazard.

12-05. In any case where the electrical supply authority is also the consumer of the electrical energy supplied by it, the conditions imposed by Regulations 12-02 and 12-03 hereof shall apply to it in its capacity as supply authority as if it were supplying electrical energy to some other consumer than itself, but in such case the Chief Electrical Engineer or some person appointed by him in writing in that behalf shall have and may exercise the power to inspect, test, and certify mentioned in Regulation 12-02 hereof and the dispensing-powers conferred by Regulation 12-03 hereof.

12-06. In the case of supply to any Government railway-station, Government railway workshop, or to any apparatus on any Government railway line the Chief Electrical Engineer or some person appointed by him in writing in that behalf shall have and may exercise the power to inspect, test, and certify mentioned in Regulation 12-02 hereof and the dispensing-powers conferred by Regulation 12-03 hereof.

MODIFICATION AND EXEMPTION.

12-11. All permits, approvals, requirements, authorizations, and generally all acts of authority which originated under the Electrical Wiring Regulations, 1927, and are subsisting or in force on the coming into force of these regulations shall take effect for the purposes of these regulations as fully and effectually as if they had originated under the corresponding provisions of these regulations and shall where necessary be deemed to have so originated.

12-12. All actions, prosecutions, and other legal proceedings commenced under the Electrical Wiring Regulations, 1927, and pending or in progress on the coming into force of these regulations may be continued, completed, and enforced either under the Electrical Wiring Regulations, 1927, as if the same had not been revoked or under these regulations.

12-13. (1) Nothing in these regulations shall be deemed to prohibit the sale, installation, or use of anything thereby affected which was in New Zealand, or in transit to New Zealand or the subject of an irrevocable order by a person in New Zealand on the date of the coming into force of these regulations provided that it shall be free from electrical hazard and either shall be in conformity with the requirements of the Electrical Wiring Regulations, 1927, or shall have been approved.

(2) The Chief Electrical Engineer may, by giving not less than six months' notice in the *Gazette*, require that all or any such material which does not comply with the requirements of the Electrical Wiring Regulations, 1927, be used only in certain places selected by him and/or have affixed thereto before sale or offering for sale or (in those cases where no sale takes place) installation an official transfer to be issued for that purpose by the Public Works Department.

(3) In the event of any dispute as to whether the material was in New Zealand, or in transit to New Zealand, or the subject of an irrevocable order by a person in New Zealand on the date of the coming into force of these regulations, the onus of proof shall be on the person who sells, or offers for sale, or (in those cases where no sale takes place) installs such material.

12-14. (1) In any case where the Chief Electrical Engineer, upon application being made to him in writing by any person proposing to make any new installation or alteration or addition to any existing installation, is satisfied that strict compliance with these regulations would involve expenditure out of proportion to the degree of freedom from electrical hazard to be secured by such compliance he may modify any such requirements if satisfied that reasonable freedom from electrical hazard can otherwise be secured.

(2) Every such application shall be accompanied by a full statement of the reasons why such modification is desired and of the nature thereof, and by a statement by the electrical supply authority's engineer that the application is (or is not) a reasonable one and that in his opinion such modification will not (or will) lead to serious increase in the electrical hazard.

(3) In granting any such modification the Chief Electrical Engineer shall specify what special work (if any) he requires to be done to render the installation reasonably free from electrical hazard.

12-15. Where an electrical supply authority changes over from one voltage or system to another, the Governor-General in Council may, by notice published in the *Gazette*, make such modification as may be specified in such notice of these regulations in their application to the reconditioning of installations for the purposes of such change-over.

12-16. Regulation 36-01 hereof shall not become operative until twelve months after the date of the coming into force of these regulations.

PART 13.—GENERAL.

13-01. The Governor-General in Council may from time to time, by notice in the *Gazette*, approve methods or types of construction or materials not especially provided for in these regulations, and impose such conditions as he deems necessary with respect to the use thereof.

13-02. The Chief Electrical Engineer may prohibit the installation and use of any appliance, apparatus, accessory, cable, fitting, machine, switchgear, switchboard, method or type of construction, or material or method of installation which in his opinion constitutes or may constitute an electrical hazard.

13-03. No person shall manufacture for sale or sell or offer for sale, and no person shall install or cause or permit to be installed or assist to install on any premises, any device or apparatus which does not comply with the requirements or which is not of the character specified by these regulations in respect of such device or apparatus.

13-04. No person shall install or cause or permit to be installed or assist to install on any premises any wiring which does not comply with the requirements, or which is not of the character specified by these regulations in respect of such wiring.

13-05. No person shall install or cause or permit to be installed or assist to install on any premises any device or apparatus or wiring in a manner contrary to these regulations.

13-06. (1) No person shall use or maintain or cause or permit to be used or maintained on any premises any apparatus, device, or wiring :—

(a) Which does not comply with the requirements or which is not of the character specified by these regulations in respect of such apparatus, device, or wiring ; or

(b) In a manner contrary to these regulations.

(2) No person shall knowingly continue to use or maintain or cause or permit to continue to be used or maintained for or in connection with the supply, distribution, or consumption of electrical energy any device or apparatus or wiring or any part of an installation if for any reason such device or apparatus or wiring or part of an installation has ceased to comply with the requirements or to be of the character specified by these regulations in respect thereof.

(3) This regulation does not apply to any apparatus, device, and/or wiring installed on any premises prior to the coming into force of these regulations provided such apparatus, device, and/or wiring is in use on the premises where so installed and is free from electrical hazard.

13-07. In the event of any dispute between a contractor or wireman and an electrical supply authority regarding the interpretation or application of these regulations the matter may be referred to the Chief Electrical Engineer for adjudication and his decision thereon shall be final.

PART 14.—PENALTIES.

14-01. Any person wilfully supplying material which does not comply with these regulations and/or which in the opinion of the Chief Electrical Engineer constitutes an electrical hazard shall be liable to a fine of not less than £10.

14-02. Any person committing a breach of these regulations for which no penalty is hereinafter provided shall be liable to a fine not exceeding twenty pounds.

PART 15.—PERMITS FOR WIRING WORK.

15-01. (1) Save as provided in Regulations 15-12, 15-13, and 15-14 hereof no person shall until he has obtained permission from the electrical supply authority—

(a) Commence or undertake any electrical-wiring work. The permission in this case if given verbally shall be confirmed in writing within forty-eight hours ; or

(b) Connect to any source from which electrical energy is available—

(i) Any electrical wiring work ; or

(ii) Any electrical apparatus intended to be used in any situation where the person touching it may, under normal conditions, simultaneously make contact with earth or earthed metal ; or

(iii) Any electrical apparatus exceeding 10 amperes in capacity.

(2) The person undertaking to carry out any electrical wiring work shall on completion of such work notify the electrical supply authority in writing that the work is completed and that the tests prescribed by Regulations 62-51 to 62-55 (both inclusive) hereof have (where applicable) been satisfied. Such notice shall include the name and registration number of the electrical wireman in charge of the work.

(3) In the case of an installation on any Government railway station, Government railway workshop, or any Government railway line, but not elsewhere, it shall be sufficient for the Railway Department to advise the electrical supply authority and obtain permission only in cases where additional demand for electrical energy is involved.

15-02. The electrical supply authority shall, on application made by the owner or occupier of the premises describing the proposed work, issue within twenty-one days of such application a permit for the undertaking of such work. The issue of such permit shall not be deemed to be evidence that the electrical supply authority is prepared to supply electrical energy.

15-03. Every such permit shall be deemed to authorize the execution of the work only on condition that the work is commenced within a reasonable period of the date of issue thereof, and if the work be not commenced within such period the permit shall be void and of no effect.

15-04. Every such permit shall be deemed to authorize the execution of the work only on condition that the work is completed within a reasonable time from the commencement thereof, and if the work be not in the opinion of the electrical supply authority so completed the electrical supply authority may by notice in writing to the person to whom the permit was issued withdraw the same and the same shall thereupon cease to have effect.

15-05. During the currency of the permit no further permit shall be issued for the same work.

15-06. An electrical supply authority may grant a permit for temporary electrical wiring work, and a permit expressed to be so granted shall be deemed to authorize the undertaking of the work referred to therein so that the provisions of Regulations 15-03, 15-04, and 15-05 hereof shall apply and be deemed also to authorize the use and maintenance of such work for a period not exceeding one month from the date when the work is first connected with the source from which electrical energy is available or such shorter period as may be stated in the permit.

15-07. Any permit issued under the last preceding regulation may be subject to such conditions, not repugnant to these regulations, as the electrical supply authority thinks fit to impose and as are set out thereon.

15-08. The period for which any temporary electrical wiring work may be used and maintained may from time to time be extended by successive permits each for a period not exceeding one month but so that the total period for which such work may be used and maintained shall not (except in the case of temporary electrical wiring work used or maintained in connection with a building or works in course of construction) exceed twelve months from the date when the work was first connected with the source from which electrical energy is available.

15-09. No person shall connect any temporary electrical wiring work with a source from which electrical energy is available until it has been inspected and approved by an Authorized Inspector as having been installed in accordance with these regulations and with the conditions (if any) set out in the permit.

15-10. No person shall continue to use or maintain any temporary electrical wiring work after the expiration of the period (including any extension thereof) authorized in that behalf by a permit granted under these regulations.

15-11. On the expiration of the period (including any extension thereof) during which any temporary electrical wiring work may lawfully be used and maintained pursuant to a permit granted under these regulations the occupier of the premises on which such work is constructed shall forthwith demolish and dismantle such work.

15-12. In any case of emergency due to a breakdown or other accident any person authorized pursuant to the Electrical Wiremen's Registration Act, 1925, to do electrical wiring work may without obtaining a permit as required by these regulations begin any work necessary to repair the installation, provided that any person who begins any such work shall make an application for a permit under these regulations to the electrical supply authority within forty-eight hours after such work is begun.

15-13. In any case where an electrical supply authority is also the consumer of the electrical energy supplied by it, or is the contractor for any electrical wiring work, the Chief Electrical Engineer or any person authorized by him in writing in that behalf shall, unless the Governor-General in Council otherwise directs, exercise and perform the powers, functions, and duties conferred or imposed on the electrical supply authority as such by the foregoing provisions of this Part of these regulations.

15-14. (1) Where electrical energy is generated upon the consumer's premises or is obtained from a privately-owned plant no person shall until he has obtained written permission from the Chief Electrical Engineer—

- (a) Commence or undertake any electrical wiring work; or
- (b) Connect to any source from which electrical energy is available—
 - (i) Any electrical wiring work; or
 - (ii) Any electrical apparatus intended to be used in any situation where the person touching it may, under normal conditions, simultaneously make contact with earth or earthed metal; or
 - (iii) Any electrical apparatus exceeding 10 amperes in capacity.

(2) The person undertaking to carry out any electrical wiring work shall on completion of such work notify the Chief Electrical Engineer in writing that the work is completed and that the tests prescribed by Regulations 62-51 to 62-55 (both inclusive) hereof have (where applicable) been satisfied. Such notice shall include the name and registration number of the electrical wireman in charge of the work.

DIVISION II.—DESIGN I.

PART 21.—ELECTRICAL PLANT.

GENERATORS.

21-01. (1) Every generator having a capacity exceeding $\frac{1}{2}$ kilowatt shall be provided with a name-plate bearing the maker's name, registered trade-mark, or registered trade-name, the output in K.W., K.V.A., or amperes, the voltage between terminals at the rated output, the speed in revolutions per minute, and, if an alternator, the number of phases and the frequency.

(2) Every generator shall be capable of complying with the particulars shown on the name-plate.

21-02. The terminals of any generator operating at other than extra-low pressure shall be so guarded or placed that they cannot be accidentally touched or short-circuited.

TRANSFORMERS, RESISTANCES, AND CHOKE-COILS.

21-11. Protecting cases or enclosures of transformers, resistances, and choke-coils shall be of material which is not readily combustible, and the conductors shall be adequately insulated from the protecting cases, enclosures, and supports, except that any neutral conductor need not be so insulated.

21-12. (1) Every transformer having a capacity exceeding $\frac{1}{2}$ kilovolt-ampere shall be provided with a name-plate bearing the maker's name, registered trade-mark, or registered trade-name, the output in K.V.A. or amperes, the voltage between primary terminals, the voltage between secondary terminals, the number of phases, and the frequency.

(2) Every transformer having a capacity not exceeding $\frac{1}{2}$ kilovolt-ampere shall, except as provided in Regulation 55-02 hereof, be provided with a name-plate bearing the output in watts or amperes, the voltage between primary terminals, and the voltage between secondary terminals.

(3) Every transformer shall be capable of complying with the particulars shown on the name-plate.

21-13. Where transformers or motor-generators are used to reduce the voltage to low pressure or extra-low pressure for the purposes mentioned in paragraphs (a) and (b) hereof the primary and secondary windings shall be isolated from each other—

- (a) To supply general wiring in buildings; or
- (b) For any other purpose where the low pressure or extra-low pressure circuit or apparatus has exposed live metal with which it is possible for any person to make contact.

21-14. Every transformer used or intended to be used for electric bell circuits as specified in Regulation 45-92 hereof shall comply with the following requirements:—

- (a) It shall be double wound; and
- (b) Its secondary voltage shall not exceed 30 volts.

21-15. Every transformer which is connected or intended to be connected to ordinary bell wiring shall comply with the following requirements:—

- (a) It shall be double wound; and
- (b) The secondary voltage shall not exceed 12 volts; and
- (c) The capacity shall not exceed 50 watts; and
- (d) It shall have an impedance sufficient on sustained short-circuit to prevent burning out.

21-16. Every transformer used or intended to be used for electric toys as specified in Regulation 45-93 hereof shall comply with the following requirements:—

- (a) It shall be double wound; and
- (b) Its primary voltage shall not exceed low pressure; and
- (c) Its secondary voltage shall not exceed 25 volts; and

- (d) Its capacity shall not exceed 150 watts; and
- (e) Its impedance shall be sufficient on sustained short-circuit to prevent burning out.

21-17. Every transformer for use with any luminous-discharge-tube electric sign, outline or decorative lighting shall comply with the requirements of paragraph (c) of Regulation 27-91 hereof.

21-18. Every transformer for use with any radio apparatus shall comply with the requirements of Regulation 35-01 hereof.

21-19. Every resistance for use with a motor shall comply with the requirements of Regulations 28-11, 28-12, 28-13, and 28-14 hereof.

BATTERY-CHARGERS AND RECTIFIERS.

21-31. (1) Every battery-charger and rectifier shall have permanently and legibly marked thereon the maker's name, registered trade-mark, or registered trade-name, the input in watts or amperes, the voltage between input terminals, the voltage between output terminals, and the polarity of the output terminals, and in the case of alternating current the number of phases and the frequency.

(2) Every battery-charger and rectifier shall be capable of complying with the particulars marked thereon.

CONDENSERS.

21-41. (1) Every static condenser (other than a condenser used for radio, communication, or signalling purposes) shall have permanently and legibly marked thereon the maker's name, registered trade-mark, or registered trade-name, the capacity in micro-farads or K.V.A., the working voltage, number of phases, phase connections, and the frequency.

(2) Every such condenser shall be capable of complying with the particulars marked thereon.

21-42. Every static condenser (other than a condenser used for radio, communication, or signalling purposes) which may remain charged when disconnected from the source of supply and which is of sufficient capacity to constitute an electrical hazard shall be provided with a legible warning notice permanently fixed on the condenser in a conspicuous position. This notice shall contain a warning that the condenser must be discharged before any work is carried out thereon.

21-43. The containing case of every oil-immersed condenser shall be of robust construction and be made oil-tight without the use of solder.

PART 22.—SWITCHGEAR.

SWITCHBOARDS.

22-01. Every switchboard shall be constructed wholly of durable non-ignitable material of adequate mechanical strength, and if intended to be in direct contact with live metal shall be of permanently high electric strength and insulation resistance.

22-02. To ensure mechanical strength in switchboard-panels made of composition material the minimum thickness of any such panel shall be in accordance with such one of the following tables respecting current and distance respectively as specifies the greater thickness:—

Current.		Distance.	
Total Current per Conductor taken to the Switchboard.	Minimum Thickness.	Maximum Distance between Supports.	Minimum Thickness.
Not exceeding 20 amperes	$\frac{1}{2}$ in.	18 in. or less ..	$\frac{1}{2}$ in.
Not exceeding 50 amperes	$\frac{3}{8}$ in.	30 in. or less ..	$\frac{3}{8}$ in.
Over 50 amperes ..	$\frac{1}{2}$ in.	Over 30 in. ..	$\frac{1}{2}$ in.

22-03. Where the frame of a switchboard is required to be earthed in accordance with the provisions of Part 54 of these Regulations suitable terminals shall be provided to which the earthing-lead shall be attached.

22-04. (1) All panel switchboards shall be mounted on vertical iron brackets or standards bearing against the board to within $1\frac{1}{2}$ in. of each horizontal edge of the board and of such dimensions as adequately to support the board.

(2) Every support for a switchboard shall be securely fixed.

22-05. (1) The various exposed live parts of a switchboard shall be so arranged by suitable spacing or shielding with insulating material which is not readily combustible that an arc cannot be maintained between any such parts or between any such part and earth.

(2) The arrangement of all parts shall be such that the connections to all instruments and apparatus can be readily traced.

22-06. All screws and nuts on every switchboard used for carrying current shall be of copper, brass, or other suitable material.

22-07. All bus-bars and connections on switchboards shall be in accordance with the temperature rise as provided in British Standard Specification No. 159.

22-08. Where a scheme of colouring is used to distinguish conductors on a switchboard the live conductors shall be coloured red, yellow, and/or blue, and the neutral, earthed conductor, or middle wire shall be coloured black.

22-09. Conductors on every switchboard shall be so placed and so arranged that the course of every conductor may be easily traced.

MAIN AND DISTRIBUTION SWITCHGEAR.

22-21. Every switchboard shall (except as provided by Regulations 22-23 and 22-24 hereof), be fitted, as a minimum, with such of the switchgear specified in Regulation 22-25 hereof as is appropriate to the particular system of wiring.

22-22. Every main switch shall be—

- (a) Capable of breaking the maximum load of the installation as defined in Regulation 43-13 hereof; and
- (b) In no case smaller than 10 amperes rating.

22-23. Where—

- (a) The supply is from an external source; and
- (b) A service cut-out is installed; and
- (c) Such service cut-out is used solely for the installation of one consumer, then such service cut-out may be deemed to take the place of the respective cut-out referred to in Regulation 22-25 hereof for the control of the incoming main supply.

22-24. The circuit-breakers or switches prescribed by Regulation 22-25 hereof may be omitted on any submain or subcircuit if the normal working current per conductor does not exceed—

- (a) 10 amperes in the case of a circuit which includes an aerial conductor; or
- (b) 50 amperes in any other case.

22-25. The switchgear to be provided on every switchboard shall be in accordance with the following tables and shall comply with the following requirements:—

- (a) Except as provided in Regulation 42-27 hereof a circuit-breaker shall be used in every case where

the full-load current exceeds 100 amperes per conductor, save that where the circuit will not be opened under load and the full-load current does not exceed 200 amperes per conductor isolating-switches and cut-outs may be used. The full-load current of an installation shall be assessed as the maximum demand in accordance with Regulation 43-13 hereof.

- (b) Where a separate cut-out or fuse-link and switch are specified a fuse-switch may be used.

- (c) Lighting, heating, or power, or any combination of these, may be controlled by separate main switches.

- (d) No switch or circuit-breaker shall be included in any neutral conductor or earthed conductor in such a manner as will permit such conductor to be opened before or closed after the corresponding live conductors, but this requirement shall not prohibit the provision of an isolating-link for testing purposes. This paragraph does not apply to a switch mounted on a portable appliance unless otherwise specified in these regulations.

- (e) Where a conductor is earthed at the source of supply without a circuit-breaker or added resistance—

- (i) No fuse-link shall be included in such conductor;

- (ii) The overload trip-coil for such conductor may be omitted;

- (iii) Circuit-breakers or switches need not control such conductor.

- (f) No fuse-link shall be included in any neutral conductor or earthed conductor except where specified in the following tables.

- (g) Where an installation consists of only one subcircuit, or one submain supplying a distribution board, the main switchgear may also be used to control and protect such subcircuit or submain.

MAIN SWITCHGEAR FOR GENERATORS.

Type of Generator.	System of Supply.	Switchgear.	
		Circuit-breaker or Switch.*†	Overload Trip-coils or Fuse-links.*†
1.	2.	3.	4.
A.C. three-phase four-wire	Any ..	Triple-pole ..	Each phase conductor.
A.C. three-phase three-wire	Any ..	Triple-pole ..	Each conductor or overload trip-coils in two conductors and earth leakage protection in the other conductor.
A.C. single-phase two-wire	{ M.E.N. .. All others .. Any .. M.E.N. .. All others .. Any ..	Single-pole ..	Unearthed conductor.
D.C. two-wire‡		Double-pole|| ..	Each conductor.||
A.C. single-phase three-wire		Double-pole|| ..	Each conductor.||
D.C. three-wire‡		Triple-pole|| ..	} Each phase conductor.
	Triple-pole§|| ..	Each outer conductor.	

* See Regulation 22-25.
 † When the generators are arranged to run in parallel only circuit-breakers with trip-coils shall be used.
 ‡ When compound-wound generators are arranged to run in parallel an equalizer switch must be provided.
 § Where the generators are arranged to run in parallel the circuit-breaker shall be double-pole.
 || See Regulation 22-25 (e).

MAIN AND DISTRIBUTION SWITCHGEAR TO CONTROL CONSUMER'S WIRING.

Nature of Consumer's Wiring and of the Supply.			Switchgear.	
System of Supply.	Incoming Main Supply and Outgoing Submains or Subcircuits.	Earth Connection of Supply System.	Circuit-breaker or Switch.*†	Overload Trip-coils or Fuse-links.*†
1.	2.	3.	4.	5.
A.C. three-phase four-wire	Four-wire and three-wire (three-phase)	Any ..	Triple-pole ..	Each phase conductor.
	Three-wire (two-phase and neutral)	{ M.E.N. .. All others .. M.E.N. .. All others .. Any or none ..	Double-pole } Triple-pole§	Each phase conductor.
	Two-wire (phase and neutral)		Single-pole ..	Unearthed conductor.
	Three-wire ..		Double-pole§	Each conductor.§
	Triple-pole ..		Each conductor or overload trip-coils in two conductors and earth leakage in other conductor	
A.C. three-phase three-wire				
A.C. single-phase two-wire	Two-wire ..	Any or none ..	Double-pole	Each conductor.
D.C. two-wire	Two-wire ..	{ M.E.N. .. All others or none .. M.E.N. .. All others .. Any	Single-pole ..	Unearthed conductor.
			Double-pole§	Each conductor.§
A.C. single-phase three-wire	Three-wire ..		Double-pole } Triple-pole§	} Each outer conductor.
D.C. three-wire	Two-wire (outer and neutral)		Single-pole ..		Unearthed conductor.
	Two-wire (outer to outer)	Any ..	Double-pole§	Each conductor.§

* See Regulation 22-25. † See Regulation 22-24. ‡ See Regulation 22-23. § See Regulation 22-25 (e).

NOTE.—The earthing of new supply systems is governed by the Electrical Supply Regulations, but provision has been made in this table for any existing systems which may not comply with the present Electrical Supply Regulations.

SWITCHBOARD INSTRUMENTS.

