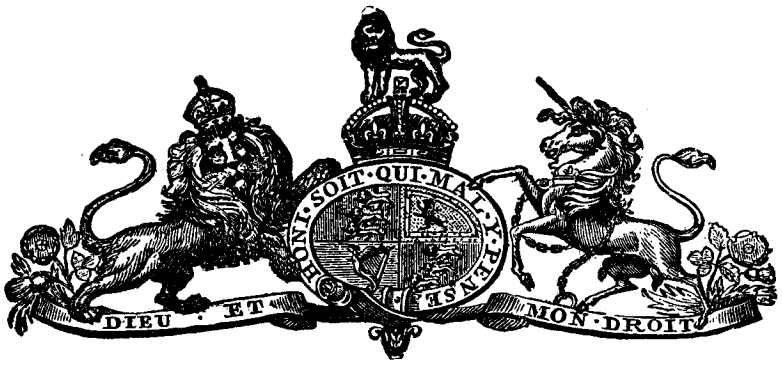

SUPPLEMENT

TO THE

NEW ZEALAND GAZETTE

OF

THURSDAY, JULY 7, 1927.

Published by Authority.

WELLINGTON, TUESDAY, JULY 12, 1927.

ELECTRICAL SUPPLY REGULATIONS, 1927,

AND

ELECTRICAL WIRING REGULATIONS, 1927.

Electrical Supply Regulations, 1927.

CHARLES FERGUSSON, Governor-General.

ORDER IN COUNCIL.

At the Government House at Wellington, this 11th day of July, 1927.

Present:

HIS EXCELLENCY THE GOVERNOR-GENERAL IN COUNCIL.

IN pursuance and exercise of the powers and authorities conferred on him by the Public Works Act, 1908, as amended by section two of the Public Works Amendment Act, 1911, and of every other power and authority enabling him in that behalf, His Excellency the Governor-General of the Dominion of New Zealand, acting by and with the advice and consent of the Executive Council of that Dominion, doth hereby revoke the regulations made under section two of the Public Works Amendment Act, 1911, and published in the *New Zealand Gazette* of the twelfth day of October, one thousand nine hundred and twenty-two, and doth hereby make for the purposes of the said section two the following regulations, which, together with the Electrical Wiring Regulations, 1927, shall be in substitution for the regulations hereby revoked, and doth hereby declare that this Order in Council shall come into operation on the date of the publication thereof in the *New Zealand Gazette*.

REGULATIONS.

PRELIMINARY.

1. THESE regulations may be cited as the Electrical Supply Regulations, 1927.

2. These regulations are divided into Parts as follows:—

Part I.—Regulations prescribing the Conditions on which Licenses may be issued and the Fees payable thereon.

Part II.—Regulations controlling the Use and Management of any Works or Lines erected after the coming into operation of these regulations, and used for generating, transforming, converting, or conveying Electricity (whether so used pursuant to a License under the Public Works Amendment Act, 1911, or not) so as to secure the Safety of Consumers or Employees and of the Public from Personal Injury by such Use.

Part III.—Regulations providing for the removal or Alteration of any Dangerous Line or Apparatus erected prior to the coming into force of these Regulations (whether erected pursuant to a License under the Public Works Amendment Act, 1911, or any other Act, or not) at the Expense in all cases of the Owner of the Line or Apparatus.

Part IV.—Penalties for Breaches of Licenses and Regulations.

3. Throughout these Regulations unless the context otherwise requires, the following terms shall have the meanings given to them in this Regulation:—

"Authorized person" means (*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.

"Conductor" means any wire, cable, bar, or tube used for the transmission of electrical energy.

"Consumer" means any body or person supplied or entitled to be supplied with electrical energy by the licensee.

"Consumer's wires" means any electric line or lines on the consumer's premises which are electrically connected with the licensee's electric distribution-lines.

"Earthed" means connected to the general mass of earth in such a manner as to ensure at all times an immediate and safe discharge to earth of electrical energy.

"Electrical Wiring Regulations" means the regulations so intituled made under the Public Works Act, 1908, as amended by section 2 of the Public Works Amendment Act, 1911, by Order in Council dated the 11th day of July, 1927, and published in the *Gazette* of 12th day of July, 1927.

"Electric line" means any wire, wires, conductor, or other means used for conveying electrical energy for power, lighting, or heating purposes; and includes any instrument, insulator, casing, tubing, pipe-covering, or pole enclosing or supporting an electric line, or anything connected therewith.

"Electric distribution-line" means that portion of the system to which electric service-lines are connected for the purpose of supplying consumers.

"Electric service-line" means the line which connects consumers' buildings with an electric distribution-line.

"Inspecting Engineer" means and includes any person authorized by the Minister to inspect electric lines.

"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 danger.

"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 danger.

"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 danger.

"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 danger.

"Licensee" means any local authority, company, body, person, or persons authorized under the Public Works Act, 1908, or any other Act to lay, construct, put up, place, or use any electric line.

"Minister" means Minister of Public Works.

"Power-house" or "generating-station" means any station for generating 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 consumed.

"Pressure" means the difference of potential between any two conductors through which a supply of electrical energy is given, or between any part of any conductor and the earth.

"Pressure extra-low" means a pressure between conductors (or between conductors and earth if the neutral is known to be earthed at the source of supply without a circuit-breaker or added resistance) normally not exceeding 30 volts in the case of alternating current and 100 volts in the case of direct current at the point at which the supply is delivered.

"Pressure low" means a pressure between conductors (or between conductors and earth if the neutral is known to be earthed at the source of supply without a circuit-breaker or added resistance) normally exceeding 30 volts in the case of alternating current, or 100 volts in the case of direct current, but not exceeding 250 volts in either case, at the point at which the supply is delivered.

"Pressure medium" means a pressure between conductors (or between conductors and earth if the neutral is known to be earthed at the source of supply without a circuit-breaker or added resistance) normally exceeding 250 volts but not exceeding 650 volts at the point at which the supply is delivered.

"Pressure high" means any pressure (between conductors or phases) over 650 volts, but not in excess of 6,600 volts.

"Pressure extra-high" means any pressure (between conductors or phases) in excess of 6,600 volts.

"Service fuse" means the device installed by the licensee for automatically disconnecting the installation on a consumer's premises from the service line.

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

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

"Switchboard" means an assemblage of switch-gear, with or without instruments.

"Telegraph" includes telephone.

"Telegraph-line" has the same meaning as "electric line" in the Post and Telegraph Act, 1908, and also includes all telegraph, telephone, and electric signal-wires belonging to the Government Railways Department.

"Township" means any locality outside a borough or town district in which there is a group of not less than ten habitable buildings fronting on a length of not more than 20 chains of continuous road.

PART I.—Regulations prescribing the Conditions on which Licenses may be issued and the Fees payable thereon.

FREQUENCY.

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

SYSTEMS OF SUPPLY.

5. The supply of electrical energy shall be given on one or more of the following systems :—

(*a*) Three-phase four-wire system, at a nominal pressure not exceeding 400 volts between phases and 230 volts between each phase and neutral conductor, measured at the consumer's main switchboard.

(*b*) Three-wire system (whether direct-current or single-phase alternating current) at a nominal pressure not exceeding 460 volts between the outer conductors and 230 volts between each outer and intermediate conductor, measured at the consumer's main switchboard.

(*c*) Two-wire system (whether direct-current or single-phase alternating current) at a nominal pressure not exceeding 230 volts measured at the consumer's main switchboard.

(*d*) High or extra-high pressure alternating current single-phase two-wire supply to motors, motor-generators, or transformers, together with a supply from the transformers to a system or systems as defined in paragraphs (*b*) and (*c*) of this regulation.

(*e*) High or extra-high pressure alternating-current three-phase supply to motors, motor-generators, rotary converters or transformers, together with a supply from the transformers, to a system or systems as defined in paragraphs (*a*), (*b*), and (*c*) of this regulation.

(*f*) High or extra-high pressure two-wire direct-current supply to motors and motor-generators.

(*g*) Series street-lighting for any pressure not exceeding 3,300 volts between transformer terminals.

(*h*) Direct-current supply at a pressure not exceeding 650 volts with the negative pole earthed.

(*i*) Such other systems as may be authorized by the Minister.

VOLTAGE OF SUPPLY.

6. (1) For purposes of supply (otherwise than from direct current with the negative pole earthed) not exceeding 2 kilowatts connected load, the nominal pressure shall not (except in the case of motors) exceed 230 volts at the consumer's main switchboard, and for supply to services exceeding 2 kilowatts connected load and motors of any capacity, the nominal pressure shall not exceed 460 volts at such switchboard.

(2) Supply for power for industrial purposes may be given at high or extra-high pressure not exceeding 11,000 volts either for transformation or for direct supply to motors : Provided that the transforming apparatus and control gear are so enclosed as to be inaccessible except to authorized persons.