22-31. Every generator switchboard shall be provided with the necessary instruments to indicate with reasonable accuracy the voltage and current generated.

SWITCHES AND CIRCUIT-BREAKERS.

22-41. All switches and circuit-breakers shall be so designed that their performance shall not be of a lower standard than that prescribed by the appropriate British Standard Specification.

22-42. Each fuse-switch when operating as a switch and each switch when used for breaking a circuit under load shall be quick-break and positive in action.

22-43. Switches and circuit-breakers operating at a pressure in excess of 30 volts and readily accessible to unskilled persons shall be so constructed and installed that no person can accidentally make contact with live metal or be injured through an arc from the switch.

22-44. Switches of the all-insulated type shall have covers made of strong material which is not readily combustible.

22-45. The covers of metal-clad switches shall be so interlocked that the cover cannot be opened when the switch is in the "On" position or the switch placed in the "On" position when the cover is open.

22-46. Every circuit-breaker shall be arranged to open at a predetermined current and shall, unless approved by the electrical supply authority, be of the free-handle type.

22-47. Every fuse-switch when opening the circuit as a fuse-link and every circuit-breaker shall comply with Regulations 22-51 and 22-52 hereof.

CUT-OUTS.

22-51. For extra-low pressure every cut-out shall comply with the following requirements:—

- (a) The cover (if any) shall be made of material which is not readily combustible and if of metal it shall be kept well clear of all live parts.
- (b) The base shall be of insulating material which is durable, not readily combustible, and non-absorbent.
- (c) The circuit contacts and their terminals shall be so spaced or shielded that an arc cannot be maintained when the fuse-link blows.
- (d) The fuse-link shall be of such construction, or be so guarded or placed as to prevent danger from overheating, arcing, and the scattering of hot metal or other substances when it blows.

22-52. For low pressure and medium pressure every cut-out shall comply with the following requirements in addition to the requirements of the last preceding regulation:—

- (a) It shall be provided with a suitable carrier made of insulating material which is not readily combustible for the fuse-link of such shape as to protect a person handling it from shock and burns, and contacts shall be provided on the carrier to which the ends of the fuse-link can be readily attached.
- (b) The base shall be provided with fixed circuit contacts of such shape as to retain the carrier in position in the presence of vibration.
- (c) The bus-bars, fixed contacts, removable contacts, and fuse-links shall be so shielded as to protect a person against contact with live metal when the fuse-carrier is being inserted or removed.

22-53. When metal-clad cut-outs are used they shall be so erected that the covers cannot accidentally open or come apart at the hinges and so that each cover can be opened sufficiently for the easy withdrawal of the fuse-link carrier.

22-54. No fuse-link shall be placed in any ceiling-rose.

PART 23.—CONDUCTORS.

MATERIAL OF CONDUCTORS.

23-01. All conductors of cables for internal wiring, other than the outer conductors of earthed concentric systems, shall be of annealed copper and shall conform to British Standard Specification No. 7 or its equivalent.

23-02. (1) When the insulating material of any conductor contains free sulphur each wire shall either be adequately and uniformly coated with tin free from all impurities or be otherwise protected in an approved manner.

(2) The quality of the tinning shall be such that there will be no corrosion of the tinning in any finished cable or flexible cord and that the tinned conductor will withstand the tinning test prescribed by Regulation 62-35 hereof.

INSULATION OF CONDUCTORS.

23-11. The types of insulation prescribed by Regulations 23-12 to 23-32 (both inclusive) hereof are hereby declared to be approved types for the purposes of these Regulations and these types, or such other types as may from time to time be approved, shall alone be employed.

RUBBER-INSULATED CABLES.

23-12. (1) Rubber-insulated cables shall be insulated with a layer of pure rubber next to the conductor, an intermediate layer of vulcanized-rubber compound, and an outer jacket of vulcanized-rubber compound. These three layers shall together constitute the insulating material. Alternatively the cables may be insulated with a homogeneous insulating material consisting of vulcanized-rubber compound applied in one or more layers.

(2) The radial thickness of the insulating material shall be not less than that specified in British Standard Specification No. 7.

(3) The maker's name, or registered trade-mark, or registered trade-name, and the grade of insulation and/or working voltage shall be legibly and continuously marked on every rubber-insulated cable in some one of the following ways:—

- (a) Printed on a layer of tape vulcanized upon the insulating material; or
- (b) Printed on a longitudinal or spiral tape inserted under the protective covering; or
- (c) Printed on the surface of the insulating material under the protective covering; or
- (d) In the case of cables having an outer protective covering of tough rubber compound in accordance with Regulation 23-71 hereof, alternatively may be embossed or indented on the outside of such covering at intervals not exceeding three feet.

PAPER-INSULATED CABLES.

23-21. (1) The conductors of paper-insulated cables shall be lapped with paper impregnated with a suitable insulating compound.

(2) The radial thickness of the insulating material shall be not less than that specified in British Standard Specification No. 480.

FLEXIBLE CORDS.

23-31. (1) The conductors (other than earthing-leads) of flexible cords shall be insulated in some one of the following ways:—

- (a) A lapping of cotton next to the conductor, then two layers of pure rubber and an overlapping of cotton; or
- (b) One layer of pure rubber next to the conductor, an intermediate layer of vulcanized-rubber compound, and an outer jacket of vulcanized-rubber compound; or
- (c) A homogeneous insulating material consisting of vulcanized-rubber compound applied in one or more layers; or
- (d) A lapping of cotton next to the conductor, then one or more layers of rubber and a close overlapping of asbestos; or
- (e) A homogeneous insulating material as in paragraph (c) of this regulation with a close overlapping of asbestos; or
- (f) A lapping of cotton or silk next to the conductor, then a homogeneous insulating material as in paragraph (c) of this regulation.

(2) The radial thickness of the insulating material shall be not less than that specified in Table VIII in Division VII hereof.

23-32. (1) Except as provided in clauses (2) and (3) of this regulation, the maker's name, or registered trade-mark, or registered trade-name, and the grade of insulation and/or working voltage shall be legibly and continuously marked on every flexible cord in some one of the following ways:—

- (a) Printed on a layer of tape vulcanized upon the insulating material; or
- (b) Printed on a longitudinal or spiral tape inserted under the protective covering; or
- (c) Printed on the surface of the insulating material under the protective covering; or
- (d) In the case of flexible cords having an outer protective covering of tough rubber compound in accordance with Regulation 23-71 hereof, alternatively may be embossed or indented on the outside of such covering at intervals not exceeding three feet.

(2) In those cases where a standard method of identification other than that prescribed by the last preceding clause is adopted flexible cords having such method shall not be used unless approved.

(3) In the case of imported portable appliances in which the flexible cord is connected by the maker, the maker's name, or registered trade-mark, or registered trade-name, and grade of insulation need not be so marked, provided such appliance is branded with the manufacturer's name, or registered trade-mark, or registered trade-name or otherwise readily identifiable.

PROTECTIVE COVERING OF CONDUCTORS.

23-41. The types of protective covering prescribed by Regulations 23-42 to 23-71 (both inclusive) hereof are hereby declared to be approved types for the purposes of these regulations and these types, or such other types as may from time to time be approved, shall alone be employed.

RUBBER-INSULATED CABLES.

23-42. Rubber-insulated cables other than flexible cables shall be provided with some one of the following coverings:—

- (a) Taped as in paragraph (a) of clause (3) of Regulation 23-12 hereof and compounded; or
- (b) Braided as in Regulation 23-51 hereof; or
- (c) Bedded and armoured, with or without serving or braiding over the armour; the bedding, armouring, and serving or braiding (if any) shall be in accordance with British Standard Specification No. 7 or its equivalent; or
- (d) Covered with tough rubber compound in accordance with the requirements of Regulation 23-71 hereof; or
- (e) Covered in accordance with the requirements of Regulation 23-43 hereof.

RUBBER-INSULATED CABLES OR PAPER-INSULATED CABLES.

23-43. Rubber-insulated cables or paper-insulated cables other than flexible cables shall be provided with some one of the following coverings:—

- (a) Sheathed with a closely fitting seamless covering of commercially pure lead having a smooth exterior surface and of a uniform radial thickness in accordance with British Standard Specification No. 7 or British Standard Specification No. 480 (as the case may be) or their equivalent; or
- (b) Lead-covered as in the last preceding paragraph, and bedded and armoured, with or without serving or braiding over the armour; the bedding, armouring, and serving or braiding (if any) shall be in accordance with British Standard Specification No. 7 or British Standard Specification No. 480 (as the case may be) or their equivalent; or
- (c) Sheathed with a closely fitting seamless covering containing not less than 95 per cent. of commercially pure lead (the remainder consisting of rarer metals) and in other respects complying with paragraph (a) of this regulation.

BRAIDING.

23-51. Braided cables shall have an exterior braiding of hemp, cotton, jute, or other suitable material, thoroughly impregnated with a protective compound that will not have any deleterious action on the rubber or armouring, as the case may be.

FLEXIBLE CABLES AND CORDS.

23-61. Flexible cables and flexible cords shall be provided with some one of the following coverings:—

- (a) Braiding of natural silk or of artificial silk; or
- (b) Glace-cotton braiding; or
- (c) Hemp, cotton, jute, or other suitable braiding thoroughly compounded; or
- (d) Wire armouring, comprising a flexible braiding of galvanized steel or bronze wire in addition to the covering specified in paragraph (c) of this regulation; or
- (e) Hard-cord braiding, plain or impregnated, in addition to the covering specified in paragraph (c) of this regulation; or
- (f) Tough rubber compound in accordance with Regulation 23-71 hereof; or
- (g) Flame-resisting braiding; or
- (h) Varnished cotton or silk waterproof braiding; or
- (i) Thin tough rubber compound over twisted conductors; or
- (j) Rubber compound with braiding overall; or
- (k) Thin tough rubber compound over conductors made up to a circular or oval section with hemp, cotton, or jute filling.

TOUGH RUBBER SHEATHING.

23-71. Tough rubber compound when used as a protective covering shall—

- (a) Form a closely fitting sheath filling the external irregularities of the laid-up cores in the case of twin and multicore cables or flexible cords and concentric with the conductor in the case of single core; and
- (b) Be waterproof and capable of offering a high degree of resistance to abrasion and decay; and
- (c) Have a radial thickness not less than that specified in British Standard Specification No. 7, or Table VIII in Division VII hereof, as the case may be.

ALTERNATIVE MATERIAL OR TYPES.

23-81. If it is desired to use a type of cable or flexible cord otherwise than specified in Regulations 23-01 and 23-12 to 23-71 (both inclusive) hereof, permission shall be obtained from the Chief Electrical Engineer for its use provisionally or otherwise. The Chief Electrical Engineer may require to be submitted samples and/or a report from a recognized testing authority (such as the National Physical Laboratory in England) as to the behaviour, properties, and life of the materials employed.

IDENTIFICATION OF CABLES AND FLEXIBLE CORDS.

23-91. (1) All insulated cables other than flexible cables shall, except as provided in clause (3) of this regulation, be rendered distinguishable by means of the following colours:—

A.C. three-phase and D.C. three-wire systems of wiring—

- (a) Live conductor—Red, yellow, or blue.
- (b) Neutral, earthed conductor or middle-wire—Black.

D.C. two-wire systems of wiring—

- (c) Positive—Red, yellow, or blue.
- (d) Negative—Black.

A.C. two-wire non-earthed systems of wiring—

- (e) One conductor—Red, yellow, or blue.
- (f) Other conductor—Black.

(2) All insulated flexible cords and all insulated flexible cables shall, except as provided in clause (3) of this regulation, be coloured in such a manner that each conductor may be readily identified.

(3) This regulation does not apply to any three-core cable used solely for three-phases or to any conductor used as an aerial conductor or enclosed within a current-using device or used for high pressure or extra-high pressure in connection with luminous-discharge-tubes.

(4) For the purposes of this regulation a conductor shall be deemed to be alive up to the lamp or other current-using appliance when the switch is in the "on" position.

PART 24.—CONDUIT AND CASING.

SCREWED CONDUIT AND FITTINGS.

24-01. Screwed conduit and fittings shall comply with the following requirements:—

(a) The conduit shall be made in accordance with British Standard Specification No. 31 and shall be of heavy gauge and welded or solid drawn.

(b) The conduit fittings, other than boxes, shall be made in accordance with British Standard Specification No. 31.

(c) The conduit boxes shall be—

(i) Where applicable made in accordance with British Standard Specification No. 31:

(ii) Rectangular boxes of sheet steel or other approved metal, in either case having a minimum thickness of 0.0625 in. ($\frac{1}{16}$ in.):

(iii) Cast-iron terminal boxes specially designed as part of a complete accessory, and where such boxes are not malleable cast-iron they shall be approved.

(d) The screwed portion of bell-mouths and other outlets shall be provided with a taper thread and shoulder to prevent the conduit projecting, or shall be of the length specified in British Standard Specification No. 31.

(e) Bell-mouths and other outlets shall be of robust construction.

WOOD CASING.

24-11. Wood casing for enclosing cables shall be of well-seasoned timber, and shall be so constructed that the width of the fillet between the grooves is not less than $\frac{1}{4}$ in. and the thickness of the wood everywhere else not less than $\frac{1}{2}$ in.

PART 25.—BELLS.

LOW PRESSURE ELECTRIC BELLS.

25-01. Every electric bell or buzzer operating directly on a low pressure subcircuit shall comply with the following requirements:—

- (a) The current-carrying parts of the bell or buzzer shall be contained within a case which is not readily combustible; and
- (b) The current-carrying parts of the bell or buzzer shall be efficiently insulated, otherwise than by wood; and
- (c) All current-carrying screws and nuts of the bell or buzzer shall be effectively locked in such a manner as will preclude movement due to vibration; and
- (d) The cover of the bell or buzzer, where fixed in any position accessible to unauthorized persons, shall be effectively secured to prevent unauthorized removal; and
- (e) The cover of the bell or buzzer shall have clearly and permanently marked thereon in letters not less than $\frac{3}{8}$ in. high the following: "230 VOLTS—DO NOT OPEN"; and
- (f) Every bell or buzzer shall be fitted with a condenser across the spark gap.

PART 26.—CABLE SOCKETS AND OTHER CONNECTIONS.

CABLE SOCKETS.

26-01. Cable sockets shall where practicable be in accordance with British Standard Specification No. 91 or its equivalent, and in every case made of material which complies with the aforementioned specification, and of such a size that all strands of the conductor can enter the socket simultaneously.

BINDING-POSTS.

26-11. Binding-posts shall be fitted with a fine-thread screw and be tapped to a depth not less than the diameter of the screw.

JOINT-BOXES.

26-21. Every joint-box shall comply with the following requirements:—

- (a) It shall be constructed wholly of material which is durable, not readily combustible, and non-absorbent, and all insulation shall be of permanently high electric strength and insulation resistance; and
- (b) The live parts within such box shall be so arranged by suitable spacing or shielding with non-ignitable insulating material that conductors of opposite polarity or different phase cannot be readily short-circuited; and
- (c) When used in damp situations it shall be weatherproof and moisture resisting; and
- (d) When used with metal conduits it shall be of metal having a minimum thickness of 0.0625 in. ($\frac{1}{16}$ in.); and
- (e) When used with Class II cables specified in Regulation 44-81 hereof it shall be made of non-ignitable material.

PART 27.—FITTINGS, APPLIANCES, AND ACCESSORIES.

FITTINGS.

27-01. All fittings shall be so constructed that—

- (a) Passages for insulated conductors are of such size and so made as to avoid risk of abrasion; and
 - (b) There is no mechanical strain on any terminal; and
 - (c) Outlets are bushed or have well-rounded edges; and
 - (d) When hanging and exceeding 10 lb. in weight, they are suspended by a metal chain, rod, or tube of adequate strength, or by several flexible cords, in which case the weight on any one cord shall not be more than that specified in paragraph (c) of Regulation 45-21 hereof; and
 - (e) If of the enclosed type they are of such size or so designed as to avoid undue heating, and if so situated that the enclosing globe is liable to mechanical injury, it is protected by a suitable guard.
- 27-02. (1) Shades of inflammable material shall be kept free from contact with lamps and lamp-holders by means of suitable guards or supports.
- (2) Celluloid or other highly inflammable material shall not be used for any shade, candle-tube, colour-screen, or in any position where it is likely to introduce an electrical hazard.

APPLIANCES.

27-11. (1) Every hand-lamp shall have the metal parts of the lamp-holder and any metal in contact therewith shrouded

by insulation to prevent contact between such metal and the metal guard, or when the lamp-bulb (namely, the incandescent lamp) is in position and the guard is removed between such metal and the user.

(2) This regulation does not apply to a hand-lamp made entirely of metal provided with a watertight glass and earthed as provided in Regulation 54-01 hereof.

27-12. The handle of every hand-lamp (not being a hand-lamp made entirely of metal as specified in the last preceding regulation) shall be made of treated hardwood, or of some suitable insulating material capable of withstanding rough usage in service.

MEDICAL AND DENTAL APPLIANCES.

27-21. Medical and dental appliances in which any metal liable to become alive is, or which may be, in direct contact with the body of the patient shall be isolated by means of double-wound transformers or motor-generators or some other approved method from any submain or subcircuit which is connected to a service-main.

ACCESSORIES.

Ceiling-roses.

27-31. Ceiling-roses shall comply with the requirements of British Standard Specification No. 67, or shall be of such other types as may be from time to time approved.

Lamp-holders.

27-41. Every lamp-holder shall be of robust construction, and where it does not comply with a British Standard Specification the variation therefrom shall be within reasonable limits and so that no electrical hazard is created thereby.

27-42. No switch lamp-holder shall be used unless it is of an approved type.

Incandescent Lamps.

27-51. Incandescent lamps for ordinary lighting purposes shall comply with the appropriate British Standard Specification or its equivalent, and shall be provided with caps of a pattern as follows:—

Not exceeding 40 watts	}	Small Standard Bayonet (S.B.C.)
		Standard Bayonet (B.C.), Small Edison Screw (S.E.S.), or Edison Screw (E.S.).
Above 40 watts and not exceeding 200 watts	}	Standard Bayonet (B.C.), or Edison Screw (E.S.).
Above 200 watts and not exceeding 300 watts		Edison Screw (E.S.).
Above 300 watts	..	Goliath Screw (G.E.S.).

Mercury-vapour Lamps.

27-61. The connections to the terminals of the lamp-tube of every mercury-vapour lamp shall be so constructed that loosening of the contact or overheating cannot occur.

27-62. The resistance and solenoid of every mercury-vapour lamp shall be completely enclosed in a metal case, and any apertures in the case for purposes of ventilation shall be made only on the sides and be covered with fine wire gauze.

Plugs, Sockets, and Adaptors.

27-71. (1) Sockets shall be constructed so that the earthing pin (if any) of the plug can make contact only with the earthing terminal.

(2) The earthing pin and terminal shall be made distinguishable by tinning or otherwise.

27-72. Plugs and sockets shall be so constructed that no person can make accidental contact with live metal.

27-73. All plugs shall, except in the case of flexible cords having a protective covering prescribed by paragraphs (a) and (b) of Regulation 23-61 hereof, be constructed with provision for gripping the flexible cord or cable together with its protective covering or sheath to prevent any stress on the connections with the terminals.

27-74. Every plug-socket shall have a minimum rated capacity of 10 amperes.

27-75. Floor-sockets shall be fitted with a strong hinged close-fitting cover which is not readily combustible, which is capable of withstanding rough usage in service, and so arranged that the cover will automatically close over the contacts when the plug is withdrawn.

27-76. The bases of plugs and sockets shall be of material other than wood and such material shall be non-conducting, non-hygroscopic, and not readily combustible.

27-77. The covers of plugs and sockets shall be of heat-retarding insulating material other than wood, or of rigid metal, which shall be kept well clear of all live parts or be provided with an insulating lining.

27-78. (1) Weatherproof plugs and sockets shall be of specially robust construction, and be provided with efficient means to keep the sockets weatherproof when the plug is removed therefrom. When a loose cover is employed for this purpose it shall be anchored to the socket by means of a metal chain.

(2) When the plug is inserted in its socket, the combined fitting and its interlocking switch (if any) shall also be weatherproof.

27-79. (1) Adaptors shall be made of tough non-hygroscopic material which is not readily combustible, and which, in the case of single-way adaptors, shall be non-conducting.

(2) Adaptor for use in bayonet lamp-holders shall comply with the corresponding dimensions for lamp-caps as specified in British Standard Specification No. 161.

(3) Adaptors for use in screw lamp-holders shall be of one or other of the following types, namely:—

(a) Combined adaptor with pull-out plug; or

(b) Adaptor with a loose screw to prevent twisting of the flexible conductor.

(4) No adaptor shall be fitted to any appliance using more than 1.25 amperes.

ELECTRIC SIGNS, OUTLINE AND DECORATIVE LIGHTING.

27-91. In the case of luminous-discharge-tube electric signs, outline or decorative lighting—

(a) All high pressure or extra-high pressure parts shall be effectively screened in such a manner as to prevent unauthorized persons having access thereto or making contact therewith; and

(b) All high pressure or extra-high pressure connections shall be mechanically and electrically sound; and

(c) Transformers shall have independent primary and secondary windings which shall not be interconnected. All windings shall be suitably insulated. The open-circuit voltage of the secondary winding shall not exceed 15,000 volts; and

(d) All metal enclosures shall—

(i) Have a minimum thickness of 0.064 in. (16 S.W.G.) when erected outdoors and liable to mechanical damage or 0.028 in. (22 S.W.G.) in all other cases; and

(ii) Be galvanized, or treated with at least three coats of anti-corrosive paint, or otherwise suitably protected from corrosion; and

(iii) Have all holes for cables, flexible cords, electrodes, and electrode lead-wires suitably bushed to guard against abrasion and creepage; and

(e) All enclosures shall—

(i) Be properly drained where exposed to the weather; and,

(ii) Be fire-resisting where used for transformers and/or resistances.

PART 28.—MOTORS AND CONTROL GEAR.

MOTORS.

28-01. The temperature rise of every motor shall comply with the requirements of British Standard Specification No. 168.

28-02. All live metal of motors operating at other than extra-low pressure shall be so guarded or placed that they cannot be accidentally touched or short-circuited.

RESISTANCES AND MACHINE-CONTROL GEAR.

28-11. The general construction of all resistances and machine-control gear shall be in accordance with the appropriate British Standard Specification or its equivalent.

28-12. All live parts of resistances and machine-control gear operated at other than extra-low pressure shall be so guarded as to prevent accidental contact therewith.

28-13. No accessible part of the case of any resistance shall rise to a temperature higher than 176° F.

28-14. Internal connections of resistances shall not be soldered, and all such connections, unless self supporting or rigidly fixed in position, shall be continuously insulated with non-ignitable beads or other suitable non-ignitable material.

PART 29.—ELECTRIC LIFTS.

29-01. (1) No subcircuit having a voltage exceeding low pressure where practicable, and in no case exceeding medium pressure, shall be connected to any lift-car.

(2) No push button for lighting or signalling purposes shall be used for any lift in any subcircuit having a voltage exceeding low pressure.

(3) No voltage exceeding medium pressure shall be used for any lift except for the operation of a motor contained within a machine-room, in which case the control and signal conductors shall be thoroughly insulated from the power conductors.

29-02. Every lift, other than a service-lift, operated by a polyphase motor shall be provided with means to prevent the motor from starting if—

(a) The phase rotation is in the wrong direction or

(b) There is a failure in any phase.

29-03. (1) Every car-switch and hand-control lever, shall be arranged to return automatically to the "stop" position when the hand of the operator is removed.

(2) All directional buttons of automatic lifts shall be arranged to return to the "open" position when the hand of the operator is removed.

DIVISION III.—DESIGN II.

PART 31.—HEATING AND COOKING APPLIANCES.

HEATING AND COOKING APPLIANCES.

31-01. Every heating and cooking appliance shall be so constructed and/or so mounted that no electrical hazard is created thereby and it shall be of robust construction.

31-02. (1) The boiling and frying elements of every cooking appliance operated at a pressure exceeding 110 volts to earth shall be metal-clad, save that portable boiling-plates used in any place where a person touching the same is not likely, under normal conditions, to be simultaneously making contact with earth or earthed metal need not be metal-clad.

(2) The baking, grilling, and roasting elements of such appliances shall be so guarded by means of a guard attached in some permanent manner that the cooking utensils cannot be brought into contact with such elements and so that direct personal contact cannot be made with them when the guard is in position. Where an open type guard is used the openings shall be such as to prevent the passage of a $\frac{1}{4}$ -in.-diameter steel ball except in the case of portable appliances used in any place where a person touching the element is not likely, under normal conditions, to be simultaneously making contact with earth or earthed metal.

31-03. (1) In the case of ranges exceeding 2½ K.W. in capacity the oven elements shall be protected by a fuse-link either separately or as a whole and all other elements shall be protected separately by a fuse-link.

(2) When a plug-socket is fitted on a heating or cooking appliance it shall be protected by a fuse-link.

31-04. No gas-electric range shall be used unless an approved insulating coupling is inserted in the gas-supply pipe immediately adjacent to the range.

APPLIANCES FOR HEATING WATER AND OTHER LIQUIDS.

31-11. The heating element of any appliance used for heating water or any other liquid shall not be in direct contact with any combustible material and where combustible material is used as lagging for a vessel containing a heating element such lagging shall be contained within an air-tight metal casing.

31-12. All heaters shall be so arranged and connected that the liquid entering into or issuing from them is at earth potential.

31-13. No appliance in which a live element is in direct contact with the liquid shall be used unless such appliance has been approved

PART 32.—THEATRES.

32-01. (1) Every switchboard mounted on or over a theatre stage shall be either of the dead-front type or the switchgear and accessories shall be of the totally enclosed type.

(2) A metal hood approved by the Authorized Inspector and extending the full length of the switchboard and projecting sufficiently to protect it from falling objects shall be fitted at the top of the switchboard.

32-02. Every floor-plug and socket used on a theatre stage shall be so constructed that dirt and dust cannot accumulate in the socket and so that the contact surfaces cannot be readily short-circuited.

PART 33.—HIGH AND EXTRA-HIGH PRESSURES.

33-01. Cables used for high pressure or extra-high pressure shall be in accordance with British Standard Specification No. 7 or British Standard Specification No. 480 (as the case may be) or other approved types.

PART 34.—EARTHING.

34-01. (1) When an earthing-lead is connected to a pipe, rod, conduit, cable-sheath, or armouring, a substantial metal clip of not less than 18 S.W.G. (0.048 in.) $\frac{3}{4}$ in. wide, tinned or otherwise rendered incorrodible under normal conditions, or any other suitable earthing device, shall be used and it shall make good electrical contact therewith. Where any

corrosive gas, fume, and/or liquid is present, or liable to be present, special precautions shall be taken to prevent corrosion or deterioration of the earthing-clip and earthing-lead.

(2) For armoured cables such clips shall be so designed as to grip firmly the wires of the armouring without damage to the insulation.

(3) For lead-sheathed armoured cables the principal contact shall be with the lead, but the clip shall be so designed as to grip the armouring firmly without damage to the lead.

PART 35.—RADIO APPARATUS.

35-01. Every transformer which is used with any radio apparatus and which is, or which may be, in electrical contact with any submain or subcircuit which is connected to a service-main shall—

(a) Be of the double-wound type in which the primary winding is effectively separated from all other windings by adequate insulation capable of withstanding the test prescribed by Regulation 62-41 hereof; and

(b) Be of such design, construction, and material that no accessible part of the transformer shall rise to a temperature higher than 176° F.

35-02. Every resistance which is used with any radio apparatus and which is, or which may be, in electrical contact with any submain or subcircuit which is connected to a service-main shall be of such design, construction, and material that no accessible part of the resistance shall rise to a temperature higher than 176° F.

35-03. Where condensers used with any radio apparatus are connected in series across any submain or subcircuit which is connected to a service-main the mid-point between the condensers shall not be connected to the chassis nor shall a condenser be connected between the chassis and such submain or subcircuit.

35-04. Every battery-eliminator shall comply with the following requirements:—

(a) It shall be enclosed in a case of metal or of some material that is tough, not readily combustible, and non-hygroscopic; and

(b) Such case shall be adequately ventilated and of such design, construction, and material as reasonably to prevent all risk of causing injury to any person.

35-05. Every condenser which is used with any radio apparatus and which is, or which may be, in electrical contact with any submain or subcircuit which is connected to a service-main shall be capable of withstanding the test prescribed by Regulation 62-42 hereof.

PART 36.—MARKING OF ACCESSORIES, APPLIANCES, LAMPS, AND SWITCHES.

36-01. There shall be permanently and legibly marked—

(a) The maker's name, or registered trade-mark, or registered trade-name on all appliances, lamps, adaptors, ceiling-roses, cut-outs, circuit-breakers, flexible cord connectors, lamp-holders, plugs and sockets, and switches; and

(b) The maximum operating voltage and amperage on all cut-outs, circuit-breakers, flexible cord connectors, plugs and sockets, and switches other than switch lamp-holders, switches not exceeding 1.25 amperes rating if incorporated in an appliance or fitting, and pendant switches save that in the case of pendant switches the maximum operating voltage shall be marked thereon; and

(c) The operating voltage and either amperage or wattage on all appliances; and

(d) The operating voltage and the amperage, or wattage, or lumens, or candle-power on all lamps other than series street-lighting lamps.

36-02. Where alternative ratings are marked on any appliance, accessory, or apparatus, such appliance, accessory, or apparatus shall be capable of withstanding the prescribed tests at the highest marked rating.

PART 37.—GENERAL.

37-01. All apparatus shall be so designed, proportioned, and constructed that it will carry its rated load at all times without heating to an extent which will cause risk of breakdown of its insulation.

37-02. All material used in the construction of any accessory, fitting, appliance, or apparatus shall, where practicable, be non-ignitable. Where the use of ignitable material is necessary, such material shall not come in contact with any part the temperature of which exceeds 212° F. and unless adequately separated therefrom by fire-resisting material, shall be maintained at a distance from all parts in which this temperature is exceeded sufficient to avoid any risk of fire.

37-03. Resistances, control gear, and all apparatus, other than apparatus designed and intended for heating and cooking purposes, shall be so arranged that in normal operation no accessible part of the enclosing case can rise to a temperature exceeding 176° F.

37-04. The connecting terminals of every apparatus in which heat is generated shall be so arranged that connecting cables are not exposed to temperatures in excess of those permitted under these regulations for the class of insulation to be used, the terminals being situated to facilitate the connecting cables entering from below where this is necessary to avoid exposure to any such excess temperatures.

DIVISION IV.—INSTALLATION I.

PART 41.—ELECTRICAL PLANT.

GENERATORS.

41-01. (1) Generators, other than flame-proof, forced-draught, induced-draught, or pipe-ventilated machines shall be placed in well-ventilated rooms where inflammable or explosive dust or gas cannot accumulate under normal conditions. In situations where inflammable or explosive materials are stored or handled generators may be placed only if adequately protected to the satisfaction of the Authorized Inspector.

(2) Generators shall be placed in positions in which they are not exposed to risk of mechanical injury, or to damage from water, steam, or oil.

41-02. Adequate precautions shall be taken in the installation of every generator as will ensure immunity from electrical hazard.

TRANSFORMERS, RESISTANCES, AND CHOKE-COILS.

41-11. (1) Transformers, resistances, and choke-coils operating at other than extra-low pressure shall, unless cased, be carried on supports of incombustible material.

(2) In situations where in the opinion of an Authorized Inspector inflammable or explosive gas, dust, or flyings are liable to be present the transformers shall be oil-immersed or gas-tight.

41-12. Adequate precautions shall be taken in the installation of every transformer, resistance and choke-coil as will ensure immunity from electrical hazard.

41-13. Auto-transformers, resistances, or choke-coils shall not, except as provided in the next succeeding regulation, be used to reduce the voltage to low pressure or extra-low pressure—

(a) To supply general wiring in buildings; or

(b) For any other purpose where the low pressure or extra-low pressure circuit or apparatus has exposed live metal with which it is possible for any person to make accidental contact.

41-14. Notwithstanding anything in the last preceding regulation resistances or choke-coils may be used for—

(a) Battery charging; and

(b) Arc lamps, provided that the maximum potential difference across the terminals of the arc or any part of the circuit between such resistance or choke-coil and the arc does not exceed 50 volts.

SECONDARY BATTERIES.

41-21. When apparatus is supplied from a secondary battery the work of connecting such apparatus to such battery shall be done in accordance with the provisions of these regulations which would govern the connecting of such apparatus with a generating plant developing the same difference of potential.

41-22. Every battery shall be so arranged that the difference in potential between adjacent cells does not exceed 50 volts unless adequate protection is provided against electrical hazard. Each cell shall be readily accessible from the top and from at least one side.

41-23. The room in which any battery is placed shall be thoroughly ventilated.

41-24. Suitable apparatus shall be provided for controlling the current with which a battery is being charged.

41-25. Where a battery is being charged through a resistance or rectifier such resistance or rectifier shall be connected in the live conductor between the source of supply and the battery. The supply to the battery shall be controlled by a suitable switch fixed in an accessible position.

41-26. Every portable battery shall while being charged from a source of supply exceeding extra-low pressure be placed so that an attendant can handle the battery only while standing upon a wooden platform, or other insulated platform, suitably designed and placed so as to prevent the accumulation of acid or water in contact with it.

BATTERY-CHARGERS AND RECTIFIERS.

41-31. Every battery-charger and rectifier shall be provided with efficient means suitably placed and so connected that the battery-charger and rectifier and all apparatus connected therewith may be isolated from the supply.

41-32. Every rectifier shall be installed in accordance with the following requirements:—

- (a) It shall where the rating exceeds 3 K.W. be controlled and protected by a circuit-breaker with overload trip-coils; and
- (b) It shall not be installed in any position where inflammable or explosive dust or gas is liable to be present.

41-33. Adequate precautions shall be taken in the installation of every battery-charger, rectifier, and the like as will ensure immunity from electrical hazard.

CONDENSERS.

41-41. Where a condenser is installed in conjunction with an individual appliance for the purpose of improving starting conditions and/or power factor, it shall be controlled and protected by the switch and cut-outs or circuit-breaker which control and protect the appliance, and the conductors connected to the condenser shall have a current-carrying-capacity of not less than the resultant current of the circuit, or it shall be connected to a separate subcircuit in accordance with the requirements of Regulation 41-42 hereof.

41-42. Where a condenser is installed in conjunction with more than one appliance for the purpose of improving starting conditions and/or power factor it shall—

- (a) Be connected to a separate subcircuit the conductors of which shall have a current-carrying-capacity as determined by the condenser capacity; and
- (b) Be controlled and protected by a switch and cut-outs or circuit-breaker; and
- (c) Be provided with discharge-resistors.

41-43. Adequate precautions shall be taken in the installation of every condenser as will ensure immunity from electrical hazard.

PART 42.—SWITCHGEAR.

SWITCHBOARDS.

42-01. The following provisions shall be observed in connection with the erection of every switchboard:—

- (a) It shall be placed in a well ventilated situation where inflammable or explosive dust or gas cannot accumulate and shall be so arranged as to prevent access of corrosive fumes to the switchboard. Whenever conveniently possible it shall be placed in a dry situation and in any case in which its situation is not, in the opinion of an Authorized Inspector, a dry situation the apparatus thereon shall be enclosed and rendered impervious to moisture; and
- (b) It shall be so erected as to permit of reasonable access to the face and to all leads and fixing-bolts at the back thereof; and
- (c) It shall not be erected above a stove or range or in a bathroom, lavatory, or washhouse; and
- (d) Where liable to mechanical injury it shall be adequately protected; and
- (e) The main switchboard shall not be erected in any room where cinematograph-film is stored, handled, or used.

42-02. (1) Where there is any live metal, at a voltage in excess of extra-low pressure, exposed at the back of a switchboard the board shall be so placed that there will be a space of not less than 12 in. between such metal and any object which is not readily movable.

(2) Where it is necessary to have access to the back of a switchboard for wiring purposes, the switchboard shall, where conveniently possible, be so placed that access can be obtained either from each side or from one side and the top and bottom, and between any object which is not readily movable and the back of the switchboard there shall be a space of not less than—

- (a) 4 in. where either the width or height of the board does not exceed 2 ft.; or
- (b) 6 in. where each such measurement exceeds 2 ft. but does not exceed 3 ft.; or
- (c) 9 in. where each such measurement exceeds 3 ft. but does not exceed 4 ft.; or
- (d) 12 in. where each such measurement exceeds 4 ft. but does not exceed 5 ft.; or
- (e) 24 in. where each such measurement exceeds 5 ft.:

Provided that where it is not conveniently possible to provide access from each side or from one side and the top and bottom or from the back every switchboard having a width in excess of 2 ft. shall have a space of 24 in. between any object which is not readily movable and the back of the switchboard.

(3) Where the space between any object which is not readily movable and the back of the switchboard is 24 in. or over all stays and conductors crossing over such space shall be so arranged as to allow a clearance above floor-level of not less than 6 ft. for stays and 6 ft. 6 in. for conductors.

(4) Where a panel is mounted less than 12 in. from any other panel such panels shall be deemed to be one switchboard.

(5) This regulation shall not apply to any switchboard so constructed and fixed that access cannot be obtained to the back thereof unless and until the switchboard is moved, provided such switchboard is suitably hinged and the conductors at the back are enclosed in a fire-resisting chamber.

42-03. (1) Every panel switchboard mounted upon a wall shall be so arranged that the space between all sides and the wall is completely enclosed by a substantial and close-fitting case. Where a switchboard is sunk into a wall the adjacent part of which is made of other than non-ignitable material the case shall be of rigid metal or non-ignitable material.

(2) Where any opening is made in the wall behind, such opening shall be closed on completion of the wiring so as to preclude the possibility of a draught tending to spread any fire which may start on the switchboard.

(3) Where there is any live metal, at a voltage in excess of low pressure, exposed at the back of any switchboard mounted otherwise than on a wall, such metal shall be made inaccessible (except to authorized persons) by screening or otherwise, and where a door is provided for access to the back of such switchboard it shall be provided with a spring or other device which shall ensure that the door remains wide open when not properly shut and locked.

42-04. Containing-cases for switchboards shall, except as provided in the next succeeding regulation, be secured in such a manner as to be easily removable for the purposes of inspection.

42-05. Non-removable cases for switchboards and designed for the purpose may be used, but they shall be of sufficiently ample dimensions to allow of easy access for the attachment of cables and for the installation or replacement of conduit and nuts.

42-06. Metal-clad switchgear may be mounted directly on a wall or on the metal framework of the switchboard.

42-07. (1) No cut-out, circuit-breaker, or switch (other than an isolating-switch) shall be fixed on the back of any switchboard if it is necessary to replace a fuse-link or operate such circuit-breaker or switch from behind the panel.

(2) Where no fuse-link or circuit-breaker is included in an earthed conductor all such circuit conductors shall be connected to a bus-bar in such a manner that each circuit conductor may be readily removed.

42-08. Every nut on any part carrying over 25 amperes, and fixed at the back of any switchboard, shall be effectively locked so that it cannot become loose.

42-09. Where not otherwise distinguishable all circuits, instruments, and important apparatus on every switchboard shall be clearly and permanently labelled for purposes of identification.

42-10. Every switch on any switchboard shall be so arranged that its blades or moving parts are disconnected from the source of supply when in the "Off" position, and shall be so mounted that the top of the handle (if any) is at a height not exceeding 7 ft. 6 in. above floor-level.

42-11. In every case in which the switches and fuse-links on any switchboard are fitted on the same pole, or phase, these switches shall preferably be so arranged that the fuse-links are disconnected from the source of supply when their respective switches are in the "Off" position.

42-12. All panel switchboards shall be mounted in accordance with Regulation 22-04 hereof.

42-13. (1) Where the main switchboard supplies distribution boards controlling separate sections of a building and the occupants of such sections have cause to use such distribution boards as main switchboards, then each such distribution board shall be controlled by a switch or circuit-breaker mounted thereon or adjoining.

(2) Where there is more than one distribution board connected to a common submain isolating-switches or cut-outs shall be mounted on, or adjacent to, each such distribution board for the purpose of isolating it from the submain.

CONTROL OF SUPPLY.

42-21. Every installation shall be adequately protected by suitable controlling apparatus as required by Regulations 22-21 to 22-25 hereof (both inclusive) easily accessible to the consumer.

42-22. (1) Where the supply is from an overhead service-line service cut-outs shall be fixed either outside the building or within a building as near the point of entry as possible, and in a permanently accessible position reasonably distant from, or protected from, combustible material. They shall not be placed between a ceiling and a roof.

(2) When the supply is from an underground service-line service cut-outs shall be fixed as near the point of entry as possible, and in a permanently accessible position reasonably distant from, or protected from, combustible material.

42-23. Where supply from an external source can be derived from more than one service-line suitable switches or circuit-breakers shall be provided to prevent such service-lines from being interconnected.

42-24. (1) All supply from an underground service-line shall be controlled by a master-switch (not necessarily a circuit-breaker) placed in a conveniently accessible position.

(2) Where the main switch is in the above position it may be used as the master-switch.

(3) Where the master-switch is protected by a case, the case shall have a hinged wooden or clear glass front. If the front is of wood it shall have the words "MASTER-SWITCH" conspicuously painted thereon in block letters not less than 1 in. in height.

42-25. In all cases where more than one consumer is connected to a service-main the various consumers' switchboards shall be clearly and permanently labelled for purposes of identification.

42-26. (1) The service cut-outs of any building to which Part 52 hereof applies shall not be used in connection with the supply of electrical energy to any other installation whatever.

(2) Where failure of light might cause panic or be otherwise dangerous, the lighting shall be controlled by independent service cut-outs, and no apparatus other than permanent lighting shall be connected with such service cut-outs.

42-27. (1) Where the full-load current of any submain or subcircuit exceeds 100 amperes per conductor—

(a) There shall be provided in addition to the main circuit-breaker a separate circuit-breaker to control each such submain or subcircuit, except in the case of a subcircuit supplying a single motor or piece of apparatus equipped in each case with overload protective devices provided that such protective devices are—

(i) Mounted on the distribution board; or
(ii) Installed at such motor or apparatus and cut-outs are mounted on the distribution board to protect such subcircuit; and

(b) Where an installation consists of only one subcircuit, or one submain supplying a distribution board, the main switchgear may also be used to control and protect such subcircuit or submain.

(2) The full-load current shall be assessed as the maximum demand in accordance with Regulation 43-13 hereof.

42-28. (1) No switch or circuit-breaker shall be included in any neutral conductor or earthed conductor in such a manner as will permit such conductor to be opened before, or closed after, the corresponding live conductors, but this requirement shall not prohibit the provision of an isolating-link for testing purposes.

(2) In the case of a non-earthed two-wire system all single-pole switches or circuit-breakers shall be fitted in the same conductor throughout.

(3) This regulation does not apply to a switch mounted on a portable appliance unless otherwise specified in these regulations.

SWITCHES AND CIRCUIT-BREAKERS.

42-41. Every single-throw tumbler switch shall be so mounted that the handle points in the upward direction when the switch is in the "Off" position.

42-42. Any switch or circuit-breaker which, in the opinion of an Authorized Inspector is exposed to the weather, to drip, or to an excessively moist atmosphere shall be contained in a weatherproof case, which shall be provided with cable glands or bushings, or be adapted to receive screwed conduit, according to the manner in which the cables are run.

42-43. No pendant switch or other switch connected to a flexible cord shall be used in any bathroom, lavatory, or wash-house, nor in any position where the person operating it would be likely, under normal conditions, to be simultaneously making contact with earth or earthed metal, nor for any current exceeding 1.25 amperes.

42-44. Every circuit-breaker shall comply with the following requirements:—

(a) In the case of all apparatus other than motors, the circuit-breaker shall be set to operate before the current exceeds more than 1½ times full-load current; and

(b) In the case of motors the circuit-breaker shall be set to operate within one minute before the current exceeds more than twice full-load current; and

(c) No circuit-breaker need be set to operate at a current less than 6 amperes.

42-45. Circuit-breakers and switches shall be so arranged and placed that no electrical hazard can result from their normal operation.

CUT-OUTS.

42-51. (1) The fusing current of every fuse-link shall not exceed twice full-load current, provided that no fuse-link smaller than one rated to blow at 6 amperes need be inserted to protect any subcircuit.

(2) The fusing current in free air shall be taken as that specified in column 3 of Tables XIII and XIV in Division VII hereof.

42-52. Every cut-out shall be of such construction, or be so guarded or placed, as to prevent danger from overheating, arcing, and the scattering of hot metal or other substances when the fuse-link blows.

PART 43.—CIRCUITS AND CONDUCTORS.

SUBDIVISION OF CIRCUITS.

43-01. (1) Except as provided in clause (2) of this regulation and in Regulations 45-31, 52-05, and 56-03 hereof, the maximum number of points that may be connected to a subcircuit shall not exceed ten and the maximum rating shall not, except as provided in clause (3) of this regulation, exceed 15 amperes. The minimum size of cable or flexible cord shall be in accordance with the following table:—

Current Rating of Fuse-link or Circuit-breaker.	Maximum Size of Copper Fuse-wire.	Minimum Number and Diameter (inches) of Wires comprising Conductor.		
		Cable.	Flexible Cord.	
1.	2.	3.	4.	5.
Amps.	S.W.G.			
3	36	1/044	23/0076	11/012
5	33	1/044	40/0076	16/012
10	26	3/036	70/0076	28/012
15	24	7/029	110/0076	44/012

Conductors of larger cross-sectional area than those prescribed by columns 3, 4, and 5 shall be used if necessary to comply with the requirements of Regulation 43-21 hereof for fall in pressure. Fittings and accessories shall be of such design as to permit of conductors being effectively looped in and terminated.

(2) The maximum number of points that may be connected to a subcircuit used solely for plug-sockets shall not, except as provided in Regulation 43-03 hereof, exceed two and the maximum rating shall not, except as provided in clause (3) of this regulation, exceed 20 amperes.

(3) Subcircuits supplying one lamp or appliance are not limited as to current-carrying capacity.

(4) Notwithstanding anything to the contrary in these regulations an electric clock may, in addition to the points provided in clauses (1) and (2) of this regulation, be connected to any subcircuit.

(5) Notwithstanding anything to the contrary in these regulations radio receiving-sets and gramophones in domestic installations may, in addition to the points provided in clauses (1) and (2) of this regulation, be connected to any subcircuit provided that where the connection is made by means of a plug-socket the plug-top shall be equipped with a fuse-link and the plug-socket shall be installed in the same room as an existing plug-socket and shall be used for no other purpose.