(3) Supply for series street-lighting may be given for pressures up to but not exceeding 3,300 volts between transformer terminals.

(4) Supply from direct current (with the negative pole earthed) may be given at a pressure not exceeding 650 volts.

REGULATION OF PRESSURE AND FREQUENCY.

7. (1) The pressure shall be maintained within 5 per cent. above or below the nominal pressure at the consumer's main switchboard, and on complaint by any consumer that the variation in voltage exceeds the limits specified, or on the instructions of the Inspecting Engineer, the licensee shall connect a portable recording voltmeter to be provided and maintained by the licensee, to record the pressure between the service-lines. If the variations thus recorded are caused within and by the licensee's system and exceed the above limits the licensee shall take immediate steps to comply with this regulation.

(2) The frequency shall be maintained within 1½ per cent. above or below the standard of 50 cycles per second.

(3) This regulation shall not apply to plants which do not supply electrical energy to consumers other than the licensee.

LOCATION OF OVERHEAD LINES.

8. The licensee shall leave one side of each street free for telegraph-lines, and where the street is continuous the licensee's lines shall be kept to the same side of the street for the whole distance.

9. Except by permission of the Minister of Telegraphs, or subject to an agreement between the Post and Telegraph Department and the licensee, all overhead electric lines shall be placed on the opposite side of the street to that on which any telegraph-lines are erected ; and where the erection or operation of the overhead electric lines necessitates an alteration of any existing telegraph-lines, and such alteration is approved by the Minister of Telegraphs, the expense of the alterations shall be borne by the licensee : Provided that where existing telegraph-lines of the Post and Telegraph Department occupy both sides of a street at any place, that Department shall bear the cost of putting all telegraph-lines on the one side of the street, or consent to an arrangement for the joint use of poles on both sides of the street.

FACILITY FOR SERVICE CONNECTIONS.

10. (1) Where electric distribution-lines are on one side of the street and telegraph-lines on the other, and service is required to be given from either to the other side, the licensee and the Minister of Telegraphs shall give to each other reasonable facilities as far as possible to effect supply.

(2) Where possible, electric service-lines shall pass over telegraph-lines, and telegraph service-lines shall pass under electric lines.

CONDITIONS OF SUPPLY TO CONSUMERS.

11. Every person within the area included in the license to whose premises electrical energy can be supplied from the licensee's distribution-lines shall be entitled to a supply under the following terms and conditions :—

(*a*) Where the length of service-lines inside a consumer's boundary does not exceed 60 ft. in the case of overhead lines or 20 ft. in the case of underground lines (the distance in each case being measured along the route of the service-lines) such service-lines 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 service-lines are required for a greater distance than 60 ft. or 20 ft. as aforesaid, as the case may be, inside the consumer's boundary, the consumer may, at the discretion of the licensee, be required to bear the cost of such additional length. Service-lines paid for by the consumer shall remain his property.

(*d*) If an 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 an extension piece on a building or an additional pole or poles are 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 or poles shall, if the licensee so demands, be paid by the consumer. All such poles paid for by the consumer shall remain his property.

12. (1) A consumer or group of consumers to whose premises electrical energy cannot be supplied unless the licensee extends his distribution-lines may demand that the licensee shall so extend such lines and supply electrical energy, and the licensee shall comply with such demand within twelve months after the date thereof—

(*a*) If the consumer or group of consumers guarantees to pay the capital cost of such extension in addition to paying at the standard rate for all electrical energy supplied ; or

(*b*) If the consumer or consumers jointly or separately give to the licensee a guarantee to pay to him in each year not only at the standard rates for all electrical energy actually consumed, but also such additional amount as may be necessary to make the licensee's total revenue from the extension not more than—

(i) In respect of a guarantee for not more than one year, 120 per cent. of the capital cost of such extension :

(ii) In respect of a guarantee for more than one year but not more than two years, 60 per cent. of the capital cost of such extension ;

(iii) In respect of a guarantee for more than two years but not more than three years, 40 per cent. of the capital cost of such extension ;

(iv) In respect of a guarantee for more than three years but not more than four years, 30 per cent. of the capital cost of such extension ;

(v) In respect of a guarantee for more than four years but not more than five years, 24 per cent. of the capital cost of such extension ;

(vi) In respect of a guarantee for more than five years, 20 per cent. of the capital cost of such extension.

(2) For the purposes of this regulation the capital cost of an extension shall be deemed to include the cost of the provision and erection of all conductors necessary to give a satisfactory supply to the consumers affected by such extension.

(3) Any additional annual amount as aforesaid shall cease to be payable by any consumer on the expiration of the period of the guarantee if all such amounts due by him under the guarantee have been paid to the licensee, and such consumer shall thereafter be entitled to be supplied with electrical energy at the standard rate for the time being in force.

(4) Notwithstanding any payments pursuant to subclause (1) of this regulation, the extension shall be the property of the licensee, and may be used by him for the purposes authorized by his license so long as such use does not prejudicially affect the supply of electrical energy to consumers who entered into any guarantee as aforesaid.

(5) Where, pursuant to the authority conferred by the last preceding subclause, a licensee proposes to supply any consumers other than those who have entered into a guarantee as aforesaid, he shall require each such additional consumer to enter into an agreement with him to pay at the standard rate for all electrical energy actually consumed, and also to pay an additional amount in each year during the remaining period of the guarantee calculated as if such additional consumer had been a party to the joint guarantee or had entered into a separate guarantee, as the case may be, and the amount payable by any guarantor in any year shall be adjusted accordingly.

13. If the licensee's plant or mains are of insufficient capacity to enable a satisfactory supply of electrical energy to be given to any consumer or to any applicant for a supply the licensee shall, on being required so to do by the Minister, forthwith proceed to install such additional plant or mains of greater capacity as are required to give a satisfactory supply of electrical energy.

14. A meter rent and minimum charge may be applied by the licensee under the following conditions:—

(*a*) The charge for electrical energy may be altered from time to time on one month's notice in writing to the consumers concerned, provided that the maximum charges stated in the license shall not be exceeded.

(*b*) A meter rent may be charged in addition to such maximum charge, but such meter rent shall not exceed 1s. a month for each meter installed.

(*c*) A minimum charge, minimum monthly or other periodical charge, including the meter rent (if any) for retail or wholesale supply, may be collected if required by the licensee, and shall be printed on the licensee's conditions of supply. The minimum charge for any period shall be subject to the approval of the Minister.

15. Every consumer within any part of the licensee'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 under similar circumstances a corresponding supply.

Notice Before Commencement.

16. (1) Before commencing any part of the work authorized by the license the licensee shall give fourteen days' notice in writing to the Chief Electrical Engineer of the Public Works Department, and to the District Engineer of the Post and Telegraph Department of the intention so to do.

(2) Notice of all proposed alterations to the initial layout of high or extra-high pressure electric lines shall be given in writing to the said Chief Electrical Engineer, and to the said District Engineer fourteen days before commencing work on the altered layout.

(3) All notices required by this regulation shall be accompanied by a plan showing the location and pressure of all wires and cables proposed to be erected, the nature of their covering (if any), and the height of the poles to be erected, and the notice to the said Chief Electrical Engineer, under subclause (1) of this regulation, shall also be accompanied by a statement in such form as the Minister directs of the calculated strengths of all line-supports.

(4) If cables of sizes other than those mentioned in the tables of sags and tensions set out in the Schedule hereto are proposed to be used, the notice to the said Chief Electrical Engineer, pursuant to subclause (1) of this regulation, shall also be accompanied by tables giving in respect of such cables similar particulars to those given in the tables in the said Schedule.

(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 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 not greater than 22 in. by 30 in. unless they are supplied in sections not greater than 22 in. by 30 in.

(6) All locality plans shall have the north point marked thereon. In showing the pressure of the electric lines the following colours shall be used on all plans: Blue to indicate extra-high pressure over 11,000 volts; red to indicate extra-high pressure not over 11,000 volts; yellow to indicate high pressure; green to indicate medium pressure and under.

Time of Construction.

17. 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.

Notice of Completion and Commencement of Supply.

18. (1) The licensee shall, before the completion of the initial installation or any separate portion thereof, give to the Chief Electrical Engineer of the Public Works Department, and to the District Engineer of the Post and Telegraph Department at least one month's notice in writing of the estimated date of each completion, and requesting that an inspection be made of the work.

(2) The licensee shall not use the initial installation or any portion thereof until receiving from the Minister notice in writing that the Inspecting Engineer has certified to such works or such portion thereof having been satisfactorily carried out.