(6) The maximum number of lamps which may be connected to a subcircuit used solely for cornice lighting, panel lighting, and the like in which the lamp-holders are grouped in close proximity to each other and are connected to the circuit without flexible cords shall be such that the total current supplied from such subcircuit does not exceed 15 amperes.

43-02. For the purposes of calculating the current of a lighting circuit, except as provided in Regulations 52-05 and 56-03 hereof, no lamp shall be rated at less than 60 watts, lamps of larger wattage (if any) being allowed for in full.

43-03. For the purpose of calculating the current of a plug circuit each plug-socket shall be rated at not less than 2,000 watts, consuming devices of larger capacity (if any) being allowed for in full, save that in the case of domestic installations where there are three or more plug-sockets in any one room, other than a room normally used for cooking purposes, three such plug-sockets may be connected to one subcircuit, and the total rating of such subcircuit shall be assessed at not less than 4,000 watts.

SIZE OF CONDUCTORS.

43-11. (1) No cable having a conductor of a cross-sectional area less than 0.0015 sq. in. (1/044 in. or its equivalent) and no flexible cord having a conductor of a cross-sectional area less than 0.001 sq. in. (23/0076 in. or its equivalent) shall be

used, save that for the internal wiring of fittings a conductor having a cross-sectional area not less than 0.0006 sq. in. (14/0076 in. or its equivalent) may be used.

(2) No conductor of a cross-sectional area less than 0.0048 sq. in. (19/26 S.W.G. or its equivalent) shall be used for high pressure or extra-high pressure in connection with luminous-discharge-tubes.

43-12. (1) No single wire having a cross-sectional area exceeding 0.0015 sq. in. (1/044 in. or its equivalent) shall be used as a conductor, except where used as a collector or trolley-wire for a travelling crane or similar appliance, or where used within a heating or cooking appliance, or where used as an earthing-lead, or where used for a battery connection.

(2) Every conductor used for connecting a motor to a sub-circuit shall be stranded.

(3) Every conductor used for connecting the safety-devices and gate locks of an electric lift to a subcircuit shall be stranded.

43-13. (1) Service-mains shall have a carrying-capacity not less than the maximum demand of the installation, but in no case shall they have a cross-sectional area less than 0.0045 sq. in. (7/029 in. or its equivalent). All neutral service-mains shall be capable of carrying the whole load which will be imposed on them when all main fuse-links on the live conductors save one have blown, except that in those cases where circuit-breakers are used to control the incoming main supply the neutral service-main need only be large enough to carry the out-of-balance current.

(2) Where the maximum demand is not otherwise readily ascertainable it shall be assessed as follows:—

(a) Lighting points—

(i) Domestic: Two-thirds of connected load.

(ii) Hotels and the like: Three-quarters of connected load.

(iii) Public buildings, business premises, and offices: Nine-tenths of connected load.

(b) Points available for heating (excluding those primarily intended for cooking)—

(i) Domestic (1 point): Total connected load. (2 to 5 points): Total connected load of one point plus one-quarter of total connected load of all the other points. (6 points and over): Total connected load of two points plus one-tenth of total connected load of all the other points.

(ii) Hotels and the like: Three-quarters of total connected load of all points in main rooms such as dining-rooms, lounges, billiard-rooms, offices, and the like, plus one-fifth of total connected load of all the other points.

(iii) All other cases: Total connected load.

(c) Points primarily intended for cooking—All cases: Three-quarters of connected load.

(d) Points primarily intended for motive power—

(i) One motor: Total connected load.

(ii) Two or more motors: Full connected load of largest motor, plus half connected load of all the other motors.

(3) Where electrical energy is used for more than one purpose the maximum demand shall be assessed by adding together the figures obtained from the above calculations.

43-14. The load on submains may be assessed as in clauses (2) and (3) of the last preceding regulation, but no allowance shall be made for load diversity in subcircuits.

43-15. For plug-sockets the minimum size of conductor shall have a cross-sectional area of not less than—

(a) 0.0045 sq. in. (7/029 in. or its equivalent) to the first plug-socket on a subcircuit; and

(b) 0.003 sq. in. (3/036 in. or its equivalent) to any subsequent plug-socket.

43-16. (1) No conductor of a less cross-sectional area than 0.0045 sq. in. (7/029 in., 1/08 in., 14 S.W.G. or their equivalent) shall be used as an earthing-lead, save that:—

(a) In the case of flexible cords having conductors of a cross-sectional area not exceeding 0.0048 sq. in. (110/0076 in., 44/012 in., or their equivalent) the cross-sectional area of the earthing-lead may be equal to that of the current-carrying conductors; and

(b) In the case of flexible cords and flexible cables having conductors of a cross-sectional area greater than 0.0048 sq. in. the cross-sectional area of the earthing-lead may be not less than half that of the current-carrying conductors but in no case shall it be less than 0.0048 sq. in.; and

(c) In the case of cables protected by tough rubber compound in accordance with Regulation 23-71 hereof and Class I metal sheathed cables in accordance with Regulation 44-81 hereof the earthing-lead may be in accordance with Table XVI hereof.

(2) The minimum size of such conductor (0.0045 sq. in.) shall be deemed sufficient for installations where the carrying-capacity of the conductors does not exceed 50 amperes.

(3) The effective area of the earthing-lead shall be increased by 0.0045 sq. in. for each additional 50 amperes or part thereof.

CAPACITY OF CONDUCTORS.

43-21. The size of conductors shall be so selected that for lighting and heating the fall in pressure from the terminals of the main switch on the main switchboard controlling the various circuits to any and every point of the installation does not exceed 1 volt plus 2 per cent. of the pressure at the said terminals when the conductors are carrying the maximum demand under the practical conditions of service.

43-22. (1) In no case, whether for lighting, heating, cooking, or power, shall the current exceed—

(a) In the case of cables other than flexible cables the respective values given in Tables IV and V in Division VII hereof for each size of conductor when the maximum current referred to in the last preceding regulation is being carried; or

(b) In the case of flexible cables and flexible cords the values given in Table VI and column 4 of Table VIII in Division VII hereof respectively.

(2) The current-carrying capacity of a conductor having wires of a number or diameter not specified in the said respective tables shall be taken to be proportionate to that of the cases specified.

INSULATION OF CONDUCTORS.

43-31. Except for earthed concentric wiring, all conductors, other than earthing-leads, shall be insulated, either by being carried on insulators (as provided by Regulation 44-22 hereof) or by the use of insulated cables and/or flexible cords.

IDENTIFICATION OF CABLES AND FLEXIBLE CORDS.

43-41. (1) All insulated cables other than flexible cables shall, except as provided in clause (3) of this regulation, be rendered distinguishable by means of the following colours:—

A.C. Three-phase and D.C. three-wire systems of wiring—

(a) Live conductor—Red, yellow, or blue.

(b) Neutral, earthed conductor or middle-wire—Black.

D.C. Two-wire systems of wiring—

(c) Positive—Red, yellow, or blue.

(d) Negative—Black.

A.C. Two-wire non-earthed systems of wiring—

(e) One conductor—Red, yellow, or blue.

(f) Other conductor—Black.

(2) All insulated flexible cords and all insulated flexible cables, shall, except as provided in clause (3) of this regulation, be coloured in such a manner that each conductor may be readily identified.

(3) This regulation does not apply to any three-core cable used solely for three-phases or to any conductor used as an aerial conductor or enclosed within a current-using device or used for high pressure or extra-high pressure in connection with luminous-discharge tubes.

(4) For the purposes of this regulation a conductor shall be deemed to be alive up to the lamp or other current-using appliance when the switch is in the "on" position.

PART 44.—INSTALLING CONDUCTORS I.

GENERAL.

44-01. The methods of installing conductors prescribed by Regulations 44-02 to 46-37 hereof are hereby declared to be approved methods for the purposes of these regulations and these methods, or such other methods as may from time to time be approved, shall alone be employed.

44-02. (1) No conductor or its insulating covering, or its protective covering, shall (except at crossings) be at a less distance than 1 in. from any pipe not forming part of the wiring system, nor any telephone wire, nor any bell wire, nor any other wire not forming part of the wiring system.

(2) No metal conduit or the metallic sheathing of any conductor (whether earthed or not) shall (except at crossings) be at a less distance than 1 in. from any gas-pipe.

(3) In the case of crossings, unless the inch clearance is provided, a non-conducting distance-piece shall be securely fixed between the two, and this distance-piece shall extend at least 1 in. in all directions at the crossing.

44-03. Conductors exposed to injury shall be adequately protected.

44-04. (1) Single cables armoured with steel wire or tape or encased in a ferrous sheath shall not be used for alternating current except in connection with an earthed concentric system in which the sheathing forms one conductor.

(2) Where single lead-covered unarmoured cables are used for alternating current the lead and return cables shall be placed as near as possible to each other.

44-05. (1) Rubber-insulated cables for use on pressures which do not vary from earth potential by more than—

(a) 250 volts shall be of not less than 600 megohm grade as prescribed by column 3 of Table IX in Division VII hereof; and

(b) 650 volts shall be of not less than 2,500 megohm grade as prescribed by column 4 of Table IX in Division VII hereof.

(2) Paper-insulated cables shall have an insulation resistance not less than that prescribed by column 5 of Table IX in Division VII hereof.

SERVICE-MAINS.

44-11. Service-mains shall in all cases be—

(a) Enclosed in conduit in accordance with Regulation 45-01 hereof, which includes no other conductor, and which in the case of all buildings of more than two rooms shall not be of a smaller diameter than $\frac{3}{4}$ in.; or

(b) Armoured cable; or

(c) Lead-covered cable embedded in bitumen.

44-12. Except in the case of different systems of supply there shall, where practicable, be only one point of entry to any building and one point within a building at which the installation as a whole can be controlled, save that where a master-switch is provided in accordance with Regulation 42-24 hereof there may be two points of control—namely, the master-switch and the main switch.

BARE CONDUCTORS.

44-21. Bare conductors may be used as collector or trolley-wires for travelling cranes and similar appliances, for battery connections, for bus-bars, for luminous-discharge-tube connections (not exceeding 12 in. in length), and for earthing-leads. Conductors used as collector or trolley-wires shall be solid.

44-22. (1) Every bare conductor, other than an earthing-lead, shall be carried on insulators unless self supporting, and it shall be so spaced and protected that risk of accidental contact is reduced to a minimum.

(2) Where the voltage exceeds extra-low pressure no bare conductor shall be readily accessible to any unauthorized person.

44-23. Except as hereinbefore specified, bare conductors shall be used only in positions not ordinarily accessible to any unauthorized person and in such circumstances as may be sanctioned by the Authorized Inspector.

AERIAL CONDUCTORS.

44-31. Where the length of any aerial line exceeds 1 chain and/or where the voltage exceeds medium pressure the provisions of the Electrical Supply Regulations, 1935, shall apply.

44-32. Where the span of an aerial line does not exceed 1 chain soft-drawn copper conductors may be used provided the voltage does not exceed medium pressure.

44-33. Where the length of any aerial line does not exceed 1 chain the conductors shall be stranded and shall have a minimum area of 0.007 sq. in. (7/036 in. or its equivalent).

44-34. Where any part of an aerial conductor other than an earthed conductor is within 7 ft. 6 in. of a building such part shall be covered with rubber insulation in accordance with Regulation 23-12 hereof and be braided, or where the voltage does not exceed medium pressure it may be covered with good quality triple-braiding thoroughly impregnated with weather-proof compound.

44-35. (1) No consumer's aerial conductor shall be erected or maintained at a less height than 9 ft. above ground-level or water-level except that in any part of the premises used by vehicles having a height (including their loads) greater than 8 ft. the minimum height shall be 12 ft.

(2) In the case of trolley-wires in tunnels and in and about mines the Chief Electrical Engineer may grant exemption from the provisions of this regulation subject to such conditions as he may impose on the grounds of freedom from electrical hazard.

44-36. Where a consumer's aerial conductors at medium pressure or any lower pressure pass above any building or part of a building the following minimum clearances, measured at a temperature of 120° F., shall be provided:—

(a) A vertical clearance of 7 ft. 6 in. above the highest point of any flat roof, open balcony, veranda roof, and lean-to roof, except as provided in paragraph (c) of this regulation; and

(b) A vertical clearance of 7 ft. 6 in. immediately under such conductors and a horizontal clearance of 4 ft. in the case of any pitched roof, except as provided in paragraph (c) of this regulation, and except where the conductors cross the ridge of the roof, in which case there shall be a vertical clearance of 2 ft. above such ridge.

(c) Where it is not practicable to terminate the conductors on a building otherwise than immediately above the attachment of a veranda roof or lean-to roof the vertical clearance may be reduced to 6 in. above the highest point of such roof.

44-37. (1) Where a consumer's aerial conductors at high pressure pass above any building or part of a building they shall have a vertical clearance of not less than 8 ft. above the highest part of the building, immediately under the lines, and a horizontal clearance of not less than 4 ft. between the lines and any part of the building.

(2) The vertical clearance shall be measured at a temperature of 120° F., and the horizontal clearance shall be measured when the line is at a maximum deflection from the vertical due to a wind-pressure of 18 lb. per square foot of diametral plane.

(3) A conspicuous notice—"DANGER: LIVE WIRES"—shall, where possible, be fixed to a part of the building nearest to the lines, where it will be readily seen by any person on the building near the wires, and shall be permanently maintained in a legible condition.

(4) Where it is not possible to fix such notice in a conspicuous place, then a notice, with the word "DANGER" in letters not less than 2 in. high, shall be fixed to one of the aerial conductors immediately over the highest part of the building, and the necessary clearance shall be allowed between the building and the bottom part of this notice.

44-38. All aerial conductors shall be efficiently supported on insulators. Where exposed to the weather such insulators shall be of the outdoor type.

44-39. Each aerial circuit shall be run as a separate circuit from the main switchboard or distribution board, or alternatively the aerial conductors shall be protected by a weatherproof cut-out fixed outside at the point where the wires leave the building. The leads of such separate circuit within a building shall have a cross-sectional area of not less than 0.002 sq. in. (3/029 in. or its equivalent).

44-40. Aerial electric lighting, heating, or power conductors shall not cross over or under in close proximity to any aerial wire, counterpoise wire, lead-in wire, or stay-wire belonging to or connected with any radio installation, or be erected in such a position that it is possible for them to make contact therewith, or for any person to make simultaneous contact accidentally with any such conductor and any such aerial wire, counterpoise wire, lead-in wire, or stay-wire.

UNDERGROUND AND UNDERWATER CONDUCTORS.

44-51. Where conductors other than service-mains are buried in the ground outside of any building the conductors shall be—

(a) Lead-covered; or

(b) Lead-covered and armoured; or

(c) Covered with tough rubber compound in accordance with Regulation 23-71 hereof; or

(d) Vulcanized-rubber insulated in accordance with Regulation 23-12 hereof and embedded in bitumen or other approved compound.

44-52. Where conductors are laid under water they shall be—

(a) Lead-covered; or

(b) Lead-covered and armoured; or

(c) Covered with tough rubber compound in accordance with Regulation 23-71 hereof.

OPEN WIRING WITH BRAIDED CABLES.

44-61. In no case shall open wiring be used unless permission in writing is first obtained from the electrical supply authority, which shall give such permission only where encased wiring would be unsuitable.

44-62. Braided cables such as are specified in paragraph (b) of Regulation 23-42 hereof may, subject to the provisions of the preceding regulation, be used without the further protection of conduit or casing for lighting, heating, or power purposes, provided that—

(a) They are used only for surface work; and

(b) They are kept away from all structural metalwork; and

(c) They are adequately protected wherever they are within 6 ft. above a floor; and

(d) They are not in electrical or mechanical contact with any gas or water-pipe; and

(e) They are secured by porcelain cleats or insulators which have smooth or rounded edges that will not indent or damage the braiding, and which are of non-absorbent material and the fixings of which are of non-absorbent, non-rusting material; and

(f) They are spaced not less than $\frac{1}{2}$ in. from walls, ceilings, or other structures, and so spaced as to prevent any two or more cables coming into contact, and that they are supported at intervals of not more than 4 ft. 6 in.; and

- (g) Where passing through floors, walls, partitions, or ceilings, they are protected by being enclosed in metal, porcelain, or other non-absorbent not readily combustible conduits the ends of which are bushed or so arranged as to prevent abrasion, such conduits when in damp situations being bitumen-filled; and
- (h) Where passing through party walls, or fire-resisting floors, walls, partitions, or ceilings, the conduits referred to in the last preceding paragraph are close-fitting, and the holes through which they pass are plugged with fireclay or similar non-ignitable material, no space through which fire might spread being left around or inside the conduits; and
- (i) Joints of opposite polarity or phase are kept at least 6 in. apart.

CABLES COVERED WITH TOUGH RUBBER COMPOUND.

44-71. Cables protected in accordance with Regulation 23-71 hereof may be used without the further protection of conduit or casing, provided that they are installed in accordance with paragraph (d) of Regulation 44-62 hereof, and provided further that—

- (a) They are secured at intervals by clips, saddles, or clamps. The intervals shall in the case of surface work be sufficiently short to prevent appreciable sagging of the cable when fixed horizontally; and
- (b) Where fixed otherwise than horizontally they are secured at the same intervals as when horizontal, save that where they are inaccessible without structural alteration a length not exceeding the length of the wall stud may be allowed vertically between supports provided that the upper support firmly grips the cable and that where there is a change in direction from horizontal to vertically downwards they are brought over a rounded support of a radius not less than six times the external diameter of the sheathing; and
- (c) Where running parallel with ceiling-joists and not immediately under a floor they are attached to the side thereof. Where laid across such joists at any angle, they are attached to the side of soft-wood strips having an area of not less than 3 sq. in. with a minimum depth of 1 in.; and
- (d) Where under floors and running parallel with the joists they may be laid flat on the ceiling and where inaccessible without structural alteration need not be secured by clips, saddles, or clamps. Where not running parallel to the joists they may be without support from joist to joist to a distance not exceeding 18 in. and all floor-boards covering such wiring are securely screwed down in such a manner that they will not damage the cable and so that they can be removed for inspection; and
- (e) Where liable to mechanical injury, under normal conditions, they are protected by wood or metal casing or conduit; and
- (f) Clips, saddles, and clamps are made of material having smooth or rounded edges which will not indent or damage the sheathing, and where exposed to the weather or otherwise in damp situations they together with their fixings are of non-rusting material; and
- (g) Where passing through structural metalwork the holes through which they pass are bushed to prevent abrasion; and
- (h) Where passing through party walls or fire-resisting floors, walls, partitions, or ceilings the holes through which they pass are plugged with fireclay or similar non-ignitable material, no space through which fire might spread being left around the cables; and
- (i) At all outlet points the sheathing is effectively secured to, or within 2 in. of, the base block or other device.

44-72. Connection boxes when used shall be of an approved type.

METAL SHEATHED AND ARMoured CABLES.

44-81. Metal sheathed cables specified in paragraph (c) of Regulation 23-42 and in Regulation 23-43 hereof are divided into the following two classes for the purposes of Regulations 44-82 to 44-85 (both inclusive) hereof:—

Class I: Cables in which each insulated conductor within the metal sheathing is independent mechanically of any other conductor and where unfilled interstices exist between the cables and the sheathing. Such cables shall contain a bare earthing-lead within such sheathing.

Class II: Cables in which the conductors, insulation, packing or filling and metal sheathing are massed to form a cable with no unfilled interstices between the component parts and each part is mechanically dependent upon the other.

44-82. Class I cables shall, except where run underground, be used only for surface work and where liable to mechanical injury, under normal conditions, they shall be protected by wood or metal casing or conduit.

44-83. In the case of Class I cables—

- (a) Every junction-box and joint-box shall be of an approved type; and
- (b) No junction-box or joint-box shall be placed at a less height than 7 ft. above a floor; and
- (c) No junction-box or joint-box shall be installed in a position where it will be subject to moisture or to any corrosive fume, gas, or liquid.

44-84. Where run underground—

- (a) Class I cables shall be enclosed in conduit or piping which together with its fittings shall be of incorrodible material or rendered incorrodible by a suitable method;
- (b) Class II cables shall, where unarmoured, be laid in troughing or be drawn into ducts, but where armoured they may be laid direct in the ground;
- (c) Where Class II cables may be subject to any corrosive fume, gas, or liquid special protection, such as bitumen or other suitable compound or covering, shall be used.

44-85. Metal sheathed cables may, except where run underground, be installed without further protection, provided that—

- (a) The metallic sheathings are electrically continuous across all joints; and
- (b) The electrical resistance of the metallic sheathing of cables in a complete installation measured between such sheathing at a point near the main switch and any other point in the installation does not exceed 2 ohms; and
- (c) They are secured at intervals by clips, saddles, or clamps. The intervals shall in the case of surface work be sufficiently short to prevent appreciable sagging of the cable when fixed horizontally; and
- (d) Where fixed otherwise than horizontally they are secured at the same intervals as when horizontal, save that where they are inaccessible without structural alteration a length not exceeding 10 ft. may be allowed vertically between supports provided that the upper support firmly grips the cable and that where there is a change in direction from horizontal to vertically downwards they are brought over a rounded support of a radius not less than six times the external diameter of the sheathing; and
- (e) Where laid across joists at any angle they are where necessary supported in a suitable manner; and
- (f) Clips, saddles, and clamps are made of such material as will not be liable to set up electrolytic action with the cable sheathing and having smooth or rounded edges which will not indent or damage the sheathing, and where exposed to the weather or otherwise in damp situations they, together with their fixings, are of non-rusting material; and
- (g) Where passing through party walls or fire-resisting floors, walls, partitions, or ceilings, the holes through which they pass are plugged with fireclay or similar non-ignitable material, no space through which fire might spread being left around the cables; and
- (h) Where they pass through any position in which they will be subject to abrasion they are suitably protected; and
- (i) If liable to corrosive action they are adequately protected; and,

(j) In the case of Class I cables,—

(i) The metal sheathing is gripped mechanically at each clip, saddle, clamp, junction-box, and joint-box, and that at all outlet points such sheathing is secured within 2 in. of the base block or other device; and

(ii) The earthing-lead is electrically connected to all junction-boxes and joint-boxes and also to all accessories and fittings where such accessories and fittings are required by these regulations to be earthed; and

(k) In the case of Class II cables,—

(i) If liable to vibration, under normal conditions, they are adequately protected having regard to the nature of their sheathing or casing; and

(ii) Where run concealed all connections are made in boxes of ample capacity and of non-absorbent, non-ignitable material.

PART 45.—INSTALLING CONDUCTORS II.

STEEL CONDUITS.

45-01. All classes of cable specified in Regulation 23-42 hereof may be enclosed in screwed steel conduits, provided that the conduits are installed in accordance with paragraph (h) of Regulation 44-62 hereof, and provided further that—

- (a) The conduits are mechanically and electrically continuous across all joints; and

- (b) The electrical resistance of the conduit in a complete installation measured between the conduit at a point near the main switch and any other point of the installation does not exceed 2 ohms; and
- (c) Where liable to condensation drip-outlets not exceeding $\frac{1}{4}$ in. diameter and not less than $\frac{1}{8}$ in. diameter are provided at the lowest point of each circuit to permit the exit of moisture; and
- (d) The conduits of each circuit are erected complete before the cables are drawn in, that conduits of less than 1 in. diameter are supported at least every 4 ft. and other conduits at least every 6 ft., save that where used between supports placed more than 6 ft. apart they shall be supported to the satisfaction of the Authorized Inspector, and that all conduits, except where checked into joists, studs, and the like, are secured by means of saddles spaced where possible at intervals not exceeding 4 ft. All saddles shall be securely fixed; and
- (e) Except where terminating at accessories and fittings, metal bell-mouths or other approved outlets are fitted to the ends of all conduits to prevent abrasion, and that the conduit at all external outlet points is set down not less than 45 degrees and terminates with a non-corroding bell-mouth; and
- (f) The ends of all conduits are—
- (i) Reamed out and do not project into any conduit-fitting, junction-box, or other outlet beyond the thread, bushing, or lock-nut in such fitting, junction-box, or other outlet; and
 - (ii) Where terminating at any accessory and/or fitting (other than where mounted on a switchboard) screwed thereto, or provided with metal outlet-boxes or approved outlet-flanges, or where the conduit is run on the surface and it is not necessary to earth the accessory or fitting the conduit may terminate in, but not pass through, a wooden block. Where a metal outlet-box is not provided with the standard length of thread the conduit shall be securely clamped thereto. Where a wooden block is used it shall comply with Regulation 47-81 hereof. All boxes and flanges shall be securely fixed; and
- (g) No inspection elbow or tee shall be used for drawing-in purposes for any cable larger than 7/036 in.; and
- (h) All bends have a radius not less than two and a half times the outside diameter of the conduit, and that all elbows and tees are of the inspection type, save that—
- (i) At the ends of conduits immediately behind fittings or accessories plain conduit fittings may be used; and
 - (ii) In surface wiring where the conduit turns to pass through a wall one plain elbow may be used if the conditions are such that the use of an inspection elbow or normal bend would be impracticable; and
- (i) In damp situations and where exposed to the weather conduits, together with their fittings, saddles, and fixings, are of incorrodible material or rendered incorrodible by a suitable method. Conduit fittings and boxes shall be rendered watertight; and
- (j) In damp situations and where exposed to the weather if the protective covering of the conduit has been removed from any part such part shall be adequately protected; and
- (k) Where conduits are to be buried in concrete, plaster, cement, or the like, in any building they shall comply with the following requirements—
- (i) The conduit shall finish at outlets in flush boxes, and no inspection fittings, solid elbows, or tees shall be used. Draw-in boxes may be used provided that their covers are flush with the finished surface; and
 - (ii) The wires shall be drawn in from the outlets or draw-in boxes specified in the preceding paragraph, and the conduit shall be cleared of all moisture and debris by pulling a swab through before the wires are drawn in; and
- (l) Where flexible conduit is used it shall be efficiently connected mechanically and electrically to the appliance and to the screwed conduit, plug, or other accessory or fitting.

WOOD CASING.

45-11. All classes of cables specified in Regulations 23-42 and 23-43 hereof may be enclosed in wood casing provided that—

- (a) It is used only in dry situations and on the surface. In positions subject to occasional condensation such as bathrooms and washhouses in domestic installations casing may be used provided the capping and casing are painted over with water-resisting paint after erection; and

- (b) It is not fixed in contact with any gas-pipe or water-pipe, or immediately below the latter; and
- (c) The capping is secured by screws at intervals not exceeding 2 ft.; and,
- (d) If the casing forms part of ornamental woodwork, ready access is provided to the cables contained therein; and
- (e) The casing is fixed at intervals not exceeding 2 ft. 6 in., unless continuously supported, in which case fixings shall be not more than 5 ft. apart, and that all joints are close fitted and all angles are mitred; and
- (f) In no circumstances shall it be used where the pressure exceeds 250 volts to earth, or for enclosing service-mains, or for passing through party walls.

FLEXIBLE CORDS.

45-21. Flexible cord shall be used only for pendants, the internal wiring of fittings, and the connecting of appliances, fittings, and lift-cages to the fixed wiring, and shall be installed in accordance with the following requirements:—

- (a) It shall be installed in a position where it will be as free from mechanical injury as the circumstances permit, and with this object in view it may be supported by insulated screw-hooks or other adequate means within the limits of the room or compartment in which it is connected to the fixed wiring; and
- (b) In no circumstances shall it support anything other than the fitting or accessory to which it is attached; and
- (c) The maximum weight carried by a twin twisted flexible cord shall be as follows:—
- | | | |
|---------------------------------|----|--------|
| 23/0076 in. or its equivalent.. | .. | 5 lb. |
| 40/0076 in. or its equivalent.. | .. | 10 lb. |
- (d) Where it is necessary for a flexible cord from a hanging fitting to pass into a ceiling to a plug-socket or other connector it shall be suitably protected; and
- (e) Where taken across the surface of a ceiling the total length shall not exceed 9 ft., and it shall be supported by insulated screw-hooks at intervals not exceeding 4 ft. 6 in.; and
- (f) The type of flexible cord to be used shall be in accordance with the requirements of Table XV in Division VII hereof.

TEMPORARY WIRING.

45-31. Temporary wiring shall be carried out only after special permission has been granted by the electrical supply authority in accordance with Regulations 15-06 to 15-11 (both inclusive) hereof, and shall comply with the following requirements:—

- (a) All such wiring shall be supported by porcelain cleats or knob insulators, or in such other manner as may be approved in any particular case by the electrical supply authority's engineer; and
- (b) The wiring shall be kept clear of any inflammable materials, and shall be so supported as to be free from risk of mechanical injury or of interference by unauthorized persons; and
- (c) All joints shall be mechanically and electrically sound; and
- (d) Temporary wiring shall not be connected to permanent wiring except at a switchboard or at a suitable point; and
- (e) Each circuit shall be controlled by a switch and protected by a cut-out; and
- (f) The maximum number of lamps on any subcircuit shall be such that the total current supplied from such subcircuit does not exceed 15 amperes.

WIRING WHERE INFLAMMABLE GOODS, OR EXPLOSIVE DUST OR GAS IS PRESENT.

45-41. (1) In any place where highly inflammable goods (e.g., cinematograph-films or petrol) are stored or packed, or where inflammable or explosive dust or gas is liable to be present, no lamp except an incandescent lamp shall be used, and it and its holder shall be enclosed in a fitting having a thick glass globe and an adequate radiating surface.

(2) Where inflammable or explosive dust or gas is liable to be present every fitting shall be gas-tight.

45-42. (1) The cables in such place as aforesaid shall be enclosed in screwed steel conduit for their entire length, and where inflammable or explosive dust or gas is liable to be present the conduit shall be rendered gas-tight by painting all threads with white-lead, red-lead, or graphite pipe-jointing compound before screwing into any conduit-fitting or other fitting, and all conduit-fittings shall be gas-tight.

(2) The conduit shall in all cases be screwed into the lamp-fitting, conduit-fitting, and/or terminal box of every motor and/or other appliance.

(3) No unenclosed flexible cable or flexible cord other than one used for a portable appliance shall be used.

45-43. No portable appliance shall be used in any situation where inflammable or explosive dust or gas is liable to be present unless such appliance has been previously approved for the particular place.

45-44. Switches, cut-outs, and all other accessories liable to arc shall, where practicable, be located outside such places as aforesaid, but where this is impracticable they shall be of the metal-clad type, and where inflammable or explosive dust or gas is liable to be present they shall be flame-proof. All flame-proof enclosures shall comply with British Standard Specification No. 229 or its equivalent.

45-45. Every switch used to control any lamp or appliance in any place where inflammable or explosive dust or gas is liable to be present shall be of the single-throw tumbler or other indicating type.

45-46. Where inflammable or explosive dust or gas is liable to be present all generators, motors, starters, and their terminals shall be flame-proof in accordance with British Standard Specification No. 229 or its equivalent.

45-47. No conductors other than those required for the supply and use of current therein shall be installed in any place where inflammable goods are stored or packed or where inflammable or explosive dust or gas is liable to be present.

45-48. The wiring for lamps, appliances, and motors attached to apparatus used to convey or deliver a highly inflammable liquid—*e.g.*, petrol—shall comply with the following requirements:—

- (a) Where the apparatus is exposed to the weather the wiring shall be connected to a separate subcircuit.
- (b) The conduit within the casing of the apparatus shall be rendered gas-tight.
- (c) Where underground conductors are used they shall terminate in a gas-tight plug-socket rigidly fixed between 2 in. and 4 in. above the level of the base flange of the casing of the apparatus. The conductors from the lamp-holders to the plug-socket shall be enclosed in rigid conduit as far as practicable and then in gas-tight flexible conduit, and shall terminate in a gas-tight plug.
- (d) Where overhead conductors are used and the apparatus is exposed to the weather the conductors from the switchboard shall terminate in a weatherproof plug-socket fixed not less than 7 ft. above ground-level. The conductors from the lamp-holders to the plug-socket shall be enclosed in rigid conduit within the apparatus, over the space between the apparatus and the building and for an additional distance of not less than 1 ft., and such conduit shall be rigidly fixed to the apparatus and to the building. The conductors between the rigid conduit and the plug-socket shall be enclosed in watertight flexible conduit and shall terminate in a weatherproof plug.
- (e) Where the conductors are not underground and the apparatus is not exposed to the weather the conductors from the switchboard shall terminate in a gas-tight plug-socket fixed in a permanent position as near as practicable to the lamp-holders on the apparatus. The conductors from the lamp-holders to the plug-socket shall be enclosed in rigid conduit within the apparatus and may be so enclosed outside the apparatus provided the conduit is properly supported. The conductors between the rigid conduit and the plug-socket shall be enclosed in gas-tight flexible conduit and shall terminate in a gas-tight plug.
- (f) In those cases where the lighting fittings have to be moved when cleaning the liquid container:—
 - (i) A gas-tight plug and socket shall be fixed near such fittings in such a position and so connected that the whole top part of the conduit, together with the lighting fittings and wiring, may be removed bodily after withdrawing the plug; or
 - (ii) In those cases where the conductors to the lighting fittings are of flexible cord protected with tough rubber compound in accordance with Regulation 23-71 hereof, a gas-tight union may be fitted in the vertical part of the conduit so installed as to permit the whole of the top part of the conduit, together with the lighting fittings and wiring, to be rotated horizontally not more than 90°.

WIRING WHERE CORROSIVE GAS, FUMES, OR LIQUIDS ARE PRESENT.

45-51. Where any corrosive gas, fume, and/or liquid is present, or liable to be present, the proposed system of wiring shall be submitted to the Chief Electrical Engineer for approval, and no wiring shall be installed or used except in accordance with such approval.

45-52. Conduit and its fittings, saddles, and fixings in such places as aforesaid shall be of incorrodible material or rendered incorrodible by a suitable method.

45-53. Conduit fittings and boxes in such places as aforesaid shall be rendered watertight.

WIRING IN FREEZING-CHAMBERS AND COOLING-CHAMBERS.

45-61. No switchboard shall be fixed in any freezing-chamber or cooling-chamber.

45-62. No switch shall be fixed in any freezing-chamber or cooling-chamber, except on an alarm circuit, in which case only switches approved for the purpose may be used.

45-63. Every switch for any freezing-chamber or cooling-chamber shall be double-pole, except in the case of multiple-earthed neutral systems and alarm circuits.

45-64. No conductors other than those required for the supply and use of current therein shall be installed in any freezing-chamber or cooling-chamber.

WIRING FOR EXPERIMENTAL AND DEMONSTRATION PURPOSES.

45-71. Where any wiring is used in connecting up any apparatus for experimental, testing, demonstration, or research purposes in electrical engineering workshops, test-rooms, and the like where qualified persons are in charge, such wiring shall comply as far as practicable with the requirements of these regulations so as to reduce any electrical hazard to a minimum. Adequate switching arrangements shall be provided so that live terminals and connections need not be handled and adequate protective apparatus shall be provided to take care of short-circuits or overload. Notices warning persons against the danger of touching live metal shall be prominently displayed.

OUTDOOR LIGHTING.

45-81. When the lamp-holders or fittings for outdoor lighting and the subcircuit conductors are attached to messenger wires the work shall comply with the following requirements:—

- (a) The messenger wire shall be of galvanized steel or copper of adequate strength to the satisfaction of the Authorized Inspector; and
- (b) The subcircuit conductors shall be attached to the messenger wire by means of outdoor type insulators spaced at intervals of not more than 4 ft.; and
- (c) The subcircuit conductors shall be of stranded copper of a cross-sectional area not less than 0.003 sq. in. (3/036 in. or its equivalent) and may be soft-drawn; and
- (d) The subcircuit conductors, other than a multiple-earthed neutral conductor, shall be covered with vulcanized rubber in accordance with Regulation 23-12 hereof.

45-82. Where no messenger wire is used and where the subcircuit conductors for outdoor lighting are used to support the fittings such conductors shall, in addition to complying with paragraph (d) of the last preceding regulation, be of hard-drawn stranded copper of adequate strength to the satisfaction of the Authorized Inspector, but in no case shall the cross-sectional area be less than 0.01 sq. in. (7/044 in. or its equivalent).

BELL AND OTHER EXTRA-LOW PRESSURE CIRCUITS.

45-91. No cable or flexible cord used for lighting, heating, or power shall be installed in the same casing or conduit as any cable or flexible cord used for an electric bell, telephone, signalling apparatus, and the like.

45-92. A bell circuit and/or a signalling circuit (except a telephone circuit) may be operated from any subcircuit which is connected to a service-main, provided that such bell or signalling circuit is connected to the secondary side of a double-wound transformer, having a secondary voltage not exceeding 30 volts, and provided further that—

- (a) Each such transformer is protected on the primary side by a single-pole cut-out; and
- (b) The conductors of such bell or signalling circuit where unenclosed are secured by means of insulated staples, and that where subject to mechanical injury such conductors are adequately protected; and
- (c) Joints in the conductors of such bell or signalling circuit are, as far as practicable, avoided; and
- (d) The conductors of such bell or signalling circuit are insulated with vulcanized-rubber of not less than 300 megohm grade, save that ordinary bell wire may be used provided that the secondary voltage does not exceed 12 volts and that the transformers comply with Regulation 21-15 hereof.

45-93. Electric toys may be operated from any subcircuit which is connected to a service-main provided that they are connected to the secondary side of double-wound transformers which comply with Regulation 21-16 hereof.

45-94. Electric bells and buzzers may be operated directly from any low pressure subcircuit which is connected to a service-main provided that every such bell or buzzer complies with Regulation 25-01 hereof and provided further that—

- (a) Every bell-push is suitable for low pressure; and
- (b) The wiring to every bell, buzzer, and push is totally enclosed right up to the terminals thereof.

PART 46.—INSTALLING CONDUCTORS III.

SELECTION OF CABLE RUNS.

46-01. Cables shall be fixed as far as possible in accessible positions, so chosen that the cables are not exposed to drip or accumulation of water or oil, or to high temperature from boilers, steam-pipes, or other hot objects, or to risk of mechanical injury.

46-02. The runs for cables shall be selected so that in no case will the inside radius of any bend to which a cable is subjected be less than—

- (a) For lead-covered cable, whether armoured or not,—
 - (i) Ten times its overall diameter when being drawn in; or
 - (ii) Six times its overall diameter for paper-insulation, or three times for rubber-insulation at any time.
- (b) For rubber-insulated cable, other than specified in the preceding paragraph, twice its overall diameter.

NUMBER OF CABLES IN CONDUIT.

46-11. The number of cables installed in any one conduit shall not exceed that prescribed in Table XII in Division VII hereof, and the run and size of the conduit shall be such that it is possible to withdraw any one cable and draw in another of equal size without injury.

46-12. When carrying alternating current, except in the case of high pressure or extra-high pressure cables specified in Regulation 56-04 hereof, the lead and return conductors of a single-phase circuit and all phase conductors with the neutral conductor (if any) of a three-phase circuit shall be installed in the same conduit.

CABLE SOCKETS AND OTHER CONNECTIONS.

46-21. The ends of all cables having a cross-sectional area greater than 0.01 sq. in. (7/1044 in. or its equivalent) shall—

- (a) Be provided with a soldering-socket; or
- (b) Have all strands secured in a binding-post.

46-22. The ends of all cables and flexible cords having a cross-sectional area of 0.01 sq. in. (7/1044 in. or its equivalent) or less shall—

- (a) Be secured under a washer, or the head of a screw, of such size as will ensure full contact being made with all strands; or
- (b) Have all strands secured in a binding-post; or
- (c) Be provided with a soldering-socket.

46-23. Where a soldering-socket or terminal is used the cable shall be so supported that there is no appreciable mechanical stress on such socket or terminal.

46-24. Soldering-fluxes containing acid or other corrosive substances shall not be used.

46-25. Insulating material damaged by the application of heat during the process of soldering shall be cut away, and shall be replaced with insulation equivalent to the original.

46-26. The braid, lead, or other covering over the insulating material, including the tape in contact therewith, shall be kept clear of live metal.

46-27. In the case of paper-insulated cables the exposed conductor and insulating material shall be protected from moisture by being suitably sealed with insulating-compound.

46-28. Where the conductors are insulated with rubber and installed in damp situations, or where the conductors are insulated with paper, the ends of stranded conductors shall either be provided with soldering-sockets or be made solid by soldering.

CONNECTION BETWEEN CONDUCTORS.

46-31. Subcircuit wiring shall in general be carried out on the loop-in system free from joints except as provided in Regulations 44-62, 44-72, 44-83, 44-85, 45-31, 45-92, and 46-37 hereof.

46-32. Joints shall be made only when unavoidable, and every joint shall be mechanically and electrically sound.

46-33. (1) Where rubber-insulated cables are metal sheathed, armoured, covered with tough rubber compound, or installed in conduit, every joint shall be enclosed in a joint-box. The protective covering of the cable shall be maintained up to a point situated within such box.

(2) In the case of paper-insulated cables the joint shall be enclosed either in a joint-box or in a lead sleeve wiped on to the cable sheathings. The box or sleeve, as the case may be, shall be filled with an insulating-compound impervious to moisture.

46-34. Every joint-box shall be accessible, save that in the case of armoured or lead-covered underground cables such boxes where underground need not be accessible.

46-35. Every joint-box used in a damp situation shall be weatherproof and moisture resisting.

46-36. Connection between a cable and a flexible cord, except where made by means of a plug and socket or similar device, shall in every case be made by means of a ceiling-rose or other approved connector fixed within a suitable receptacle. In the case of heavy fittings which cannot be connected by the above method, the proposed method shall be approved by the Authorized Inspector.

46-37. No joint shall be made in a flexible cord, except within a fitting or appliance, and pieces of flexible cord shall not be joined together otherwise than by means of a substantial coupling or connector of the plug and socket type properly insulated and so installed that its live parts are so guarded or recessed as to prevent accidental personal contact therewith both when uncoupled and when coupled together.

PART 47.—FITTINGS, APPLIANCES, AND ACCESSORIES.

FITTINGS.

47-01. All fittings shall be so erected that—

- (a) They are securely fixed; and
- (b) There is no mechanical strain on any terminal; and,
- (c) Where hanging and exceeding 10 lb. in weight, they are suspended in accordance with the requirements of paragraph (d) of Regulation 27-01 hereof; and,
- (d) If of the rigid type, they are stayed, where necessary, to prevent turning at the joints; and,
- (e) If exposed to rain, drip, or externally condensed moisture, they are weatherproof, and if erected outdoors and over 2 ft. in length are stayed unless specially designed to withstand wind-pressure; and
- (f) If so situated that the enclosing globe is liable to mechanical injury, it is protected by a suitable guard.

47-02. (1) Shades of inflammable material shall be kept free from contact with lamps and lamp-holders by means of suitable guards or supports.

(2) Celluloid or other highly inflammable material shall not be used for any shade, candle-tube, colour-screen, or in any position where it is likely to introduce an electrical hazard.

47-03. Fittings shall, unless provided with reasonable space for the connections, or where the circuit wires are taken direct into the lamp-holder, be mounted on a base block or metal outlet box. The base block or metal outlet box shall be securely fixed.

APPLIANCES.

47-11. Every washing-machine shall be connected to the supply in the room in which the machine is used by means of a three-pin plug and socket and three-core flexible cord, or by means of fixed wiring.

47-12. Medical and dental appliances in which metal liable to become alive is, or which may be, in direct contact with the body of the patient shall comply with the requirements of Regulation 27-21 hereof.

ACCESSORIES.

General.

47-21. Accessories which are not mounted on a switchboard shall, unless provided with reasonable space for the connections, be mounted on a base block or metal outlet box. The base block or metal outlet box shall be securely fixed.

47-22. Accessories of the centre-contact, concentric, or screw type shall have the live conductor connected to the centre contact.

Ceiling-roses.

47-31. Ceiling-roses shall not be used for pressures normally in excess of 250 volts.

Lamp-holders.

47-41. Switch lamp-holders shall be provided with further means of control in a readily accessible position in the same room.

47-42. Lamp-holders in domestic installations shall not be fixed on any wall at a less height than 5 ft. above floor-level unless suitably protected to prevent contact being made by any person with the contacts in the lamp-holder.

Incandescent Lamps.

47-51. No incandescent lamp for ordinary lighting purposes shall be used on a pressure normally in excess of 250 volts.

Arc Lamps.

47-61. Where an open type arc lamp is used—

- (a) When the lamp is fixed, the floor immediately underneath the lamp shall, unless of incombustible material, be protected from falling particles of carbon by an incombustible covering; and
- (b) When the lamp is portable, either the floor, unless of incombustible material, shall be protected, in every place where the lamp may be used, by an incombustible covering, or a tray of adequate size and made of incombustible material shall be permanently fixed to the underside of the lamp.

Plugs, Sockets, and Adaptors.

47-71. (1) Every plug-socket shall be controlled by a switch in the live conductor, save that in the case of sockets not exceeding 10-amperes capacity where the plug and socket is of a type approved for the purpose the switch may be omitted on an alternating current subcircuit.

(2) Every socket used for a motor exceeding $\frac{1}{2}$ horse-power shall be controlled by a switch.

47-72. All plug-sockets shall be mounted in such a manner that dirt and dust cannot readily accumulate therein.

47-73. In the case of two-pin non-reversible type plug-sockets the neutral conductor shall be connected to—

- (a) The slot on the radial line; or
- (b) The outer contact where the contacts are concentric; or
- (c) The larger contact where the pins are of different size; or
- (d) The circular contact where the pins are of different shape.

47-74. In the case of three-pin plug-sockets,—

- (a) The earthing-lead shall be connected to—
 - (i) The slot on the radial line; or
 - (ii) The contact for the longer pin where the pins are circular; or
 - (iii) The outer shell where the plug has two pins and an outer metal shell;

(b) Assuming the terminal of the socket to which the earthing-lead is connected to be called number one and the other terminals numbered consecutively in a clockwise direction a live conductor shall be connected to terminal number two and the neutral (or other) conductor to terminal number three;

(c) Where any plug-socket in any installation is fixed in a position in which earthing is necessary to comply with the requirements of these regulations three-core flexible cord shall be used on all appliances in such installation which may require to be earthed.

47-75. Plugs and sockets exposed to rain, drip, or externally condensed moisture shall be weatherproof.

47-76. In every position where earthing of apparatus is necessary to comply with the requirements of Regulations 54-01 and 54-02 hereof, the plug-socket shall be equipped with a contact for earthing purposes and such contact shall be earthed.

Wooden Blocks.