(3) Applications for an inspection shall be accompanied by a plan of the lines to be inspected, setting out the details required to show routes completed and pressure of lines. Every such plan shall be in accordance with the requirements of subclauses (5) and (6) of Regulation 16 hereof.

Records to be Kept.

19. (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 Government Statistician such information as he may require.

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

Continuity of Supply.

20. From the time when the licensee commences to supply energy in pursuance of the license, he shall maintain continuously, during the period of the day for which he has agreed with any consumer to supply energy, sufficient power for the use of all such consumers for the time being entitled to be supplied: 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.

Extensions and Alterations.

21 (1) Before commencing the extension of any lines or the erection of any new line (other than a service-line), not included in the initial layout, the licensee shall, where the extension or new line exceeds 40 chains, give at least seven days' notice in writing to the Chief Electrical Engineer of the Public Works Department, and also to the District Engineer of the Post and Telegraph Department or his deputy, of the intention to carry out the work.

(2) The provisions of subclauses (3) to (6) of Regulation 16 hereof shall apply to notices under this regulation.

22. (1) Before commencing the alteration of any line already erected (except an alteration involving a change from single phase to two or three phase, where three phase is standard construction for the licensee's area) the licensee shall give at least seven day's notice in writing to the District Engineer of the Post and Telegraph Department or his deputy of the intention to carry out the work.

(2) The provisions of subclauses (3), (5), and (6) of Regulation 16 hereof, in so far as they refer to the said District Engineer shall apply to notices under this regulation.

(3) The alteration of any line includes an alteration in voltage.

23. Notwithstanding the provision of Regulation 18 hereof, the licensee may use such extensions and service-lines, provided that the work has been carried out in strict conformity with the requirements of these regulations, and further provided that in the case of high or extra-high pressure lines not less than seven days' prior notice is given to the District Engineer of the Post and Telegraph Department of the intention to bring the lines into use.

24. For the purpose of ascertaining whether or not the extensions and service-lines comply with these regulations the Inspecting Engineer may from time to time inspect the work, and if he finds that any portion of same does not comply with such requirements the Minister may call upon the licensee to discontinue the use of such part of the work until he is satisfied that such requirements have been complied with.

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

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

26. (1) Within fourteen days after the end of each calendar month the licensee shall furnish to the District Engineer of the Post and Telegraph Department or his deputy a list of, or alternatively a plan showing all service-lines and extensions less than 40 chains in length, erected or altered during the previous month that cross any telegraph line or wire, and not later than the 30th day of June in each year shall furnish to the Chief Electrical Engineer of the Public Works Department, in such form as the Minister may require, a summarized list of, or alternatively a plan showing, all extensions (whether more or less than 40 chains in length), to the lines made during the twelve months ended on the 31st day of March of that year.

(2) Such list or plan shall contain the following details :—

(*a*) Date of each extension ;
(*b*) Location or route ;
(*c*) Bare or covered (T.B. or V.I.R.) ;
(*d*) Length of each extension ;
(*e*) Voltage of each extension.

ASSIGNMENT.

27. (1) A license, and the benefits and obligations thereunder, shall not be assigned or delegated by the licensee without the express consent in writing of the Governor-General in Council first had and obtained ; but such consent shall not be withheld if it is proved to the satisfaction of the Minister that the person to whom the license is proposed to be transferred is financially and otherwise able to carry out the obligations specified under the license.

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

PUBLIC WORKS COMPENSATION, ETC.

28. Nothing herein contained shall be deemed in any way to interfere with, affect, or abridge any rights or powers vested in His Majesty the King, or in 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. Nor shall His Majesty or the Governor-General, or the Minister, or any other person be liable to pay to the licensee any compensation for injury done to the works authorized by the license by the construction, management, or working of any such public work as aforesaid, or for the loss occasioned thereby, or for the exercise of any such right or power as aforesaid.

MONOPOLY.

29. Nothing in the license or otherwise shall be deemed to give to the licensee a monopoly or the exclusive right to supply electricity within the area authorized by the license.

WIRING CONSUMERS' PREMISES : MONOPOLY FORBIDDEN.

30. The licensee shall not grant or agree to grant any company, firm, or person the sole right to supply or erect the electric wiring on any consumer's premises, nor shall any consumer be required to purchase from the licensee or his assigns any material or apparatus for installing the electric wiring of such premises, or to have the work carried out by the licensee or his assigns, as a condition precedent to a supply of electrical energy being given by the licensee to the consumer.

REPORT OF ACCIDENTS, INTERRUPTIONS, AND BREAKAGES.

31. (1) The licensee shall give notice to the Chief Electrical Engineer of the Public Works Department of—

(*a*) Any accident caused by electric lines, electrical apparatus, or electrical equipment connected with the licensee's plant.
(*b*) Any other accident in connection with the licensee's plant which has caused or which might have caused loss of life or personal injury.
(*c*) Any accident to the licensee's plant caused by explosion or fire.
(*d*) Any fire on a consumer's premises due to electrical causes.
(*e*) Any interruption exceeding twelve hours' duration to any part of any electric line or work other than service-lines, and the duration of such interruption.
(*f*) Broken poles or wires, giving the following information :—

Broken poles : (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.

Broken wires : (i) Date ; (ii) voltage ; (iii) number of wires broken ; (iv) type—specify whether main line (M.L.), or house-service (H.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 not less than one month after notice has been given to the Chief Electrical Engineer as aforesaid all broken poles and damaged ends of broken wires, and all 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.

(3) The notice required to be given to the Chief Electrical Engineer under subclause (1) hereof in respect of the matters mentioned in paragraphs (*a*), (*b*), (*c*), and (*f*) thereof shall be given forthwith after the accident or other happening. Notice of the matters mentioned in paragraphs (*d*) and (*e*) thereof shall be given at the end of each 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.

GOVERNOR-GENERAL'S DECISION FINAL.

32. 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 by such person, corporate body, or local authority may lie against the licensee.

FEES.

33. (1) The following fees shall be payable on the issue of licenses to erect electric lines :—

	£	s.	d.
(*a*) For any installation up to and including 100 kilowatts installed capacity	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*) Extensions to or amendments of existing licenses	1	1	0

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

PART II.—Regulations controlling the Use and Management of Any Works or Lines erected after the coming into operation of these Regulations and used for Generating, Transforming, Converting, or Conveying Electrical Energy (whether so used pursuant to a License under the Public Works Amendment Act, 1911, or not), so as to secure the Safety of Consumers or Employees and of the Public from Personal Injury by Reason of such Use.

CONDITIONS OF DIRECT-CURRENT SUPPLY WITH EARTH RETURN.

34. (1) Supply under the conditions of paragraph (*h*) of Regulation 5 of Part I hereof shall be limited to the operation of electric motors, motor-generators, and to outdoor electric lighting.

(2) In such cases a single-pole fuse or automatic circuit-breaker shall be inserted in the positive conductor, and arranged to operate within 5 seconds with an overload not exceeding 200 per cent. of the rated full-load current. The overload within these limits shall be at the discretion of the licensee. Such fuse or circuit-breaker shall be placed in a suitable locked or sealed receptacle of fireproof construction fixed at a convenient height at the point of supply.

(3) At the distributing-point of a lighting-circuit there shall be inserted in the positive conductor a single-pole switch, together with a fuse arranged to operate within 5 seconds with an overload of 200 per cent. of the rated full-load current of such circuit.

(4) In a motor-circuit there shall be provided in the immediate vicinity of each motor connected thereto a single-pole switch and fuse or circuit-breaker arranged to operate within 3 seconds with an overload not exceeding 200 per cent. of the rated full-load current of the motor so controlled. The overload within these limits shall be at the discretion of the licensee.

(5) Each motor shall also be provided with an automatic no-voltage release and a series resistance for starting.

(6) The negative conductor shall be continuous throughout its length without a switch, fuse, or circuit-breaker.

CONNECTION OF CIRCUITS WITH EARTH.

35. In medium, low, or extra-low pressure alternating-current systems the connection of circuits with earth shall be made in accordance with the following requirements :—

(*a*) The intermediate conductor of a medium, low, or extra-low pressure three-wire single-phase system, and the neutral conductor of a medium, low, or extra-low pressure three-phase four-wire system, shall be earthed in multiple—that is, at the point of supply (the generating-station, substation, or transformer) and at one or more other points along the distribution 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 intermediate or neutral conductor and earth shall not exceed the limits prescribed by Regulation 52 hereof.

(*c*) The neutral point of a medium, low, or extra-low pressure three-phase three-wire system shall be effectively earthed at the point of supply.

36. In medium, low, or extra-low pressure direct-current systems the connections of circuits with earth shall be made in accordance with the following requirements :—

(*a*) In a three-wire direct-current system the intermediate conductor shall be earthed at the generating-station only, and the current from the intermediate 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 steps shall be taken immediately to improve the insulation of the system.