47-81. (1) Every wooden base block shall—

- (a) Be made of thoroughly seasoned suitable timber and be of robust construction; and
- (b) Be rendered impervious to moisture when mounted in a position liable to be damp; and
- (c) For surface conduit work, be counter-bored in such a manner as to receive the conduit but so as to prevent it from projecting within the recess of the block; and

(d) Be securely fixed.

(2) Wooden blocks shall not be used for direct-current installations where one of the supply conductors is earthed, unless the permission of the electrical supply authority is first obtained.

PORTABLE APPLIANCES, FITTINGS, AND ACCESSORIES.

47-91. Where portable appliances, fittings, or accessories are used the pressure between any two points in one room or compartment shall not exceed 250 volts, unless—

- (a) The appliances, fittings, or accessories between which there may be a higher pressure are so situated that they cannot be brought within 6 ft. of each other; or
- (b) The metal frames and sheathings of all such appliances, fittings, and accessories are earthed; or
- (c) Such appliances, fittings, and accessories are of the all-insulated type.

47-92. Every portable appliance used in a wet situation shall be supplied at extra-low pressure.

47-93. No domestic portable appliance shall be used on a pressure normally in excess of 250 volts to earth.

47-94. Portable appliances and fittings shall be connected to the fixed wiring by means of plugs and sockets, connectors, or adaptors of suitable capacity.

PART 48.—MOTORS AND CONTROL GEAR.

MOTORS.

48-01. Motors shall, wherever possible, be placed in well ventilated spaces in which inflammable or explosive dust or gas is not likely to accumulate. Where this is not practicable the motors shall be of a type the use of which will not create an electrical hazard.

48-02. Motors located in situations where the temperature is such that the surrounding air does not provide sufficient cooling to prevent electrical hazard shall be of special construction to provide for this condition, or alternatively shall be provided with suitable ventilation taken from a source of cool air supply, and the air-intakes shall be guarded against the admission of dirt or moisture.

48-03. Motors shall, wherever possible, be placed in positions in which they are not normally exposed to risk of mechanical injury or to damage from water, steam, oil, or excessive dust. Motors necessarily exposed to such conditions shall be of suitable types as specified in British Standard Specification No. 168 or its equivalent.

48-04. Adequate precautions shall be taken in the installation of every motor as will ensure immunity from electrical hazard.

CONTROL OF MOTORS.

48-11. Every motor shall be provided with efficient means suitably placed and so connected that the motor and all apparatus in connection therewith may be isolated from the supply: Provided that in the case of supply from a system having a multiple-earthed neutral, it shall not be necessary to disconnect the neutral.

48-12. Every motor shall be provided with an efficient switch or circuit-breaker for starting and stopping the motor, so placed as to be easily and safely operated by the person controlling the motor. Such switch or circuit-breaker may be embodied in the starting or controlling device used with the motor.

48-13. (1) Every motor having a rating exceeding $\frac{1}{2}$ horse-power for direct current or 3 horse-power for alternating current shall be provided with—

- (a) Means for automatically opening the circuit if the supply pressure falls sufficiently to cause the motor to stop; and
- (b) In the case of direct current motors, means for limiting the amount of current taken when starting and accelerating; and
- (c) In the case of alternating current motors in locations where the electrical supply authority so requires, means for limiting the amount of current taken when starting and accelerating to such reasonable value as the electrical supply authority may require.

(2) Every motor having a rating exceeding 3 horse-power shall be provided with an automatic overload release in each live conductor. In the case of alternating current motors such release shall be of the time-lag type.

48-14. Except where a double-throw starting switch is used every motor having a rating exceeding $\frac{1}{2}$ horse-power and not exceeding 3 horse-power shall, when the starting current exceeds twice full-load current, be provided in each live conductor with—

- (a) A circuit-breaker equipped with a time-lag automatic overload release; or
- (b) A time-lag cut-out.

Where such circuit-breaker or cut-out also protects the subcircuit, the subcircuit circuit-breaker or cut-out (as the case may be) prescribed by Regulation 22-25 hereof may be omitted.

RESISTANCES AND CONTROL-GEAR.

48-21. Nothing in Regulations 48-22 and 48-23 hereof shall apply to apparatus having a capacity of less than 60 watts.

48-22. (1) All resistances and control gear shall, as far as possible, be placed—

- (a) In positions in which they will not be exposed to risk of mechanical injury or to damage from water, steam, or oil; and
- (b) In well ventilated spaces in which inflammable or explosive dust or gas is not likely to accumulate.

(2) Where necessarily exposed to such conditions as aforesaid, resistances and control gear shall be completely enclosed; and if liable to be exposed to inflammable or explosive dust or gas, control gear shall be flame-proof.

48-23. Adequate precautions shall be taken in the installation of every resistance as will ensure immunity from electrical hazard.

PART 49.—ELECTRIC LIFTS.

49-01. The supply of power to every lift, other than a service-lift, shall be taken direct from the main switchboard by means of a submain or subcircuit to which no lighting, heating, or other power device is connected.

49-02. No circuit-breaker operated automatically by a fire-alarm system shall interrupt the power, or the control, or the lighting of a lift.

49-03. The pressure for a lift shall be in accordance with the requirements of Regulation 29-01 hereof.

49-04. A switch or circuit-breaker to comply with the requirements of Regulation 48-11 hereof shall be located adjacent to the door of the machine-room in a position which is visible from the machine and which is safely and readily accessible. There shall be a clear working-space of not less than 3 ft. in front of such switch or circuit-breaker, and it shall not be possible to move such switch or circuit-breaker into the "on" position from any other part of the building.

49-05. Every limit, hatchway, safety, and door switch or circuit-breaker connected in any lighting or power subcircuit shall be installed in an approved metal case and such case shall be earthed.

49-06. Every conductor in the lift-well, other than a trailing-lead, shall be enclosed in steel conduit as specified in Regulation 45-01 hereof, with the control and motor leads in separate conduits which contain no other conductors, or armoured cables shall be used except in special cases such as chemical works or cold stores in which cases the wiring shall be installed in a manner approved by the Electrical Engineer of the electrical supply authority.

49-07. The trailing-leads for the lift-car shall—

- (a) Be so installed that the wiring for the lighting, the wiring for the control, and the wiring for each set of safety devices will be entirely separate from each other and from other conductors; and
- (b) Be multicore and in accordance with the requirements of Table XV in Division VII hereof; and
- (c) Be provided with a substantial and approved slow-burning outer covering; and
- (d) Be adequately supported to relieve the strain from the conductors; and
- (e) Be of such a length that they cannot come into contact with the bottom of the lift-well when the car is at the lowest point of normal travel; and
- (f) Terminate in metal-clad junction boxes fitted with connectors.

49-08. The common lead to the operating device in the lift-car shall be run in a separate and independent trailing-lead.

DIVISION V.—INSTALLATION II.

PART 51.—HEATING AND COOKING.

HEATING AND COOKING APPLIANCES.

51-01. The junction between the elements or switches of heating and/or cooking appliances and the external connecting-leads shall, where no terminal block is provided, be effected without solder by suitable connectors.

51-02. Every gas-electric range shall be provided with an insulating coupling in accordance with the requirements of Regulation 31-04 hereof.

51-03. Every heating and/or cooking appliance shall be controlled as a whole by a switch in each live conductor or by an approved plug and socket as provided in Regulation 47-71 hereof, and such switch or socket shall be mounted within easy reach of such appliance.

51-04. Every switch mounted on a cooking appliance shall be connected in the live conductor.

APPLIANCES FOR HEATING WATER AND OTHER LIQUIDS.

51-11. No heating element used for heating water or any other liquid shall be in direct contact with any combustible material. Every vessel in which the base and/or lower rim is not lagged with heat-retarding material shall, if it contains a heating element within 3 in. of the base and is made of material which will readily conduct heat, be supported on non-ignitable heat-retarding material.

51-12. Conductors covered with combustible insulating material, unless suitably protected against heat, shall terminate not less than 12 in. from the heating element as aforesaid, and conductors covered with non-ignitable heat-retarding insulating material shall be used between such termination and the terminals of the heating element.

51-13. All heaters used for heating water or any other liquid shall comply with the requirements of Regulation 31-12 hereof.

51-14. No appliance in which a live element is in direct contact with the liquid shall be connected to any source from which electrical energy is available unless such appliance has been approved. No such fixed appliance shall be so connected unless the installation thereof has been carried out to the satisfaction of the electrical supply authority.

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PART 52.—THEATRES.

52-01. All fixed wiring in a theatre shall be enclosed in steel conduits as specified in Regulation 45-01 hereof, or in situations which are not readily accessible cables covered with tough rubber compound as specified in Regulation 44-71 hereof, or metal-sheathed cables and armoured cables as specified in Regulations 44-81 to 44-85 (both inclusive) hereof, may be used.

52-02. Every switchboard used for controlling the lighting and/or effects on a theatre stage shall be mounted in a convenient position and shall be inaccessible to all but the switchboard operator. Such switchboard when mounted on or over a stage shall comply with Regulation 32-01 hereof.

52-03. Every switchboard in a theatre shall be fixed in an accessible position where it will not obstruct a passage or exit-way.

52-04. (1) Every resistance in a theatre shall be mounted on an incombustible base, and shall be so protected and placed at such a distance from any combustible material that no part of the resistance, if broken, can fall on such material, or *vice versa*.

(2) Every such resistance shall be provided with adequate ventilation.

52-05. Stage-lighting, including footlights, border-lights, and proscenium side lights in a theatre shall be so wired that the maximum number of lamps on any subcircuit shall be such that the total current supplied from such subcircuit does not exceed 15 amperes.

52-06. Conductors to battens and floats in a theatre shall be suspended in such a manner that no stress can be applied by the conductors to any terminal to which they may be connected, and shall be either—

- (a) Flexible cables or cords covered with tough rubber compound; or
- (b) Vulcanized-rubber insulated cables containing not less than seven strands for each conductor and enclosed in canvas hose; or
- (c) Flexible cables or cords covered with slow-burning braiding; or
- (d) Flexible cables or cords covered with hard-cord braiding.

52-07. (1) Footlights or lamps on battens, floats, and other stage-lighting in a theatre shall be so installed that the flanges of the reflectors, or other suitable guards, will protect the lamps from mechanical injury and from accidental contact with scenery or other combustible material.

(2) No readily combustible material shall be used in connection with any lamps in such a manner that it might come in contact with the lamps or conductors.

52-08. Every electrical fitting or apparatus of any description in a theatre shall be so fixed or arranged that in no circumstances can it interfere with the proper working of the safety-curtain.

52-09. (1) Portable lamps for the orchestra or similar lighting in a theatre shall not be connected to any subcircuit to which other lighting is connected.

(2) Outline or exterior lighting shall not be connected to any subcircuit to which other lighting is connected.

52-10. Every stage floor-plug and socket in a theatre shall be in accordance with the requirements of Regulation 32-02 hereof.

SPECIAL AS TO MOTION-PICTURE THEATRES.

52-21. Conductors from the switchboard in the projection-room to the cinematograph machine in a motion-picture theatre shall be enclosed in steel conduit in accordance with Regulation 45-01 hereof, and shall terminate in a terminal box. Conductors from such box to the lamp-house shall be covered with fire-resisting material where liable to become ignited due to heat from the arc.

52-22. (1) The conductors for any cinematograph machine and accessory in a motion-picture theatre shall be connected to a service separate from that supplying the lighting in the theatre, or shall be connected to independent service cut-outs. Switches and cut-outs shall be inserted in such conductors near to the consumer's main cut-outs and in addition a switch shall be fitted in such conductors within the projection-room. Such switch shall be double-pole in the case of direct current and single-pole in the case of single-phase alternating current.

(2) Every resistance for a cinematograph machine shall be placed inside the projection-room.

52-23. All fixed wiring in the projection-room of a motion-picture theatre shall be enclosed in steel conduit as specified in Regulation 45-01 hereof.

PART 53.—HIGH AND EXTRA-HIGH PRESSURES.

53-01. The regulations in this Part shall apply to all high pressure and extra-high pressure apparatus, other than luminous-discharge-tubes specified in Regulation 56-04 hereof and medical and dental apparatus specified in Re-

gulation 47-12 hereof, situated on a consumer's premises and embody special requirements in addition to any other requirements of these regulations.

53-02. Transformers shall be installed only in situations approved by the Electrical Engineer of the electrical supply authority or where there is no such authority then approved by the Chief Electrical Engineer.

53-03. The installation shall be carried out in accordance with the appropriate Electrical Supply Regulations, 1935.

53-04. Motors shall be installed only in situations approved by the Electrical Engineer of the electrical supply authority or where there is no such authority then approved by the Chief Electrical Engineer.

PART 54.—EARTHING.

SPECIFYING WHAT SHALL BE EARTHED.

54-01. Where the voltage exceeds extra-low pressure the following shall be earthed to the satisfaction of the Authorized Inspector:—

- (a) Metallic sheathing of metal sheathed cables.
- (b) Metallic sheathing of armoured cables.
- (c) Metal conduits.
- (d) Isolated lengths of metal sheathed cables, armoured cables and/or conduit, in each case not exceeding 20 ft. in length, need not be earthed when used in positions which are more than 7 ft. 6 in. from any unguarded earthed material or from any earthed metal sheathed cables, armoured cables and/or conduit.
- (e) One side of the secondary winding of double-wound transformers stepping down to extra-low pressure, except where such transformer is provided with an earthed metallic screen between the primary and secondary windings, or which will withstand a test pressure of 1,000 volts (R.M.S.) alternating current, or which is used for medical and dental appliances as provided in Regulation 47-12 hereof.
- (f) All metal cases for motor-driven switching or flashing apparatus for signs, outline and decorative lighting.
- (g) All metal liable to become alive when in a damp situation or in a place where a person touching it would be likely, under normal conditions, to be simultaneously making contact with earth or earthed metal, save that appliances when used in any situation other than one which is damp or which has a conducting floor need not be earthed if due to the design and/or construction of the appliance and/or particular conditions of use earthing would introduce rather than obviate an electrical hazard.
- (h) Portable appliances, fittings, and accessories where necessary to comply with Regulation 47-91 hereof.

54-02. Where the pressure exceeds low pressure, the metal cases, frames or enclosures of all accessories, appliances, fittings, generators, motors, transformers, choke-coils, and all other apparatus shall be earthed to the satisfaction of the Authorized Inspector.

54-03. Where practicable accessories, appliances, and fittings of the all-insulated type shall be used in those places where exposed metal is required by these regulations to be earthed. The guards of shrouded hand-lamps made in accordance with clause (1) of Regulation 27-11 hereof shall not be earthed.

STRUCTURAL METALWORK.

54-11. Where structural metalwork (such as steel-frame construction) or the side of a building having exposed metal (such as corrugated-iron) is not itself earthed all metal conduit and any metal liable to become alive shall be protected from electrical contact with such metalwork or exposed metal.

METHODS OF EARTHING.

54-21. When any metal conduit or metallic sheathing of a cable is required to be earthed, or is itself used as an earthing connection, every joint in such conduit or sheathing shall be so made that the current-carrying capacity of the joint will not be less than that of the conduit or sheathing itself.

54-22. Where bed-plates or slide-rails are used the earthing-lead shall be connected to the bed-plate or slide-rail, as the case may be.

54-23. Where the current per conductor exceeds 50 amperes the metal conduit shall not be considered as an earthing-lead, but where the current does not exceed 50 amperes metal conduit (other than flexible conduit) may be used as an earthing-lead.

54-24. (1) Where supply to a device is given by means of flexible cable or flexible cord the earthing-lead shall form part of the flexible cable or flexible cord and shall be connected to a separate terminal of the plug. If this flexible cable or flexible cord has a metallic covering such covering shall in

addition be effectively connected electrically and mechanically to the metal frame of the device and to the earthed metal of the plug and socket connection.

(2) The connection to earth shall be made automatically when the plug is inserted in the socket.

54-25. The neutral conductor of any system shall not be used as an earthing-lead, except that in the case of a multiple-earthed neutral system—

- (a) An earthing-lead shall be taken direct to earth from the neutral bus-bar (or stud) on the main switchboard and the metal conduit or metallic sheathing of cables shall be connected to this earthing-lead at the neutral bus-bar (or stud); and
- (b) Such neutral may be used for earthing metal (other than structural metalwork or the side of a building having exposed metal) in any building which is detached from the building containing the main switchboard, provided—

(i) That no earthed water-supply system as prescribed by clause (1) of Regulation 54-31 hereof is available at such building, or that it is not practicable to provide at such building an earth-connection as prescribed by clause (2) of Regulation 54-31 hereof with a resistance to earth not exceeding that prescribed by Regulation 62-55 hereof; and

(ii) That such neutral is of a cross-sectional area not less than that prescribed by Regulations 43-16, 44-31, or 44-33 hereof (as the case may be); and

(iii) That where an earth-connection as prescribed by clause (2) of Regulation 54-31 hereof has a resistance to earth in excess of that prescribed by Regulation 62-55 hereof such earth-connection shall be interconnected with the neutral only in such cases where the person touching metal liable to become alive will be simultaneously standing on an earthed conducting floor (such as earth or earthed metal), and such floor shall, where practicable, be connected to the earth-connection.

- (c) Such neutral may be used for earthing stays, outdoor lamp-brackets, earthing-guards, and other line hardware provided that it is of a cross-sectional area not less than that prescribed by Regulations 43-16, 44-31, or 44-33 hereof (as the case may be).

PRECAUTIONS IN EARTHING.

54-31. (1) Where an earthed water-supply system with metal-to-metal joints is available the main earthing-lead shall be connected to the pipes of such water-supply system, and the earthing-lead shall be as short as possible.

(2) Where an earthed water-supply system is not available a galvanized-iron water-pipe (or pipes), of not less than $\frac{3}{4}$ in. (internal diameter) shall be driven vertically into the ground to such a depth as to ensure adequate contact with the moist subsoil with a minimum depth in the ground of 4 ft., and the main earthing-lead shall be connected to such pipe (or pipes). Alternatively an earth-plate, or rod, approved by the Authorized Inspector may be used. In either case the resistance to earth shall not exceed that prescribed by Regulation 62-55 hereof.

54-32. Pipes conveying gas or an inflammable liquid or other inflammable material shall not be used as part of an earthing system.

EARTHING-LEADS.

54-41. Every conductor (other than metal conduit or the metallic sheathing of cables) used as an earthing-lead shall be of high conductivity copper, protected by tinning or otherwise against corrosion.

54-42. Where an earthing-lead is run across an open space it shall be adequately supported. All earthing-leads shall be run, as far as possible, to avoid risk of interference and shall be protected against mechanical injury. Where the earthing-lead is fixed to the outside of a building the mechanical protection shall extend to a distance of not less than 6 ft. above ground. A bare earthing-lead shall not be enclosed in conduit or pipe containing insulated conductors if such conduit or pipe is more than 6 ft. in length or if it contains any elbows, tees, or bends.

54-43. All connections of the earthing-lead to the installation and to the earthing system itself shall be accessible.

54-44. If more than one plate, pipe, or rod is employed for one earthing system they shall be effectively and permanently connected together.

54-45. In the case of a multiple-earthed neutral system the earthing-lead and the neutral service-main shall be sweated together into a cable socket which shall be effectively connected to the neutral bus-bar (or stud). The carrying-capacity of the earthing-lead shall not be less than one-half the carrying-capacity of the neutral service-main and shall comply with Regulation 43-16 hereof.

PART 55.—RADIO APPARATUS.

55-01. (1) The regulations in this Part shall apply to apparatus which is used, or adapted for, radio reception or radio transmission, or both, and which is or which may be in electrical contact with any submain or subcircuit which is connected to a service-main.

(2) The regulations in this Part shall not apply to the fixed wiring on any premises where such apparatus as aforesaid may be installed.

(3) Except as provided in Regulation 55-04 hereof nothing in this Part or any other Parts of these regulations shall apply to any part of the apparatus specified in clause (1) of this regulation beyond the secondary side of the power-transformer where such apparatus is supplied by means of a power-transformer incorporated in such apparatus.

55-02. (1) Nothing in Regulations 21-12 (2), 21-13, 28-11, and 41-11 hereof shall apply to radio apparatus.

(2) Nothing in Regulation 54-24 hereof, so far as the provision for earthing purposes of a separate contact in the plug or a separate conductor within the flexible cord, shall apply to radio apparatus where the earthing-lead used for reception purposes is the only earth with which a person in contact with the metalwork of the radio set can, under normal conditions, make contact, provided that such earthing-lead is used for earthing the metalwork of the radio set.

55-03. No radio material or apparatus shall be used on any circuit having a pressure in excess of 33½ per cent. greater than that for which it is primarily designed, nor shall it be adapted for such use solely by the insertion of an additional resistance.

55-04. All live parts of any radio apparatus operating under normal working conditions at a pressure in excess of 100 volts shall be adequately insulated, or so protected that accidental personal contact therewith is impossible.

55-05. Auto-transformers may be used only for supply to the primary winding of a double-wound transformer and provided they are enclosed in a case of metal or some tough non-hygroscopic material which is not readily combustible, and provided further that all live parts are enclosed.

55-06. Reactances shall not be used to reduce the pressure of supply for any radio apparatus.

55-07. No single-pole switch mounted on a radio receiving set shall be used to control the power input unless the electrical energy is introduced into the set by means of a non-reversible accessory device. No such switch shall be connected in any neutral conductor or earthed conductor.

55-08. Every radio set, battery-charger, and eliminator shall be adequately protected by a cut-out.

55-09. Every set of radio apparatus other than a battery-charger or eliminator shall be provided with a legible warning notice permanently fixed to the set in a conspicuous position where access to the electrical equipment is provided. This notice shall contain a warning that no internal parts shall be touched until the set has been disconnected from the supply by the withdrawal of the plug or adaptor.

55-10. Where it is reasonably necessary to protect the supply system from high pressure surges, or feed-back, there shall be installed in the supply to each radio transmitting set exceeding ¼ kilowatt input, and as near as possible to each radio transformer, rotary converter, or other auxiliary apparatus some one of the following:—

- (a) A condenser of not less than one-tenth micro-farad capacity and capable of withstanding the test prescribed by Regulation 62-42 hereof and having therewith connected across the line, in parallel with such condenser, a shunting fixed spark-gap capable of not more than ½ in. separation; or
- (b) A protector of the vacuum-tube type across the line; or
- (c) A lightning-arrester of the aluminium-cell type or other approved type.

PART 56.—ELECTRIC SIGNS, OUTLINE AND DECORATIVE LIGHTING.

56-01. Electric signs, outline and/or decorative lighting shall be installed in accordance with Regulations 56-02, 56-03, and 56-04 hereof, and with the following requirements:—

- (a) Every such sign shall be accessible for inspection and attention; and
- (b) Every such sign having more than five lamps, and all outline or decorative lighting (other than that on portable signs) and all luminous-discharge-tube electric signs (other than portable signs) shall be connected to subcircuits to which no other lighting is connected, and shall, except as provided in paragraph (c) of Regulation 56-04 hereof, be controlled by a switch in each live conductor; and

(c) Where motor-driven switching and flashing apparatus is installed a special metal enclosure shall be provided for such apparatus and shall be earthed.

56-02. If exposed to the weather, in addition to the requirements of the last preceding regulation,—

- (a) Every such sign shall be weatherproof or alternatively the lamp-holders and the wiring shall be weatherproof; and
- (b) All wiring exposed to the weather (except in the case of high pressure or extra-high pressure wiring for luminous-discharge-tube systems) shall be of cables—
 - (i) Enclosed in steel conduit in accordance with Regulation 45-01 hereof; or
 - (ii) Covered with tough rubber compound in accordance with Regulation 23-71 hereof; or
 - (iii) Metal sheathed in accordance with paragraph (b) of Regulation 23-43 hereof; and
- (c) Every such system of outline or decorative lighting (other than luminous-discharge-tube lighting) shall be supplied at extra-low pressure unless the lamp-holders are enclosed or of the weatherproof type.

56-03. (1) In the case of outline and/or decorative lighting or indoor signs in which the lamps are spaced not more than 12 in. apart the maximum number of lamps on any sub-circuit shall be such that the total current supplied from such subcircuit does not exceed 15 amperes.

(2) In the case of outdoor signs each subcircuit supplying an electric lamp sign may be considered as supplying one appliance irrespective of the number of lamps.

(3) In all other cases the installation shall comply with the requirements of Regulation 43-01 hereof.

56-04. In the case of luminous-discharge-tube electric signs, outline and/or decorative lighting, the following conditions shall apply in addition to the requirements of Regulations 56-01, 56-02, and 56-03 hereof:—

- (a) All metal which does not normally carry current shall be earthed, and the earthing-lead shall be adequately protected against damage, disconnection, or corrosion; and
- (b) A legible warning notice shall be placed so as to be readily visible to any one working on or about any high pressure or extra-high pressure connection. This notice shall contain a warning that no internal part shall be touched until the supply has been switched off; and
- (c) Every sign and all outline and decorative lighting, or the submain to the distribution board from which such sign or lighting is supplied, shall be controlled by a separate switch, save that in the case of an indoor sign supplied from a plug-socket the switch may be omitted. Every such switch shall be permanently and conspicuously marked with the words "ELECTRIC SIGN." In the case of outdoor signs the switch shall be mounted on the main switchboard. In all other cases the switch shall be mounted in a conspicuous position easy of access to any fireman; and
- (d) No electrode or electrode lead-wire shall be placed at a less distance than 6 in. from any unprotected combustible material; and
- (e) All tubes shall be substantially supported, and they shall not normally be exposed to mechanical injury; and
- (f) High pressure or extra-high pressure conductors—
 - (i) Shall be of types approved for that purpose and have a cross-sectional area of not less than that prescribed by Regulation 43-11 hereof; and
 - (ii) Where exposed, under normal conditions, to mechanical injury and where outdoors and within reach from ground, roof, or window shall be armoured or otherwise suitably protected; and
 - (iii) Where unenclosed, shall be secured at intervals not exceeding 2 ft. when horizontal and 3 ft. 6 in. when vertical by suitable clips, saddles, clamps, or insulators; and
 - (iv) Need not be bunched and shall not be enclosed with any lower pressure conductors, and shall be kept away from the latter as far as practicable; and
 - (v) Shall not be bare, except when used for connections (not exceeding 12 in. in length) between separate tubes and letters.
- (g) All bends or sets in the high pressure or extra-high pressure conductors shall have a radius as large as the circumstances conveniently permit, and in no case less than six times the outside diameter of the conductor; and
- (h) Not more than one transformer shall be connected to any subcircuit, except when the combined load on such subcircuit is less than 1,800 volt-amperes; and

- (i) Resistances (if any) shall be placed in a fire-resisting enclosure and in such a position that any heat generated will not prejudicially affect any other apparatus; and
- (j) Transformers shall be placed in a fire-resisting enclosure; and
- (k) No unenclosed sign, outline or decorative lighting shall be erected at a less height than 7 ft. 6 in. above any public footpath; and
- (l) Every enclosure for resistances or transformers exposed to the weather shall be weatherproof, and the lids shall be securely fixed by means of screws or bolts; and
- (m) Live metal in the secondary circuit, if not enclosed in suitable insulating material, shall be spaced not less than 2 in. from earthed metal; and
- (n) Means shall be provided for the immediate automatic discharge (e.g., by a high-resistance leak) of every condenser on disconnection of the supply.

PART 58.—GENERAL.

BATHROOMS.

- 58-01. No portable appliance shall be used in any bathroom.
- 58-02. Where an open element is used in any appliance in any bathroom it shall be effectively guarded.

PART 59.—ADDITIONS TO AND ALTERATIONS OF INSTALLATIONS.

- 59-01. All dead or disused conductors, fittings, accessories, appliances, and apparatus:—
- (a) Which do not conform to these regulations shall either be removed from the building or be rendered useless for electrical purposes to the satisfaction of the Authorized Inspector.
- (b) Which do conform to the regulations shall be maintained free from electrical hazard.

DIVISION VI.—INSPECTION AND TESTING.

PART 61.—INSPECTION.

MANHOLES AND TRAPS.

- 61-01. Manholes shall be provided in ceilings to facilitate access to the roof of every building for the purposes of inspection.
- 61-02 Traps shall, where practicable, be provided at all inspection fittings and draw-in boxes, and such traps shall be securely fastened by means of screws.

INSPECTION ON BEHALF OF MINISTER.

- 61-11. (1) Any person authorized in writing in that behalf by the Minister may at any time, between the hours of 9 a.m. and 5 p.m. on any day of the week other than Sunday, demand admission to the premises of any consumer for the purpose of ascertaining whether the requirements of these regulations have been complied with.
- (2) The consumer shall render such person every reasonable facility for inspecting and testing the installation.
- (3) If any consumer refuses to admit such person during such hours the electrical supply authority shall, on demand in writing by the Chief Electrical Engineer, discontinue to supply electrical energy to such consumer.

INSPECTION OF ACCESSORIES, APPARATUS, APPLIANCES, FITTINGS AND MATERIALS.

- 61-21. (1) All accessories, apparatus, appliances, fittings, and materials submitted to the Chief Electrical Engineer for inspection shall bear an indelible mark suitable for identification purposes, and where any such accessory, apparatus, appliance, fitting, or material is to be returned, it shall be accompanied by a photograph of suitable dimensions for identification, illustration, and record purposes.
- (2) A sample of the accessory, apparatus, appliance, fitting, and/or material submitted may be retained by the Chief Electrical Engineer.
- (3) Where any accessory, apparatus, appliance, fitting or material is considered unsatisfactory by an Authorized Inspector, it may be submitted to the Chief Electrical Engineer for inspection, in which case it shall be accompanied by a statement setting out in full the objections of the Authorized Inspector to its use,

61-22. Fees in accordance with the following scale shall be forwarded to the Chief Electrical Engineer with every application for inspection of any accessory, apparatus, appliance, fitting or material:—

	£	s.	d.
(1) Where no test is required	0	10	6
(2) In every other case	2	2	0
(b) In all other cases—			
(i) Where no test is involved	1	1	0
(ii) Where any test is involved—			
(1) Capacity up to and including 3 kw.	2	2	0
(2) Capacity over 3 kw. and not over 10 kw.	3	3	0
(3) Capacity over 10 kw. and not over 100 kw.	5	5	0
(4) Capacity over 100 kw.	10	10	0
(5) Cables, each test	2	2	0
(6) Insulating material, each test	2	2	0
(7) Articles not specially mentioned, minimum	2	2	0

PART 62.—TESTS.

SWITCHES AND CIRCUIT-BREAKERS.

- 62-01. (1) Every tumbler switch, rotary snap switch, and the like, not exceeding 15-amperes rating shall be capable of withstanding the following tests in the order named, save that new samples may be used for the endurance test:—
- (a) An overload test of 33½ per cent. greater amperage than its rated capacity. The switch shall be operated slowly for fifty makes and fifty breaks at the approximate rate of ten makes and ten breaks a minute, and shall make and break the circuit sharply and with a quick snap.
- (b) An endurance test, at rated current, of six thousand makes and six thousand breaks. The switch shall be tested by means of a power-driven testing-machine at a rate not exceeding ten makes and ten breaks a minute.

At the completion of each test each switch shall be in good operating condition and show practically no damage to contacts or other parts.

All covers of switches shall be in position and where they are of metal they shall be earthed throughout the test.

The tests shall be carried out at a pressure of 250 volts and for the overload test prescribed by paragraph (a) of this regulation direct current shall be used. The circuit shall be non-inductive and one side shall be earthed.

Lubrication of the switch and its contacts, such as is desirable during use of the switch, may be carried out at any stage of the tests.

The switch may be operated for one hundred makes and one hundred breaks without load or pressure prior to being subjected to any test.

Six switches shall be selected at random from any consignment or batch. Should more than one of the six switches prove unsatisfactory a further selection at random of six switches shall be made and tested. Should more than one switch of the second selection also prove unsatisfactory the switches as a whole shall be deemed not to comply with these regulations.

(2) All other switches, fuse-switches and circuit-breakers shall be capable of withstanding the tests prescribed by the appropriate British Standard Specification or some other approved test.

CUT-OUTS.

62-11. Every cut-out shall be capable of withstanding the tests prescribed by British Standard Specification No. 88 or some other approved test.

PLUGS AND SOCKETS.

62-21. Every plug and socket not exceeding 10-amperes rating, and used without an interlocked switch, shall be capable of breaking 50 per cent. greater amperage than its rated capacity, ten times at ¼-minute intervals, a direct current at a pressure of 250 volts in a non-inductive circuit without permitting an arc to be maintained.

CABLES AND FLEXIBLE CORDS.

62-31. Cables insulated with vulcanized-rubber or impregnated paper shall be capable of withstanding the pressure test and other tests specified in British Standard Specification No. 7, or British Standard Specification No. 480 (as the case may be). Subsequent to such pressure test, and whilst the cable is still immersed in water, the insulation resistance at

a temperature of 60° F. after one minute's electrification at a pressure of at least 500 volts direct current shall not be less than that given in Table IX in Division VII hereof.

62-32. The insulation resistance of each insulated conductor of a multicore cable shall not be less than that given in the said Table IX for single conductors of the same cross-sectional area.

62-33. The insulation resistance of the insulating material separating the two conductors of a concentric cable shall not be less than that given in the said Table IX for single conductors having the same diameter as the inner conductor.

62-34. The insulating material of flexible cords shall withstand for fifteen minutes the alternating pressure and frequency set out in Table X in Division VII hereof.

62-35. (1) Samples of tinned copper wire taken from a conductor, either before or after the insulating material has been vulcanized, shall be coiled into helices of six turns, the diameter of which shall be not less than twenty-four times nor more than thirty times the diameter of the wire. Each helix shall be provided with suitably long ends. The samples shall be cleaned by immersion in a suitable solvent, such as alcohol or ether, to remove any grease.

(2) Each sample shall be immersed for three complete cycles in not less than 100 cubic centimeters of the test solutions, prescribed by clause (3) of this regulation, maintained at a temperature of approximately 60° F. Each cycle shall consist of immersion for—

- (a) One minute in the hydrochloric acid solution, after which the sample shall be washed in running water; and
- (b) Thirty seconds in the sodium polysulphide solution, after which the sample shall be washed in running water.

On completion of three complete cycles each sample shall be carefully examined and if there is any visible blackening effect on the surface of any sample the conductor shall be deemed not to comply with these regulations.

In the event of any one sample of a set giving results widely dissimilar from the other samples a fresh sample shall be tested.

(3) The test solutions shall be prepared as follows:—

- (a) The hydrochloric acid solution shall be made by diluting pure hydrochloric acid with distilled water to a specific gravity of 1.088 at 60° F.
- (b) The sodium polysulphide solution shall be made by dissolving 25 grammes of pure sodium sulphide crystals ($\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$) in distilled water to a total volume of 100 cubic centimeters. Sufficient powdered sulphur shall be added to saturate the solution. The solution shall be boiled for approximately one hour and shall be constantly stirred. The solution shall be cooled and filtered and shall then be diluted with distilled water to a specific gravity of 1.142 at 60° F.

(4) The hydrochloric acid solution shall be deemed to be exhausted when twenty wires have been tested in it and it shall then be discarded.

The sodium polysulphide solution shall be tested for specific gravity immediately before use. It shall be capable of thoroughly blackening a piece of clean plain copper in five seconds before being used for testing purposes.

RADIO APPARATUS.

62-41. Every transformer which is used with any radio apparatus, and which is, or which may be, in electrical contact with any submain, or subcircuit, which is connected to a service-main shall while still hot after a full-load temperature test be capable of withstanding the following tests:—

- (a) A test pressure of 1,000 volts (R.M.S. value) alternating current plus twice the highest primary open-circuit pressure shall be applied for one minute between the primary winding and the secondary windings. Throughout the test the secondary windings, core, frame, and case of the transformer shall be connected together.
- (b) A test pressure of 1,000 volts (R.M.S. value) alternating current plus twice the highest open-circuit pressure of each secondary winding shall be applied for one minute between the secondary winding under test and all other windings (both primary and secondary), these latter being connected to the core, frame, and case of the transformer.
- (c) The insulation resistance between the primary winding and the secondary windings when measured after the above pressure tests shall be not less than 20 megohms when tested with a direct current pressure of 500 volts or twice the maximum working pressure whichever is the greater.

62-42. Every condenser which is used with any radio apparatus, and which is, or which may be, in electrical contact with any submain, or subcircuit which is connected to a service-

main, shall be capable of withstanding for one minute a test pressure of three times the highest pressure to which it is possible to subject it during normal use.

WIRING INSTALLATIONS.

62-51. There shall be the following insulation resistance tests of every wiring installation with a direct current pressure in each case of not less than twice the pressure to which the circuits will normally be subject, provided that in the case of medium pressure circuits the test pressure need not exceed 500 volts:—

- (a) Where a test is desired of the permanent wiring before any fittings, accessories, appliances, or lamps are installed the conductors shall be connected together so as to ensure that all parts of every circuit are simultaneously tested. The test shall be made between the conductors as a whole and earth:

Provided that such test shall be deemed to be satisfied if the insulation resistance is not less in megohms than the result of dividing the number 100 by the number of outlets (points and switch positions) from the fixed wiring.
- (b) (i) A test of the completed installation, or an addition to or alteration of an existing installation, with all fuse-links in place, all switches in the "on" position (including the main switch if practicable), and all lamps in position. The test shall be made between the conductors as a whole and earth:

Provided that such test shall be deemed to be satisfied if the insulation resistance is not less in megohms than the result of dividing the number 50 by the number of outlets (points and switch positions) from the fixed wiring.
- (ii) Control rheostats, heating, cooking, and power appliances, and outdoor electric signs may be disconnected from the circuits during the test, in which case the insulation resistance between the case or framework and all live parts of each such rheostat, appliance, and sign shall be tested:

Provided that such test shall be deemed to be satisfied if the insulation resistance is not less than half a megohm.

(c) Where practicable a test between conductors:

Provided that such test shall be deemed to be satisfied if the insulation resistance is not less in megohms than that prescribed in paragraph (b) (i) of this regulation.

62-52. There shall be the following continuity tests of every wiring installation:—

- (a) A test between the connection to earth and any other part of the completed installation in all cases where metal conduits, metallic sheathed cables, or armoured cables which have no other metallic sheath are used; and
- (b) A test between the connection to earth and any part of any earthing-lead:

Provided that each such test shall be deemed to be satisfied if the electrical resistance of such conduit, sheathing, or earthing-lead does not exceed 2 ohms.

62-53. A test shall be made on every wiring installation to verify that no single-pole switch or circuit-breaker has been fitted in any neutral conductor or earthed conductor, and in the case of a non-earthed two-wire system that every such switch or circuit-breaker is fitted in the same conductor throughout. This test shall not apply to a switch mounted on a portable appliance.

62-54. A test shall be made of every two-pin non-reversible type plug-socket and every three-pin plug-socket to verify that the conductors have been connected in accordance with Regulations 47-73 and 47-74 hereof.

62-55. Except where the metal conduit or metallic sheathing of cables is connected to the neutral bus-bar (or stud) as provided in Regulation 54-25 hereof, there shall be, in the case of earths made in accordance with Regulation 54-31 (2) hereof, the following earth resistance tests:—

- (a) A test between the earth-plate, pipe, or rod, and the general mass of earth; and
- (b) A test between the metal conduit or metallic sheathing and the general mass of earth:

Provided that each such test shall be deemed to be satisfied if the electrical resistance does not exceed 10 ohms.

TRANSFORMERS.

62-61. Every step-down transformer shall be capable of withstanding the tests prescribed by Regulation 62-41 hereof.

GENERAL.

62-71. All moulded insulating material shall be capable of withstanding the tests prescribed by British Standard Specification No. 488.

PART 63.—CERTIFICATION.

63-01. (1) After having inspected any electrical wiring work the Authorized Inspector, if satisfied that the work has been carried out in accordance with the requirements of these Regulations, shall certify in writing to the electrical supply authority, or, where there is no such authority, then to the Chief Electrical Engineer, that he has duly inspected such work and that the tests are satisfactory, and that to the best of his knowledge and belief the installation may be safely connected with the source from which electrical energy is available.

(2) Nothing in any such certificate shall relieve the owner or occupier of any premises from the obligation to bring any installation into conformity with these Regulations if on any subsequent inspection any defects are discovered which render such installation electrically hazardous.

(3) The electrical supply authority, or the Chief Electrical Engineer, as the case may be, shall, if supply is available, forthwith authorize the person undertaking the work to make the connection, or unless requested to the contrary arrange for the connection to be made.

63-02. (1) Notwithstanding anything to the contrary in the foregoing provisions of this Part of these Regulations, the electrical supply authority may, in case of urgency, permit an installation to be temporarily connected with the source from which electrical energy is available notwithstanding that any one or more of the hereinbefore prescribed insulation resistance tests have not been satisfied; provided that no such permit shall be granted unless the installation otherwise generally complies with the requirements of these Regulations and is certified by the Authorized Inspector to be reasonably free from electrical hazard, nor for a longer period than one month; unless the Chief Electrical Engineer, on the recommendation of the electrical supply authority, extends such period beyond one month.

(2) On the expiration of the period or extended period as aforesaid for which temporary connection has been so permitted the installation shall be disconnected from the source from which electrical energy is available, unless before such expiration the Authorized Inspector has issued his certificate pursuant to the last preceding regulation.

DIVISION VII.—TABLES.

TABLE I.—DIMENSIONS, WEIGHT, AND RESISTANCE OF SOLID AND STRANDED CIRCULAR CONDUCTORS.

(Standard Annealed Copper.)

Number and Diameter (Inches) of Wires comprising Conductor.	Over-all Diameter of Conductor.	Nominal Area.	Calculated Area.	Weight per 1,000 Yards of Conductor.	Resistance per 1,000 Yards at 60° F.		
					Standard.	Maximum allowable for Plain Wires.	Maximum allowable for Tinned Wires.
1.	2.	3.	4.	5.	6.	7.	8.
1/.036	0.036	0.001	0.001018	11.77	23.59	24.29	24.53
1/.044	0.044	0.0015	0.001521	17.58	15.79	16.26	16.42
3/.029	0.062	0.002	0.001943	23.37	12.36	12.61	12.85
3/.036	0.078	0.003	0.002994	36.02	8.019	8.180	8.260
1/.064	0.064	0.003	0.003217	37.20	7.463	7.687	7.761
7/.029	0.087	0.0045	0.004546	54.39	5.281	5.387	5.493
7/.036	0.108	0.007	0.007005	83.81	3.427	3.496	3.530
7/.044	0.132	0.01	0.01046	125.2	2.294	2.340	2.363
7/.052	0.156	0.0145	0.01462	174.9	1.643	1.675	1.692
7/.064	0.192	0.0225	0.02214	264.9	1.084	1.106	1.117
19/.044	0.220	0.03	0.02840	340.4	0.8468	0.8637	0.8721
19/.052	0.280	0.04	0.03960	475.5	0.6063	0.6184	0.6244
19/.064	0.320	0.06	0.05999	720.3	0.4002	0.4082	0.4122
19/.072	0.360	0.075	0.07592	911.6	0.3162	0.3225	0.3257
19/.083	0.415	0.1	0.1009	1,211.0	0.2380	0.2427	0.2451
37/.064	0.448	0.12	0.1168	1,403.0	0.2056	0.2097	0.2118
37/.072	0.504	0.15	0.1478	1,776.0	0.1625	0.1657	0.1673
37/.083	0.581	0.2	0.1964	2,360.0	0.1223	0.1247	0.1259
37/.093	0.651	0.25	0.2465	2,963.0	0.09738	0.09933	0.1003
37/.103	0.721	0.3	0.3024	3,635.0	0.07939	0.08098	0.08177
61/.093	0.837	0.4	0.4064	4,886.0	0.05908	0.06026	0.06085
61/.103	0.927	0.5	0.4985	5,994.0	0.04816	0.04913	0.04961
91/.093	1.023	0.6	0.6062	7,290.0	0.03961	0.04040	0.04079
91/.103	1.133	0.75	0.7435	8,942.0	0.03229	0.03294	0.03326
127/.093	1.209	0.85	0.8459	10,175.0	0.02838	0.02895	0.02923
127/.103	1.339	1.0	1.0376	12,481.0	0.02314	0.02360	0.02383

TABLE II.—COMPARISON BETWEEN THE OLD STANDARD SIZES OF CONDUCTORS AND THE NEW STANDARD SIZES SET OUT IN B.S.S. NO. 7.

New Standard.		Old Standard.	
Number and Diameter (Inches) of Wires comprising Conductor.	New Nominal Area.	Number and Gauge or Diameter (Inches) of Wires comprising Conductor.	Old Nominal Area.
1.	2.	3.	4.
	Sq. in.		Sq. in.
1/·036	0·001	1/20 S.W.G.	0·001
1/·044	0·0015	—	—
—	—	1/18 "	0·0018
—	—	3/22 "	0·0018
3/·029	0·002	—	—
—	—	7/25 "	0·0022
3/·036	0·003	3/20 "	0·003
—	—	7/23 "	0·0031
1/·064	0·003	1/16 "	0·0032
—	—	7/22 "	0·0042
7/·029	0·0045	—	—
—	—	7/21½ "	0·0049
7/·036	0·007	7/20 "	0·007
—	—	7/19 "	0·0086
7/·044	0·01	—	—
—	—	7/18 "	0·0125
7/·052	0·0145	—	—
—	—	7/17 "	0·017
7/·064	0·0225	7/16 "	0·022
19/·044	0·03	—	—
—	—	19/18 "	0·034
—	—	7/14 "	0·035
19/·052	0·04	—	—
—	—	19/17 "	0·046
19/·064	0·06	19/16 "	0·06
19/·072	0·075	19/15 "	0·075
—	—	19/14 "	0·094
19/·083	0·1	—	—
37/·064	0·12	37/16 "	0·117
—	—	19/13 "	0·125
37/·072	0·15	37/15 "	0·15
—	—	37/14 "	0·182
37/·083	0·2	37/·083 in.	0·2
37/·093	0·25	37/·092 "	0·25
37/·103	0·3	37/·104 "	0·3
61/·093	0·4	61/·092 "	0·4
61/·103	0·5	61/·104 "	0·5
91/·093	0·6	61/·112 "	0·6
91/·103	0·75	91/·101 "	0·75
127/·093	0·85	—	—
127/·103	1·0	127/·101 "	1·0

TABLE III.—FLEXIBLE CABLES. DIMENSIONS AND RESISTANCE OF CONDUCTORS.

(Standard Annealed Copper.)