(*b*) Where the intermediate 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 circuit, 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.

37. In high 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 point of supply—that is, the generator neutral point or the neutral point of the transformer secondary where change of voltage occurs—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 such 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 unattended generating stations or substations supplying overhead lines earth leakage relays shall be provided, so that in the event of a leak to earth occurring either the faulty line will be cut out or the whole of the system supplied from this station or substation rendered dead.

(*d*) These leakage relays if connected to individual feeders or lines shall be set to operate with a time lag not exceedings 5 seconds with a current not exceeding 10 per cent. of the full-load rating of the feeder or line, or, if connected between the neutral point of the generator or transformer and earth, at a current not exceeding 1 ampere.

(*e*) Where under any conditions the use of earth leakage relays may be impracticable such relays may, with the written consent of the Chief Electrical Engineer of the Public Works Department, be omitted.

(*f*) In continuously attended generating stations or substations a visual and audible indication may be used in place of automatic disconnection of supply. In such case 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.

(*g*) In the case of delta-connected systems or star-connected systems with isolated neutrals earthing-transformers or other means approved by the Chief Electrical Engineer of the Public Works Department 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.

(*h*) Similar leakage protection or indication shall be provided for these systems to that specified in paragraphs (*c*) to (*f*) of this regulation for systems with earthed neutrals.

38. High or extra-high pressure single-phase systems shall be earthed in a manner approved by the Chief Electrical Engineer of the Public Works Department.

39. Where any part of a supply system other than on a consumer's premises is normally connected with earth, no switch, fuse, or circuit-breaker shall be inserted in the earthed conductor or in any conductor connected thereto, and the connection with earth shall be efficiently maintained, except when it is interrupted for the purpose of periodical tests.

40. Notwithstanding anything contained in the last preceding regulation, systems including more than one generator operating in parallel may have the neutral conductor of a three-phase star-connected generator 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 inter-connected, 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-stations.

41. Notwithstanding anything contained in Regulation 39 hereof, the intermediate 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 36 hereof.

42. 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.

43. 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.

EARTHING-LEADS AND EARTHING-CONNECTIONS.

44. (1) Earthing-leads shall be of copper, and in no case of a less cross-sectional area than 0·02 sq. in. (1/·160 No. 8 S.W.G. 7/·064 or 7/16 S.W.G.) outdoors, or 0·0045 sq. in. (7/·029 or 7/22) indoors, provided that galvanized-iron strip not less in cross-section than 1 in. by $\frac{1}{16}$ in. or stranded steel cable or copper-covered steel not less in area than 0·02 sq. in. (7/·064 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 No. 18 gauge.

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

45. 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 8 ft. from the ground.

46. (1) Lightning-arresters and earth-leakage relays shall, except with permission in writing of the Minister, each be earthed by means of an independent earthing-lead and earth-connection spaced well apart from each other, and from any earthing-lead or earth-connection used for earthing circuits or equipment.

(2) The earth-connections for the lightning-arresters and earth leakage relays respectively shall, except in the case of pole substations, be placed not less than 6 ft. from each other and from any other earth-connection, and shall on no

account be interconnected with each other or with any earth-connection used for earthing circuits or equipment.

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

(4) Earthing-leads for lightning-arresters shall not pass through iron or steel pipes, and shall be taken as direct as possible between the lightning-arrester and the earth-connection. Bends shall be avoided where possible, but where bends are unavoidable they shall have as large a radius as possible.

47. On alternating-current star-connected systems, with the neutral earthed, pipe crossings for medium, low, or extra-low pressure electric lines may be earthed by running a bare neutral wire in the pipe.

48. Where the neutral of a medium or any lower pressure three-phase four-wire system is used for earthing stay-wires, earthing-bars, and other line hardware, it shall not be of a less area than that specified in Regulation 44 hereof unless such neutral is earthed at points as nearly equidistant as possible and at intervals of not more than 15 chains each.

49. Joints between earth-wires shall be soldered or made with suitable clamps or metal sleeves.

50. Earthing-leads, if laid underground, shall, unless otherwise mechanically protected, be laid slack to prevent their being readily broken, and shall have all joints carefully painted or otherwise protected against corrosion.

51. Earth-pipes, earth-plates, and other earth-connections, shall be located, where practicable, below permanent moisture-level, or, failing this, at least 6 ft. below ground-level. Areas where ground-water level is close to the surface shall be used when available.

EARTH TESTS.

52. All earth-wires and earth-connections shall, before the electric lines are livened 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.

53. (1) All earthing-leads and earth-connections except those specified in Regulation 190 shall be tested at least once every twelve months.

(2) All earth-wires and earth-connections under Regulations 46, 59, and 156 (*b*) hereof 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 the 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 intermediate 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.

54. Records of all tests made shall be kept by the licensee, 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 and Government Railways Departments when required.

55. 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 of the Public Works Department, a certified copy of the record of all earth tests made;

(*b*) To the District Telegraph Engineer or his deputy, a certified copy of the record of all tests made on guards erected over telegraph-wires and on all earthed metal at telegraph crossings;

(*c*) To the Signal and Electrical Engineer of the Government Railways Department, a certified copy of the record of all tests made on guards and earthed metal at railway crossings.

56. 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.

57. Additional tests of any earthing-leads or earth-connections shall be made if and when required by the Minister.

SWITCHBOARDS.

58. (1) All power-house and substation switchboards, including the frames to which they are attached, shall be made of fireproof material; and the maximum permissible current and temperature in any conductor mounted thereon or leading thereto shall not exceed the values permitted under the British Engineering Standards Association's Specification No. 159.

(2) No conductor at a pressure above 650 volts shall be exposed on the front of any switchboard; and the back of any switchboard on which bare live metal at a pressure of 250 volts and over to earth is mounted shall be made inaccessible (except to authorized 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 fuse (other than the primary fuse of a potential transformer) circuit-breaker or switch (other than an isolating switch) shall be fixed on the back of any switchboard or in the screened-in space at the back thereof if it is necessary to operate such fuse circuit-breaker or switch from behind the switchboard. No equipment shall be mounted at the back of any switchboard if it is of such a construction as will endanger any other equipment when such first-mentioned equipment is in normal operation.

59. (1) All power-house and substation switchboards controlling high 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 (unless otherwise protected), and other metal parts thereof shall be connected.

(2) Means shall be provided for testing the resistance through the earth between these two earth connections, as specified in Regulations 52 and 53 hereof.

60. (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 controls lines or apparatus working at a pressure above 250 volts to earth.

(*b*) Which, being mounted on a floor of conducting material, controls lines or apparatus working at a pressure above 100 volts to earth, except in the case of medium or any lower pressure, where all live metal on such switchboard is totally enclosed and all other metal thereon, or connected therewith, is efficiently and permanently connected to earth.

(2) A rubber mat as aforesaid shall be provided in the screened-in space at the rear of every powerhouse and substation switchboard (not being of the totally enclosed iron-clad cubicle type) 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.

61. 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 the British Engineering Standards Association's Specification No. 158.

62. All panels shall have marked thereon, near each switch, the name of the feeder controlled by such switch.

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

(2) The last preceding subclause shall not apply—

(*a*) Where the oil circuit-breaker can be withdrawn from all sources of supply (*e.g.*, truck-type cubicles):

(*b*) Where the switchboard consists of one panel and it can be made dead by opening a switch outside and adjacent to the substation:

(*c*) Where there is a single panel supplied from one generator.

64. (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 hereinafter mentioned, namely—

(*a*) Medium and low-pressure switchboards—an overhead clearance (except in screened spaces dealt with in paragraph (*c*) of this regulation) of not less than 7 ft. from the floor to any bare 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 and extra-high pressure switchboards (not exceeding 11,000 volts between phases), other than operating desks or panels working solely at medium, low, or extra-low pressure—an overhead clearance (except in screened spaces dealt with in paragraph (*c*) of this regulation) of not less than 8 ft. from the floor to any bare 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 screened spaces 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 or extra-high pressure and not less than 4 ft. for medium or lower pressures 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 voltages in excess of 11,000 volts such clearances as are approved by the Chief Electrical Engineer of the Public Works Department.

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

65. (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 spaces, and passage-ways shall be adequately lighted to prevent danger.

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

Power-houses and Substations.

66. (1) All power-houses and all substations shall be totally enclosed and inaccessible to all unauthorized persons.

(2) Where barb wire is used for such purpose the wire shall be attached to supports or battens spaced not more than 5 ft. apart. The distance between barb wires shall not exceed 9 in.

(3) Every fence which is used as an enclosure under this regulation (whether or not such fence is constructed of barb wire) shall have three barb wires spaced not less than 6 in. or more than 9 in. apart, fixed to supports on top of the fence and leaning outward at an angle of approximately 45°.

(4) The gates of all enclosures shall be constructed to prevent access by climbing.

67. The entrance-doors of unattended power-houses or substations shall where practicable be provided with a spring or other approved device, which shall ensure that the door remains wide open when not properly shut and locked.

68. All those parts of power-house or substation premises in which electrical apparatus is placed shall be adequately lighted to prevent danger.

69. Adequate working-space and means of access free from danger shall be provided in respect of all electrical apparatus which has to be worked or attended to by any person.

70. Every high and extra-high pressure conductor situated within reach of any working-platform or in any switchboard passage-way shall be so placed or protected as adequately to prevent danger.

71. Where necessary to prevent danger, 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.

72. Adequate precautions shall be taken to prevent any conductor or apparatus from becoming accidentally or inadvertently electrically charged when persons are working thereon.

73. Where necessary to prevent danger, insulating-stands or screens shall be provided and kept permanently available, and shall be maintained in a sound condition.

74. (1) Ladders stored in the vicinity of pole substations shall be securely padlocked or otherwise made inaccessible to unauthorized persons.

(2) Ladders fixed to pole substations shall either be of the shut-up type, and kept securely closed and padlocked when not in use, or of such a type that they cannot be used by unauthorized persons.

75. Wiring in power-house or substation buildings shall be carried out in accordance with the Electrical Wiring Regulations, 1927.

76. (1) Where platform type of construction is used, 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 3 ft. 3 in. above the platform.

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

77. Fire-buckets of suitable capacity, filled with clean, dry sand and ready for immediate use in extinguishing fires, or suitable fire extinguishers filled with non-conducting fluid, shall be kept in a convenient situation adjacent to the electrical apparatus and conspicuously marked.

78. Such instructions as the Minister may from time to time approve as to the treatment of persons receiving electric shocks shall be affixed in a conspicuous place in every power-house and sub-station.

79. Integrating wattmeters shall, if the licensee sells electrical energy, be installed for recording the generating-station output in Board of Trade units, or, in the case of power purchased in bulk, to record the amount purchased. The units purchased or generated and the maximum half-hourly demand shall be recorded daily.

Transformers.

80. (1) Where transformers are exposed to the weather they shall be fitted with weatherproof cases, and when fixed on poles they shall be either thoroughly protected against interference or attached to the poles at such a height as to make them inaccessible except by means of a ladder or other special appliance.

(2) Pole-steps shall not be placed less than 9 ft. above the ground-level.

81. Where transformers are placed within a building or enclosure they shall be inaccessible except to authorized persons; and all high or extra-high pressure conductors in such buildings or enclosures shall be screened and protected so that persons cannot make accidental contact therewith.

82. Every transformer or bank of transformers shall be equipped with primary fuses or overload circuit-breakers.

83. The cases of all transformers, whether within or without a substation, shall be earthed by a copper conductor in accordance with Regulations 44 and 45 and 49 to 51 hereof.

Lightning-arresters.

84. Where electrical apparatus or appliances are connected to electric lines of any voltage in such a position as to be liable to injury from lightning, efficient protection shall be provided to safeguard such apparatus or appliances.

Rubber Gloves, Safety Belts, and other Safeguards.

85. Rubber gloves, protective covers and mats, rubber-soled boots and goloshers, insulated stands, safety belts, and hand-lines shall be provided by the licensee for use, when necessary, by persons employed by him.

86. Pliers and other tools insulated with a brittle material, or otherwise liable to have the insulation damaged in use, shall not be used.

87. Rubber gloves shall be used where possible when working on live metal, and always when removing or replacing fuses or cut-outs on high or extra-high pressure lines.

88. Safety belts shall be used where possible when working on poles.

89. Hand-lines shall be used when hauling material up above live lines.

90. (1) Rubber gloves, protective covers, mats, boots and goloshers, insulated stands, and safety belts shall be inspected immediately before use, and any found defective shall be immediately repaired or destroyed.

(2) Protective covers, rubber gloves, boots, and goloshes in regular use shall be tested once in every two months, and no such equipment shall be used unless it has been tested within the previous two months.

(3) A record shall be kept of all tests made on protective equipment.

91. Every person working on the lines or apparatus shall be held responsible for using in a proper manner the safeguards provided and for satisfying himself by inspection that they are in good order and condition.

Feeder and Distribution Protection.

92. (1) Each outgoing feeder or distributor from any power-house or substation shall be provided with fuses or an automatic circuit-breaker equipped with overload inverse time-limit or other approved tripping-device.

(2) The fuse or tripping-device shall be located in each conductor, except an earthed neutral, and in the case of three-phase circuits one overload inverse time-limit trip-coil may be replaced by an earth-leakage trip-coil.

93. In transformer substations not exceeding 50-kilowatt capacity only the high-tension or primary side of the transformer need be equipped with fuses or circuit-breaker, and special precautions shall be taken in the adjustment of these to the capacity of the transformer.

94. (1) All overload devices shall be set to operate within three seconds at a current not exceeding 200 per cent. of full load of such feeder or distributor, except that in the case of fuses the time stated may be *one minute*. Where the 200 per cent. of normal full load is not in excess of 2 amperes a fuse to blow at 2 amperes may be used.

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

(3) Where automatic reclosing switches or circuit-breakers are used they shall not be set to reclose more than twice after any interruption, and the lockout device shall then prevent any reclosing except by hand. The interval between the automatic reclosings shall not exceed 10 seconds.

95. Fuses or circuit-breakers shall not be inserted on the medium or any lower pressure side of transformers when lines are erected in accordance with Regulation 156 hereof, unless the fuses or circuit-breakers are set to open the circuit at a current not less than 25 per cent. greater than that required to operate the fuse or circuit-breaker on the primary feeder to which the transformer is connected, and where such fuses are inserted they shall be renewed at intervals of not more than six months.

96. On star-connected systems with earthed neutral current-transformers Z-connected to two-trip coils shall not be used.

97. Series street-lighting circuits shall be provided with protective apparatus of a type approved by the Chief Electrical Engineer of the Public Works Department, set to operate in the event of a break occurring in the secondary circuit.

CIRCUIT-BREAKERS AND SWITCHES.

98. Every switch, switch-fuse, circuit-breaker, and isolating-link shall be—

(*a*) So constructed, placed, or protected as to prevent danger:

(*b*) So constructed and adjusted as accurately to make and maintain good contact:

(*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:

(*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.

(*e*) Safety catches shall be provided on disconnecting-switches when mounted in such a way that gravity tends to open them, and also when the magnetic forces due to short circuits are of values liable to open them.

99. Every switch intended to be used for breaking a circuit, and every circuit-breaker, shall be so constructed that an arc cannot accidentally be maintained.

100. Every circuit-breaker shall be of the loose-handle type, and capable of breaking the undermentioned currents by hand without undue arcing and without injury to the operator: in the case of direct current it shall be capable of breaking 200 per cent. of 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.

101. All enclosed switches or circuit-breakers shall have an external device to indicate clearly whether the switch or circuit-breaker is open or closed.

102. All metal handles of high or extra-high pressure switches or circuit-breakers, and (where necessary to prevent danger) all metal not normally connected to the circuit, shall be earthed.

103. Where practicable, switches shall be so wired that the blades will be dead when the switch is open.

FUSES.

104. Every fuse shall be either of such construction or so protected by a switch that the fusible metal may be readily renewed without danger.

STRANDING OF OVERHEAD CONDUCTORS, AND MINIMUM SIZE.

105. In all overhead lines—

(*a*) Copper conductors used for medium or any lower pressure may be either solid or stranded:

(*b*) Copper conductors used for high or extra-high pressure shall be stranded:

(*c*) Galvanized-iron, steel, or copper-covered steel conductors for all pressures may be either solid or stranded:

(*d*) Aluminium conductors for all pressures shall be stranded.

106. (1) The area of any overhead conductor shall be not less than that shown in the following table, namely,—

Material.	Medium, Low, or Extra-low Pressure.		High or Extra-high Pressure.
	Service-lines.	Other than Service-lines.	
Copper ..	Stranded wire, 7/·036 or 7/20 S.W.G. Solid wire, 1/·128 or No. 10 S.W.G.	Stranded wire, 7/·052 or 7/17 S.W.G. Solid wire, 1/·160 or No. 8 S.W.G.	Stranded wire only. 7/·064 or 7/16 S.W.G.
G.I. steel or copper covered steel	Same as for copper	Same as for copper	Stranded wire, 7/·064 or 7/16 S.W.G. Solid wire, 1/·160 or No. 8 S.W.G.
Aluminium	Stranded wire only, 3/·118*	Stranded wire only, 3/·118*	Stranded wire only, 7/·110.
Steel-core aluminium	Stranded wire only, 7/·0586	Stranded wire only, 7/·0586	Stranded wire only, 7/·0834

* Smallest British size manufactured.