Number and Diameter of Wires comprising Conductor.				Nominal Area.	Resistance per 1,000 Yards at 60° F.		
Diameter 0·010 in.	Diameter 0·012 in.	Diameter 0·018 in.	Diameter 0·029 in.		Standard.	Maximum allowable for Plain Wires.	Maximum allowable for Tinned Wires.
1.	2.	3.	4.	5.	6.	7.	8.
				Sq. in.	Ohms.	Ohms.	Ohms.
140	97*	—	—	0·01	2·29	2·34	2·39
195	—	60*	—	0·0145	1·64	1·68	1·71
296	—	91*	—	0·0225	1·08	1·11	1·13
—	266	117*	—	0·03	0·847	0·864	0·881
—	368	163*	—	0·04	0·606	0·618	0·631
—	557	243*	—	0·06	0·400	0·408	0·416
—	705	313	121*	0·075	0·316	0·323	0·329
—	—	416	160*	0·1	0·238	0·243	0·247
—	—	482	186*	0·12	0·206	0·210	0·214
—	—	610	235*	0·15	0·163	0·166	0·169
—	—	810	312*	0·2	0·122	0·125	0·127
—	—	1,017	392*	0·25	0·0974	0·0993	0·101
—	—	—	481	0·3	0·0794	0·0810	0·0826
—	—	—	646	0·4	0·0591	0·0603	0·0614
—	—	—	792	0·5	0·0482	0·0491	0·0501

* For trawling-cables and similar purposes.

TABLE IV.—RUBBER-INSULATED CABLES: CURRENT-CARRYING CAPACITY AND CORRESPONDING FALL IN PRESSURE.
(Standard Annealed Copper.)

Number and Diameter (Inches) of Wires comprising Conductor.*	Nominal Area.	Maximum Current permissible (subject to Voltage-drop).				Approximate Total Length in Circuit (Lead and Return) for 1-volt drop with Maximum permissible Current (Col. 4).
		One Single Cable.	Two Single Cables.	One Concentric or Twin Cable.	One Three-core Cable.	
1.	2.	3.	4.	5.	6.	7.
	Sq. in.	Amps.	Amps.	Amps.	Amps.	Ft.
1/.036	0.001	5	4.1	4.1	4.1	30
1/.044	0.0015	7	6.1	6.1	6.1	30
3/.029	0.002	9	7.8	7.8	7.8	30
3/.036	0.003	13	12.0	12.0	12.0	29
1/.064	0.003	14	12.9	12.9	12.9	29
7/.029	0.0045	20	18.2	17.5	16.0	28
7/.036	0.007	27	24.0	22.0	19.5	33
7/.044	0.01	34	31.0	26.0	23.3	39
7/.052	0.0145	41	37.0	31.0	27.0	45
7/.064	0.0225	51	46.0	38.5	33.0	55
19/.044	0.03	59	53.0	45.0	39.0	61
19/.052	0.04	71	64.0	53.0	47.0	71
19/.064	0.06	92	83.0	69.0	61.0	83
19/.072	0.075	108	97.0	80.0	71.0	90
19/.083	0.1	131	118.0	96.0	87.0	98
37/.064	0.12	144	130.0	108.0	99.0	103
37/.072	0.15	169	152.0	125.0	115.0	112
37/.083	0.2	204	184.0	150.0	140.0	123
37/.093	0.25	238	214.0	176.0	165.0	132
37/.103	0.3	267	240.0	200.0	—	145
61/.093	0.4	320	288.0	244.0	—	162
61/.103	0.5	369	332.0	280.0	—	172
91/.093	0.6	427	384.0	—	—	181
91/.103	0.75	512	461.0	—	—	185
127/.093	0.85	569	512.0	—	—	190
127/.103	1.0	661	595.0	—	—	200

* The current-carrying capacity of a conductor having wires of a number or diameter not specified in this table shall be taken to be proportionate to that of the cases specified.

(i) Cables laid together. Multiply amps. for one cable by

3	..	..	..	0.85
4	..	..	..	0.80

(ii) Where cable is laid Multiply amps. in above columns by

(a) In a duct underground	..	..	1.1
(b) On the solid system	..	..	1.2
(c) Direct in dry earth	..	..	1.3
(d) Direct in wet earth	..	..	1.4
(e) Direct under water	..	..	1.5

(iii) The figures given in the table apply to one single cable, two single cables run in iron conduits or in wood casing, and to single cables sheathed with tough rubber compound, and to concentric, twin, and three-core cables of any finish, run singly.

(iv) The maximum permissible currents (subject to voltage-drop) for the various sizes of conductors up to 1 sq. in. in cross-sectional area are shown in columns 3, 4, 5, and 6 of the table, which allow for a rise in temperature of 20° F. for rubber-insulated cables. For sizes below 0.007 sq. in. the table is based on a current density of 4,000 amperes per square inch.

(v) The table refers to situations where the temperature of the air does not exceed 80° F., and thus the normal maximum running temperature is 100° F. Rubber-insulated cables should not be allowed to attain a temperature higher than 120° F. for long periods, or 130° F. for a short period. The figures, therefore, in the latter case allow of a margin of 30° F.

(vi) Where the temperature of the air exceeds 80° F. the permissible current shall be reduced in accordance with the following reduction factors:—

Initial Air Temperature. Degrees F.	Amperes permissible to be multiplied by
90	.. 0.87
100	.. 0.71
110	.. 0.50

(vii) The further limitation of the size of conductor by the permissible drop in voltage is dealt with in Regulation 43-21 hereof.

TABLE V.—PAPER-INSULATED AND LEAD-COVERED CABLES: CURRENT-CARRYING CAPACITY AND CORRESPONDING FALL IN PRESSURE.

(Standard Annealed Copper.)

Number and Diameter (Inches) of Wires comprising Conductor.*	Nominal Area.	Maximum Current permissible (subject to Voltage-drop).				Approximate Total Length in Circuit (Lead and Return) for 1-volt drop with Maximum permissible Current (Col. 4).
		One Single Cable.	Two Single Cables.	One Concentric or Twin Cable.	One Three-core Cable.	
1.	2.	3.	4.	5.	6.	7.
1/.036	0.001	5	4.1	4.1	4.1	30
1/.044	0.0015	7	6.1	6.1	6.1	30
3/.029	0.002	9	7.8	7.8	7.8	30
3/.036	0.003	13	12.0	12.0	12.0	29
1/.064	0.003	14	12.9	12.9	12.9	29
7/.029	0.0045	20	18.2	18.0	18.0	28
7/.036	0.007	31	28.0	25.0	23.0	27
7/.044	0.01	47	42.0	35.0	31.5	27
7/.052	0.0145	63	57.0	45.0	41.0	28
7/.064	0.0225	83	75.0	60.0	56.0	32
19/.044	0.03	97	87.0	71.0	66.0	35
19/.052	0.04	116	104.0	85.0	78.0	41
19/.064	0.06	150	135.0	114.0	101.0	48
19/.072	0.075	174	157.0	130.0	117.0	52
19/.083	0.1	212	191.0	157.0	142.0	57
37/.064	0.12	233	210.0	174.0	161.0	60
37/.072	0.15	273	246.0	200.0	186.0	65
37/.083	0.2	329	296.0	242.0	227.0	72
37/.093	0.25	381	343.0	280.0	265.0	78
37/.103	0.3	428	385.0	322.0	304.0	85
61/.093	0.4	516	464.0	394.0	—	95
61/.103	0.5	600	540.0	457.0	—	100
91/.093	0.6	693	624.0	—	—	105
91/.103	0.75	820	738.0	—	—	109
127/.093	0.85	905	815.0	—	—	116
127/.103	1.0	1,035	932.0	—	—	121

* The current-carrying capacity of a conductor having wires of a number or diameter not specified in this table shall be taken to be proportionate to that of the cases specified.

(i) Cables laid together. Multiply amps. for one cable by

3	0.85
4	0.80

(ii) Where cable is laid Multiply amps. in above columns by

(a) Cleated to a wall	0.9
(b) On the solid system	1.1
(c) Direct in dry earth	1.2
(d) Direct in wet earth	1.3
(e) Direct under water	1.5

(iii) The figures given in the table apply to one single cable, two single cables, and to concentric, twin, and three-core cables run singly.

(iv) The maximum permissible currents (subject to voltage-drop) for the various sizes of conductors up to 1 sq. in. in cross-sectional area are shown in columns 3, 4, 5, and 6 of the table, which allows for a rise in temperature of 50° F. for impregnated-paper cables. For sizes below 0.0145 sq. in. the table is based on a current density of 4,000 amperes per square inch.

(v) The table refers to situations where the temperature of the air does not exceed 80° F., and thus the normal maximum running temperature is 130° F. Impregnated-paper lead-covered cables for pressures not exceeding 660 volts should not be allowed to attain a permanent temperature higher than 176° F., and the figures therefore allow of a margin of 46° F.

(vi) Where the temperature of the air exceeds 80° F. the permissible current shall be reduced in accordance with the following reduction factors:—

Initial Air Temperature. Degrees F.	Amperes permissible to be multiplied by
90	0.93
100	0.85
110	0.76
120	0.65
130	0.54

(vii) The further limitation of the size of conductor by the permissible drop in voltage is dealt with in Regulation 43-21 hereof.

TABLE VI.—RUBBER-INSULATED FLEXIBLE CABLES FOR USE WITH PORTABLE APPLIANCES: CURRENT-CARRYING CAPACITY. (Standard Annealed Copper.)

Number and Diameter (Inches) of Wires comprising Conductor.*	Nominal Area.	Maximum Current permissible (subject to Voltage-drop).	
		Two Conductors.	Three Conductors.
1.	2.	3.	4.
	Sq. in.	Amps.	Amps.
140/.010	0.01	20	17
195/.010	0.0145	24	20
296/.010	0.0225	30	25
266/.012	0.03	35	30
368/.012	0.04	42	35

* The current-carrying capacity of a conductor having wires of a number, or diameter, not specified in this table shall be taken to be proportionate to that of the cases specified.

An earthing-lead, whether insulated or not, forming part of a flexible cable is not deemed to be a conductor for the purpose of this table.

TABLE VII.—FLEXIBLE CORDS: DIMENSIONS AND RESISTANCE OF CONDUCTORS.

Ordinary Flexible Cords or Flexible Cords with Tough Rubber Sheathing.*				Flexible Cords with Tough Rubber Sheathing.		
Number of 0.0076-inch-diameter Wires comprising Conductor.	Resistance per 1,000 Yards at 60° F.			Number of 0.012-inch-diameter Wires comprising Conductor.	Resistance per 1,000 Yards at 60° F.	
	Stand-ard.	Maximum allowable for Plain Wires.	Maximum allowable for Tinned Wires.		Stand-ard.	Maximum allowable
1.	2.	3.	4.	5.	6.	7.
	Ohms.	Ohms.	Ohms.		Ohms.	Ohms.
14†	39.7	40.5	41.3	—	—	—
23	24.2	24.6	25.1	11‡	24.6	25.1
40	13.9	14.2	14.4	16*	14.2	14.4
70	7.94	8.1	8.26	28*	8.1	8.26
110	5.05	5.15	5.25	44*	5.15	5.25
162	3.43	3.5	3.57	65*	3.5	3.57

* All copper.

† 14/0076 may be used only in accordance with Regulation 43-11 hereof.

‡ 9 copper; 2 steel.

TABLE VIII.—FLEXIBLE CORDS: CURRENT-CARRYING CAPACITY AND THICKNESS OF INSULATION.

Number and Diameter of Wires comprising Conductor.*		Nominal Area.	Maximum Current permissible (subject to Voltage-drop).	Minimum Radial Thickness of Insulating Material.						Minimum Radial Thickness of Tough Rubber Sheathing for Heavy Duty.‡			
0.0076-inch-diameter Wires.†	0.012-inch-diameter Wires.			High Insulation.			Medium Insulation.			Single.	Twin.	Three-core.	Four-core.
				Pure Rubber.	(a) Pure and/or Vulcanized Rubber; (b) Homogeneous Insulation.	Homogeneous Insulation with a Lapping of Cotton or Silk next to the Conductor.	Pure Rubber.	(a) Pure and/or Vulcanized Rubber; (b) Homogeneous Insulation.					
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	
		Sq. in.	Amps.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
14‡	—	0.0006	1.8	0.020	0.033	0.031	0.015	0.028	—	—	—	—	
23	11§	0.0010	3.0	0.020	0.034	0.031	0.015	0.029	0.050	0.050	0.050	0.060	
40	16‡	0.0017	5.0	0.020	0.035	0.031	0.015	0.030	0.050	0.050	0.060	0.060	
70	28‡	0.0030	10.0	0.020	0.036	0.036	0.015	0.031	0.050	0.060	0.060	0.060	
110	44‡	0.0048	15.0	0.020	0.038	0.038	0.015	0.032	0.050	0.060	0.060	0.060	
162	65‡	0.0070	20.0	0.020	0.039	0.039	—	—	0.050	0.060	0.060	0.060	

* The current-carrying capacity of a conductor having wires of a number or diameter not specified in this table shall be taken to be proportionate to that of the cases specified.

† All copper.

‡ 14/0076 in. may be used only in accordance with Regulation 43-11 hereof.

§ 9 copper; 2 steel.

|| A thickness of 0.030 in. is permissible for pendants up to 250 volts in the case of twin flexible cords having conductors of 23/0076 in. or 11/012 in.

TABLE IX.—INSULATION RESISTANCE OF CABLES.

Number and Diameter (Inches) of Wires comprising Conductor.	Nominal Area.	Minimum Insulation Resistance, Megohms for a Mile Length at 60° F.		
		Rubber-insulated Cables.		Paper-insulated Cables.
		600-megohm Grade.*	2,500-megohm Grade.*†	
1.	2.	3.	4.	5.
	Sq. in.	Megohms.	Megohms.	Megohms.
1/.036	0.001	2,000	5,000	140
1/.044	0.0015	2,000	5,000	140
3/.029	0.002	1,250	4,500	140
3/.036	0.003	1,250	4,500	140
1/.064	0.003	2,000	5,000	140
7/.029	0.0045	1,250	4,500	140
7/.036	0.007	900	4,000	140
7/.044	0.01	900	4,000	140
7/.052	0.0145	900	4,000	140
7/.064	0.0225	900	3,500	130
19/.044	0.03	750	3,500	125
19/.052	0.04	750	3,000	115
19/.064	0.06	750	3,000	100
19/.072	0.075	600	3,000	85
19/.083	0.1	600	3,000	80
37/.064	0.12	600	3,000	75
37/.072	0.15	600	3,000	60
37/.083	0.2	600	2,500	55
37/.093	0.25	600	2,500	50
37/.103	0.3	600	2,500	50
61/.093	0.4	600	2,500	50
61/.103	0.5	600	2,500	45
91/.093	0.6	600	2,500	40
91/.103	0.75	600	2,500	40
127/.093	0.85	600	2,500	35
127/.103	1.0	600	2,500	35

* For (a) Direct-current systems for pressures not varying from earth potential by more than 250 volts; (b) three-phase systems, with centre point earthed, for pressures not more than 500 volts between phases.

† For pressures not varying from earth potential by more than 650 volts.

TABLE X.—TEST PRESSURES FOR FLEXIBLE CORDS.

Kind.	Insulating Material.	Test Pressure and Frequency.	Nature of Test.*
1.	2.	3.	4.
High insulation ..	(a) Pure rubber .. (b) Pure and/or vulcanized-rubber (c) Homogeneous insulation	1,500 volts } at 25-100	Between conductors in dry state.
Medium insulation ..	(a) Pure rubber .. (b) Homogeneous insulation	1,000 volts } 1,500 volts }	

* Where a flexible cord has a covering purporting to be waterproof it shall be tested after twenty-four hours immersion in water.

TABLE XI.—INSULATION RESISTANCE OF FLEXIBLE CORDS HAVING VULCANIZED-RUBBER INSULATION.

Number and Diameter of Wires comprising Conductor.		Nominal Area.	Minimum Insulation Resistance, Megohms for a Mile Length at 60° F.	
0.0076-in.-diameter Wires.	0.012-in.-diameter Wires.		High Insulation.	Medium Insulation.
1.	2.	3.	4.	5.
		Sq. in.	Megohms.	Megohms.
14	—	0.0006	1,250	300
23	11	0.001	1,250	300
40	16	0.0017	1,250	300
70	28	0.003	1,250	300
110	44	0.0048	1,250	300
162	65	0.007	900	300

TABLE XII.—PERMISSIBLE NUMBER OF CABLES IN CONDUITS, AND CAPACITY OF CONDUITS FOR THE DRAWING-IN OF CABLES.

Size of Conduit.			½ in.	¾ in.	1 in.	1¼ in.	1½ in.	2 in.	2½ in.
Internal Diameter of Conduit (approximate).			0.498 in.	0.606 in.	0.856 in.	1.106 in.	1.34 in.	1.816 in.	2.316 in.
Number and Diameter (Inches) of Wires comprising Conductor.	Nominal Area of Conductor.	Approximate Over-all Diameter of Cable.	Maximum Permissible Number of Cables.						
			4.	5.	6.	7.	8.	9.	10.
1.	2.	3.							
1/·044	Sq. in. 0.0015	In. 0.173	5	8	11	—	—	—	—
3/·029	0.002	0.195	4	6	10	—	—	—	—
3/·036	0.003	0.215	3	5	8	—	—	—	—
7/·029	0.0045	0.226	2	4	6	9	—	—	—
7/·036	0.007	0.259	—	3	5	8	—	—	—
7/·044	0.01	0.287	—	2	4	7	—	—	—
7/·052	0.0145	0.317	—	—	3	5	7	—	—
7/·064	0.0225	0.359	—	—	2	4	7	—	—
19/·044	0.03	0.393	—	—	—	3	5	7	8
19/·052	0.04	0.441	—	—	—	2	4	7	8
19/·064	0.06	0.513	—	—	—	—	3	5	6
19/·072	0.075	0.596	—	—	—	—	—	4	4
19/·083	0.1	0.663	—	—	—	—	—	3	4
37/·064	0.12	0.702	—	—	—	—	—	2	3
37/·072	0.15	0.768	—	—	—	—	—	2	2

(i) The table applies to 250-volt, vulcanized-rubber, braided cables in accordance with British Standard Specification No. 7, and to screwed conduits which comply with British Standard Specification No. 31.

(ii) The grouping in one tube of more than two of the larger cables is not recommended, and where it is done the current rating given in Tables IV, V, and VI hereof should be reduced to ensure that the cables are not overheated.

(iii) It shall be possible to withdraw any conductor and draw in another of equal size in its place without injury (see Regulation 46-11).

(iv) Where wires of different sizes are installed in the same conduit their outside diameter when bunched shall not exceed the diameter of the number of wires permitted in this table.

TABLE XIII.—APPROXIMATE FUSING CURRENTS OF COPPER WIRES IN FREE AIR.

Size.	Diameter of Wire.	Fusing Current.	Maximum Safe-working Current.
1.	2.	3.	4.
S.W.G.	In.	Amps.	Amps.
36	0.0076	6.8	3.4
34	0.0092	8.6	4.3
33	0.010	9.8	4.9
32	0.0108	11.0	5.5
—	0.0120	12.8	6.4
30	0.0124	13.5	6.8
28	0.0148	17	8.6
26	0.018	22	11
24	0.022	30	15
22	0.028	41	21
—	0.029	43	22
20	0.036	62	31
19	0.040	73	37
—	0.044	86	43
18	0.048	98	49
—	0.052	111	56
17	0.056	125	63
16	0.064	156	78
15	0.072	191	96
14	0.080	229	115

The table refers to wires in free air and of the following lengths: 2½ in. to 3½ in. for wires up to 0.018 in. diameter, and not less than 4 in. for larger wires.

TABLE XIV.—APPROXIMATE FUSING CURRENTS OF LEAD-TIN ALLOY WIRES IN FREE AIR (LEAD 75 PER CENT., TIN 25 PER CENT.).

Size.	Diameter of Wire.	Fusing Current.	Maximum Safe-working Current.
1.	2.	3.	4.
S.W.G.	In.	Amps.	Amps.
25	0·020	3	2
24	0·022	3·5	2·3
23	0·024	4	2·6
22	0·028	5	3·3
21	0·032	6	4·1
20	0·036	7	4·8
18	0·048	10	7
16	0·064	16	11

The table refers to wires in free air and of the following lengths: 2½ in. to 3½ in.

TABLE XV.—FLEXIBLE CORDS: TYPE OF COVERING TO BE USED (REG. 23-61).*

Use.	Situation.	
	Dry.	Damp.
Pendants	Any ..	(f), (h), and (i).
Appliances—		
(a) Not subject to hard usage ..	Any except (i)	(d), (e), (f), and (h).
(b) Subject to hard usage ..	(c), (d), (e), (f), and (j)	(d), (e), and (f).
Lifts (Trailing-leads)	(c), (e), (f), (g), and (j).	

* For types of insulation see Regulation 23-31.

Extract from Regulation 23/61.

- (a) Braiding of natural silk or of artificial silk.
- (b) Glace-cotton braiding.
- (c) Hemp, cotton, jute, or other suitable braiding thoroughly compounded.
- (d) Wire armouring, comprising a flexible braiding of galvanized steel or bronze wire in addition to the covering specified in paragraph (c).
- (e) Hard-cord braiding in addition to the covering specified in paragraph (c).
- (f) Tough rubber sheathing in accordance with Regulation 23-71.
- (g) Flame-resisting braiding.
- (h) Varnished cotton or silk waterproof braiding.
- (i) Thin tough rubber compound over twisted conductors.
- (j) Rubber compound with braiding overall.
- (k) Thin tough rubber compound over conductors made up to a circular or oval section with hemp, cotton, or jute filling.

TABLE XVI.—SIZE OF EARTHING-LEAD IN METAL SHEATHED AND TOUGH RUBBER SHEATHED CABLES.

Size of Current-carrying Conductor.		Approximate Minimum Cross-sectional Area of Earthing-lead.	Minimum Number and Diameter (in.) of Wires forming Earthing-lead.			
Number and Diameter (in.) of Wires.	Nominal Cross-sectional Area.		Metal Sheathed Cables.		Tough Rubber Sheathed Cables.	
			Single-core.	Twin and Three-core.	Single-core.	Twin and Three-core.
1.	2.	3.	4.	5.	6.	7.
1/·044	Sq. in. 0·0015	Sq. in. 0·001	3/·020	1/·036	9/·012	9/·012
3/·029	0·002	0·001	3/·020	1/·036	9/·012	9/·012
3/·036	0·003	0·0015	5/·020	1/·044	14/·012	14/·012
7/·029	0·0045	0·0015	5/·020	1/·044	14/·012	14/·012
7/·036	0·007	0·0015	5/·020	1/·044	14/·012	14/·012
7/·044	0·01	0·0015	5/·020	1/·044	14/·012	14/·012
7/·052	0·0145	0·002	7/·020	1/·052	19/·012	7/·020
7/·064	0·0225	0·003	10/·020	1/·064	28/·012	10/·020
19/·044	0·03	0·004	13/·020	1/·072	37/·012	13/·020
19/·052	0·04	0·005	17/·020	1/·083	47/·012	17/·020
19/·064	0·06	0·005	17/·020	1/·083	47/·012	17/·020

(See Regulation 43-16 (1) (e).)

A. W. MULLIGAN,
Acting Clerk of the Executive Council.

(P.W. 26/218/12.)

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