(2) Earthing-leads shall be of the sizes prescribed by Regulation 44 hereof.

107. Joints between 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.

STRESSES IN OVERHEAD LINES.

108. (1) The lines shall be so designed and constructed that the stress in overhead conductors will not exceed—

(*a*) 25,000 lb. per square inch for hard-drawn copper, or

(*b*) 14,000 lb. per square inch for annealed copper, or

(*c*) 12,500 lb. per square inch for hard-drawn aluminium, or

(*d*) 34,000 lb. per square inch for steel, or

(*e*) 22,500 lb. per square inch for iron

when subjected simultaneously to a minimum temperature of 20° F. (or such other temperature as may be specified in the license) and at 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).

(2) In the case of a composite conductor with a steel core, the maximum load under the circumstances mentioned in the last-preceding subclause shall not exceed 40 per cent. of the ultimate strength of the conductor if the steel core has a diameter of 0·162 in. or less, and 50 per cent. if the diameter of the steel core exceeds 0·162 in.

(3) Where in the opinion of the Minister the lines are liable to be subjected to ice loading, they 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.

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

110. Overhead wires shall be strung and pulled up in such a manner that the metal 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 FOR OVERHEAD LINES.

112. Overhead electric lines erected across street intersections shall not at any part thereof over such intersection be at a less height than 21 ft. above ground-level, and, if so required by the District Telegraph Engineer, shall be erected at such greater height than 21 ft. as he specifies in writing.

113. Overhead electric lines at medium or lower pressures shall not at any part thereof be erected and maintained along or across any street at a less height than 18 ft. above the ground-level, except 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 the ground-level.

114. (1) Overhead electric lines at medium or lower pressures 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 not less than 16 ft. (if bare) or 14 ft. (if covered) above ground-level: Provided that in the case of service-lines, the height above ground-level in the span between the building and the nearest pole thereto may be not less than—

(*a*) 14 ft. where the line crosses any way open to the public:

(*b*) 12 ft. where the line crosses any way used exclusively by vehicles:

(*c*) 9 ft. in any other part of the span.

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

(3) Service-lines shall be so attached to the building that it is impossible to touch them 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 service-lines.

115. Overhead electric lines at high pressure shall not at any part thereof be erected and maintained along or across any street or footpath at a less height than 20 ft. above ground-level, and such lines erected elsewhere shall not be erected and maintained at a less height above-ground level than 18 ft. if bare or 16 ft. if covered, save that where such last-mentioned lines cross any place used by vehicles having a height (including their loads) greater than 10 ft. the 20 ft. clearance shall be provided.

116. Overhead electric lines at extra-high pressure shall not at any part thereof be erected and maintained at a less height above ground level than—

(*a*) 20 ft. in the case of such lines operating at a pressure not exceeding 11,000 volts and erected elsewhere than in a street or elsewhere than across a footpath or any place used by vehicles having a height (including their loads) greater than 12 ft.; or

(*b*) 22 ft. in any other case.

117. (1) Where, in borough, town-district, and township limits, medium, low, and high or extra-high pressure lines (other than electric service-lines) are carried on the same poles, a minimum height above ground-level of 20 ft. shall be maintained at any part thereof in respect of the medium and low pressure lines for the purpose of allowing telegraph wires to cross beneath the lines.

(2) The said height of 20 ft. shall be maintained, in country areas, at the nearest such pole to any building.

(3) In the case of electric service-lines, the said clearance of 20 ft. shall be maintained at telegraph crossings.

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

118. Overhead electric lines crossing electric-tramway lines shall have the following minimum clearances above the trolley wire or wires — namely, 4 ft. in the case of lines operating at a pressure not exceeding 11,000 volts; 6 ft. in any other case.

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

120. (1) Overhead lines of high and extra-high pressure shall cross any other separately owned aerial lines or cables only pursuant to an agreement between the respective owners, and in every case shall have the following clearances between lines, measured horizontally or vertically at maximum sag :—

Between.	Minimum Clearance.
(*a*) Medium 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 or any lower pressure and extra-high pressure not over 11,000 volts	4 ft.
(*c*) Medium 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 volts	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.

(2) When crossing underneath in a span between the poles supporting the lines above, the lower lines shall have the following horizontal clearances between the nearest line and any pole supporting the lines above :—

Between.	Minimum Clearance.
(*a*) Pole and medium or any lower pressure—	
If covered (except neutral)	2 ft.
If bare (except neutral)	4 ft.
(*b*) Pole and high-pressure—	
If covered	4 ft.
If bare	6 ft.
(*c*) Pole and extra-high pressure	6 ft.

(3) When crossing underneath at a pole supporting the lines above, all the lower lines shall be attached to insulators fixed on cross-arms fitted to this pole.

(4) Where guard-wires are used they shall, for the purposes of this regulation, be deemed to be medium-pressure electric lines, and the clearances specified in subclause (1) hereof with respect to medium-pressure lines shall be observed.

121. (1) Where medium or any lower pressure and high or extra-high pressure electric lines are carried on the same poles, the lines shall have the following clearances, measured at the pole :—

Between.	Minimum Clearance.
(*a*) Medium 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.
(*b*) Medium or any lower pressure and extra-high pressure not over 11,000 volts—Vertical..	4 ft.
(*c*) Medium or any lower pressure and extra-high pressure over 11,000 volts—Vertical ..	6 ft.
(*d*) High pressure and extra-high pressure not over 11,000 volts—	
(i) Vertical	4 ft.
(ii) Horizontal	3 ft.
(*e*) High pressure and extra-high pressure over 11,000 volts—Horizontal or vertical ..	4 ft.
(*f*) 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 embodied 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 subclause.

122. (1) Where lines of the same pressure are carried on the same poles the circuits shall have the following clearances, measured horizontally or vertically at the pole :—

Between.	Minimum Clearance.
(*a*) Medium or any lower pressure	1 ft.
(*b*) High pressure	2 ft.
(*c*) Extra-high pressure not over 11,000 volts—	
Vertical	2 ft.
Horizontal	2½ ft.

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

(3) Under any of the conditions of wind-pressure and temperature embodied 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 subclause (1) of this regulation.

123. Where lines of different pressures are taken down poles to transformers 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 5 ft. apart, or by strain insulators fitted at top and bottom, and the following clearances between lines of different pressures shall be provided :—

Between.	Minimum Clearance.
(*a*) Medium or any lower pressure and high pressure	1 ft.
(*b*) Medium 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.

124. (1) Where it is possible for any conductor to be alive on any cross-arm below the top circuit or circuits, while any conductors above are dead, either the following climbing-spaces shall be provided at the pole between conductors, or all conductors through which it is necessary to climb shall be made dead before any work is undertaken on the overhead lines, or else the conductors below the top circuit or circuits shall be enclosed in an earthed pipe or pipes :—

Between.	Minimum Clearance.
(*a*) Medium or any lower pressure, covered* ..	2½ ft.
(*b*) Medium or any lower pressure, bare ..	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.

* Medium or any lower pressure, covered, includes bare earthed neutral where used.

Provided that where vertical-rack construction is used for medium 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.

125. (1) Where medium or any lower pressure electric lines cross over buildings the following minimum vertical clearances, measured at a temperature of 120° F., shall be provided :—

(*a*) 7 ft. 6 in. above the highest point of flat roofs and open balconies :

(*b*) 2 ft. above the ridge of pitched roofs :

(*c*) 6 in. above a veranda-roof.

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

126. (1) Where high-pressure electric lines cross over buildings 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 wind-pressure, as specified in subclause (1) of Regulation 108 hereof.

(3) A conspicuous notice—" 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 overhead 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.

127. Where high or extra-high pressure electric lines cross over buildings with metal sides and roof, the roof shall be effectively bonded to the sides of the building, and such sides shall be effectively earthed to ensure the operation of the protective devices in the event of contact being made between the electric lines and any metal part of the building.

128. If any tree or trees are likely to cause damage to an electric line, such tree or trees, or any part thereof, shall be removed by the licensee if requested by the Inspecting Engineer.

129. Overhead electric lines shall be so erected as to be inaccessible to any person without the use of a ladder or other climbing appliance.

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

131. Where overhead electric lines cross navigable waterways, such clearances as the Minister directs shall be provided.

SUPPORTS FOR OVERHEAD ELECTRIC LINES.

132. (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 electric line is erected 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 cross-arm nearest the fence will touch the ground at a distance of not less than 5 ft. from the fence.

133. (1) Every support for overhead electric lines 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.

(2) The factor of safety of each support shall be 2 in the case of iron, steel, or ferro-concrete, and 4 in the case of wood, calculated on the crippling-load of the structure.

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

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

(5) In the case of lattice steel or compound structures, 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.

134. (1) Where cross-arm construction is used and the span exceeds 3 chains, double cross-arms, each fitted with insulators, shall be provided on all angles over 45° for high or any lower pressure electric lines.

(2) Where lines are subject to ice or snow loading, the cross-arms shall be designed to provide additional strength to withstand the extra loading.

135. (1) In computing the strength of wooden supports, the following working-stresses, based on heart-wood measurement, shall be used :—

	Pounds per Square Inch
Ironbark	3,500
Other approved Australian hardwoods	3,000
Puriri	2,500
Maire	2,500
Rata	2,200
Black-beech	2,000
Matai	2,000
New Zealand blue-gum	2,000
Totara	1,500
Silver-pine	1,500
Macrocapa	1,500
Larch	1,100
New Zealand cedar	1,000

(2) The working-stress of any timber not mentioned in the last preceding subclause shall be subject to the approval of the Chief Electrical Engineer of the Public Works Department.

(3) No poles of New-Zealand-grown blue-gum shall be used unless the trees from which it is proposed to cut such poles are approved as suitable for that purpose by an officer of the State Forest Service.

136. Pole-steps shall not be placed at a less height than 9 ft. above ground-level.

137. (1) All overhead electric lines shall be attached to suitable insulators carried on cross-arms or brackets of suitable material and cross-section, and 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 cross-arm shall be braced or so fixed that it is kept in a permanent position.

(2) All lines at angles shall be attached to the insulator so that the insulator, and not the binding-wire, takes the strain.

(3) All high and extra-high pressure 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, the line is on the inside of the shackle ; or

(*c*) When strain or suspension insulators are used in which the electric line is attached to the insulator by means of a clamp of a design approved by the Chief Electrical Engineer of the Public Works Department.

(4) Guard-hooks need not be earthed.

(5) Pins for pole-top insulators shall not be screwed into the pole-top, but attached to the side of the pole.

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

138. Where an uplift occurs at a pole—

(*a*) High or extra-high pressure electric lines shall be secured to shackle or other suitable insulators so that they cannot become detached, or they shall be protected by a stirrup fitted over the lines and fastened at both ends to the cross-arm, save that in those cases where such lines, in becoming detached from their supports, will not reduce the standard clearance or otherwise be dangerous the shackles or stirrups may be omitted.

(*b*) Medium or any lower pressure electric lines erected on the same poles as other pressures shall be secured to shackle, or other suitable insulators, 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 less than one-half the clearances specified in Regulation 121 hereof.

139. The cross-arm carrying high-pressure electric lines which are erected on a pole carrying telegraph-lines shall have a distinctive red marking thereon.

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

(2) Bare binding-wire shall not be used on covered wire unless not less than two layers of compounded weather-proof tape is first wrapped round the outside of the covering of the wire.

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

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

142. Electric lines at medium 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.

143. (1) Where stay-wires or truss-rods are used within borough, town-district, or township-limits, they shall be attached, at a point not less than 9 ft. above the ground, to a pole or suitable structure, except where they are erected alongside a substantial fence or hedge.

(2) Outside such limits as aforesaid, stay-wires may be attached to a stub-pole or a log of durable wood, or other form of "deadman," buried at least 4 ft. in the ground, and they shall be attached to the "deadman" by means of a galvanized-iron bolt at least $\frac{5}{8}$ in. in diameter, and the wires themselves shall not, at any part thereof, be in contact with the ground.

(3) Where any stay-wire is not already 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-wire; or

(*d*) A double wooden batten (each batten being not less than 2 in. by 1 in.) securely fastened, with the stay-wire between the battens,

and the guard shall extend from the point where the stay enters the ground to a point where the stay is not less than 9 ft. above ground-level: Provided that where a stay-wire 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.

(6) The height of stay-wires over roadways shall not be less than 18 ft. above ground-level.

(7) When used to stay poles carrying high or extra-high pressure electric lines within borough, town-district, or township limits, all stay-wires or truss-rods shall be effectively earthed. Outside such limits, such stay-wires or truss-rods shall be earthed when any part thereof is erected at a less height than 9 ft. above ground-level.

144. (1) In those cases where the stay-wire is required by these regulations to be earthed, and where the resistance in accordance with Regulation 52 hereof cannot be obtained, the stay-wire, when used to stay poles other than metal, shall have, in addition to earthing, a strain insulator or insulators of the interlocking type inserted therein not less than 9 ft. vertically above ground-level.

(2) Each of the insulators used shall have a mechanical strength at least equal to that of the stay in which it is installed, and shall also have a minimum flashover voltage (when tested with a sphere gap) in accordance with the following table:—

	Maximum Voltages (between phases) of Lines on Poles to which Stay is attached.	Minimum Dry Flashover Voltage.	Minimum Wet Flashover Voltage, one-fifth inch Rain per Minute.
(*a*)	650 volts ..	5,000	3,500
(*b*)	3,300 volts ..	10,000	6,000
(*c*)	6,600 volts ..	14,000	7,000
(*d*)	11,000 volts ..	20,000	11,000
(*e*)	22,000 volts ..	35,000	22,000
(*f*)	35,000 volts ..	50,000	35,000
(*g*)	50,000 volts ..	75,000	50,000
(*h*)	66,000 volts ..	Two units of rating (*f*).	
(*i*)	110,000 volts ..	Two units of rating (*g*).	

145. In all cases where contact may be made by telegraph linesman with a stay-wire or truss-rod it shall be effectively earthed.

146. All live metal less than 14 ft. above ground-level, and attached to poles, shall be protected in such a manner that unauthorized persons cannot make accidental contact therewith.

147. All metal which is not connected to the circuit, and which may become charged by accident or otherwise, shall be efficiently earthed or otherwise adequately protected if placed less than 9 ft. above ground-level.

148. (1) Where metal towers or poles are used they shall be effectively earthed.

Maximum Length of Span.

149. (1) The distance between supports carrying electric lines 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 directs in writing.

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

Street Crossings.

150. Where an overhead electric line crosses any street within which it is erected, any angle formed by the street and the line crossing the street shall not be less than 45°. This regulation shall not apply to street-intersections where the electric line does not change its direction.

Covering of Overhead Electric Lines and Use of Bare Wires.

151. (1) Overhead electric lines at medium or any lower pressure within a borough, town district, or township, or within such other limits as may be specified in the license, shall be covered throughout with triple braiding, thoroughly impregnated with weather-proof compound. This covering shall not be deemed to be an insulating covering for making the lines safe to handle when alive. All joints shall be effectively covered with compounded weather-proof tape.

(2) Overhead electric lines 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 lines safe to handle when alive. All joints shall be effectively covered with rubber and taped.

(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) Electric lines at extra-high pressure shall be bare.

(5) Except as prescribed in Regulation 189 hereof, electric lines at medium or any lower pressure, or high pressure, erected outside the limits aforesaid, may be bare.

152. (1) Every portion of any medium or lower pressure electric line (other than an earthed neutral or intermediate conductor) which is outside and attached to a building shall be effectively covered with rubber of not less than 600-megohm grade or triple braiding in the span between the pole and the building, except where a pole is necessary against the building, to provide the clearances required by Regulations 113 and 114 hereof, in which case bare wire may be used for all lines which do not cross over the building, provided there is not less than 5 ft. 6 in. clearance between the wires on the pole and the highest point of the building at the pole.

(2) The wires between the top of the pole and the inside of the building shall be enclosed in galvanized conduit, effectively earthed, fitted with a bell mouth, and turned down outside to exclude moisture.

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

153. Earthed neutral or intermediate conductors may be bare, and the earthed neutral of a star-connected medium or lower-pressure system may, without the use of insulators, be attached to its support, other than buildings, by clamps of types approved by the Chief Electrical Engineer of the Public Works Department.

154. (1) A conspicuous, durable notice, reading "Danger—Live Wires," or any equivalent suitable warning approved by the Chief Electrical Engineer of the Public Works Department, shall be erected on poles or supports carrying high-pressure bare conductors, or extra-high-pressure conductors.

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

(3) Where the lines are erected on the side of a street the notice shall be so fixed that it is plainly visible from the street.

(4) Every notice shall be fixed at a uniform height of not less than 6 ft. or more than 12 ft. from the ground-level.

155. The erection and use of bare medium or lower pressure and bare high-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 of bare electric lines shall be discontinued, the licensee shall, upon receiving notice from the Minister, and within such time as he may fix, substitute therefor electric lines covered in the manner prescribed in Regulations 151 and 152 hereof.

(*b*) Where telegraph-lines are affected the bare electric lines shall also be subject to the conditions prescribed in Regulation 189 hereof with respect to the protection of telegraph-wires.

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

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

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

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

(*b*) The neutral point of each system shall be effectively earthed at its source of supply, and in accordance with Regulation 35 and Regulations 37 to 40 hereof. Each earth-connection for high or extra-high pressure shall consist of two independent leads to separate sets of earth-plates or pipes connected in parallel; or, if town water-supply pipes are used for earthing, the two independent leads shall be connected to the supply-pipes at two points not less than 12 in. apart.

(*c*) The resistance of each earth-connection shall comply with the requirements of Regulation 52 hereof.

(*d*) Medium, low, extra-low, or high pressure electric lines erected on the same poles as extra-high-pressure electric lines may in all cases be bare, unless the Minister otherwise directs.

(*e*) The wires shall be placed as follows:—

(i) No medium or lower-pressure wires shall be above the level of any high or extra-high pressure wires:

(ii) No high-pressure wires shall be above the level of any extra-high-pressure wires:

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

Provided that where lines cross any other separately owned aerial lines, in accordance with Regulation 120 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.

TELEPHONE-LINES ON ELECTRIC-LINE POLES.

157. (1) Telephone-lines supported on electric-line poles shall be of wire having an area of not less than 0·008 sq. in. (1/·104 No. 12. S.W.G. 7/·036 or 7/20).

(2) When the induced voltage on the telephone-wires exceeds 650 volts the telephone-lines shall be deemed to be high-pressure electric lines, and clearance between other lines and ground-level shall be provided in accordance with the relevant requirements of Regulations 113 to 131 hereof.

(3) The minimum clearance between the lowest point of the span and ground-level of any telephone-line supported on electric-line poles shall be 18 ft. on any street and 16 ft. in any other place.

(4) The telephone shall be suitably guarded against lightning, and shall be equipped with fuses.

(5) If carried on poles also carrying high or extra-high pressure wires, such arrangement shall be made where the telephone is placed as will prevent the possibility of injury resulting to any person using the telephone as the result of a conductor coming into contact with the telephone-wires, or as the result of leakage or induction.

REMOVAL OF LINES.

158. (1) An overhead electric line (including a telephone-line) shall not be permitted to remain erected after it has ceased to be used for the supply of electrical energy or for telephone purposes, as the case may be, unless the licensee intends within a reasonable time again to use such line.

(2) 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 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 the overhead conductors by underground conductors.

UNDERGROUND CONDUCTORS.

159. Underground conductors shall be thoroughly insulated, and shall be protected from mechanical damage 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 provided with a cover of at least 9 in. Where laid under any place used by vehicles the cover shall be not less than 2 ft.

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

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

162. 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

163. Where any underground electric line is brought through the surface of the ground it shall—

(*a*) Unless steel-armoured, be completely enclosed in an efficiently earthed metal pipe, or boxed in with hardwood or other timber approved by the Inspecting Engineer, for a height of at least 12 ft. above the ground-level:

(*b*) When steel-armoured, be effectively earthed.

164. Electric lines placed in a tunnel or subway not in the sole occupation of the licensee shall be insulated, and protected by an earthed metallic sheath or enclosed in an earthed metal pipe.

165. When any high 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 or extra-high pressure electric line.

166. A high or extra-high pressure electric line shall not be used for the supply of energy before it has been completely laid, properly jointed, examined, and tested in accordance with Regulation 171 hereof.

STREET-BOXES.

167. The covers of street-boxes shall be so secured that they 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.

168. Extra-high pressure electric lines shall not pass through the same street-box as other electric lines unless they are enclosed in strong metal casing efficiently earthed.

169. Street-boxes containing extra-high pressure electric lines shall not contain water, gas, or other services pipes, or electric lines belonging to another licensee.

EARTHING UNDERGROUND CONDUIT.

170. All metal conduits, pipes, or casings containing high or extra-high pressure electric lines shall be effectively 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.

INSULATION OF ELECTRIC LINES.

171. 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 the electric line is to be used, and has withstood such application.

172. The insulation of every complete circuit used for the supply of electrical energy, including all machinery, apparatus, and devices forming part of or in connection with such circuit, shall be so maintained that the leakage-current shall not under any condition exceed one-thousandth part of the maximum supply-current. Suitable steps shall be taken promptly to locate such leakage and every such leakage shall be remedied without delay.

ELECTRIC SERVICE-LINES.

173. (1) Service connections from aerial lines shall be taken direct from insulators, and shall not be tapped off the aerial lines between supports.

(2) They shall be led as directly as possible to insulators firmly attached to a position on the consumer's buildings which is not accessible to any person without the use of a ladder or other special appliance.

(3) Service mains shall not be brought out through the roof or attached to insulators fixed on the roof of a building.

(4) Service mains shall enter the building as near as practicable to the point at which the service connection is first attached to the building.

174 (1) Service-lines shall on no account be run on bobbin or similar insulators attached to the exterior of a building. They may be carried on brackets attached to the building, provided that they are inaccessible from any portion of the building without the use of a ladder or other special appliance, and further provided that they are secured in such a manner that they cannot fall away from the insulator-support, or make contact with the building.

(2) The distance between the last point of attachment of the service-lines and the point of entry shall not exceed 30 in.

WORKING ON CONDUCTORS, APPARATUS, AND SWITCHBOARDS.

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

176. Except in case of emergency due to breakdown or other accident, no person shall work on live high pressure or extra-high pressure conductors or apparatus unless accompanied by a person competent to render assistance when necessary.

177. All men working on live electric conductors or live electrical apparatus shall be competent to apply the method of artificial respiration illustrated on the resuscitation notices required by these regulations to be displayed in power-houses and substations.

178. Where any high pressure or bare medium or low pressure conductor (except an earthed neutral or intermediate conductor) is in use no work shall be carried out on such conductor unless rubber gloves and safety belts, an insulated stand or rubber protective shields, or other means approved by the Chief Electrical Engineer of the Public Works Department are used 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.

179. Where electric conductors are disconnected from the source of supply, and are in proximity to live high or extra-high pressure electric conductors, care must be taken to effectively earth the conductors after disconnection and before work commences, in order to discharge electrostatic induction, and shall remain so earthed until all work thereon has been completed.

180. When working on high or extra-high pressure electric conductors or apparatus disconnected from the source of supply, the conductors and apparatus shall be effectively earthed at the point where the work is being carried out and shall remain so earthed until all work thereon has been completed.

181. All switches or 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 is again closed: 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. The main-line outdoor switches or circuit-breakers shall be locked when in the open position.

182. Properly designed clips attached to insulated sticks shall be used for earthing conductors. Chains shall on no account be used for earthing purposes.

183. When working on telephone wires supported on poles carrying high or extra-high pressure electric lines similar precautions to those provided in Regulation 178 hereof shall be taken.

184. When work has to be carried out on any high or extra-high pressure switchboard, then, unless the switchboard is otherwise so arranged as to secure that the work may be carried out without danger, 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 danger, the section on which work has to be done shall be made dead.

PROTECTION OF TELEGRAPH-WIRES AND TELEGRAPH APPARATUS.

185. 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.

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

187. In order to minimize inductive interference with telegraph circuits all generators and other synchronous apparatus shall have a wave form as near as possible to a sine wave as specified in the British Engineering Standards Association's Specification No. 169.

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

189. Where electric lines intersect or menace telegraph-lines the following conditions shall apply:—

(*a*) High-pressure electric lines 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*) of this regulation shall apply.

(*b*) Medium or any lower pressure electric lines shall be covered with triple braiding, thoroughly impregnated with weather-proof compound, unless the electric lines are bare, in which case the special conditions of paragraphs (*l*) to (*o*) of this regulation shall apply.

(*c*) Where lead-covered telegraph-cables and high or any lower pressure electric lines intersect, the high-pressure electric lines shall be covered with vulcanized rubber of not less than 600-mehogm grade, and the lower pressure electric lines shall be covered with triple braiding.

(*d*) The distance between high pressure electric lines and telegraph-lines at any point shall not be less than 4 ft. and between lower pressure electric lines and telegraph-lines shall not be less than 2 ft., except as provided in paragraph (*e*) of this regulation. At any intersection the distance between telegraph-lines and extra-high pressure lines up to 11,000 volts shall be 6 ft., and over 11,000 volts 8 ft. No provision as regards clearances need be made for guard-wires for telegraph-lines.

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

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

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

——	Medium, Low, and Extra-low Pressure.	High Pressure.	Extra-high Pressure.
(1) Covering ..	T.B.	V.I.R. in boroughs, town districts, and townships; bare outside these limits.	Bare.
(2) Vertical clearance to telegraph-line	2 ft.	4 ft...	6 ft., 11,000 volts; 8 ft. over 11,000 volts.
(3) Length of span at crossing	Not greater than normal span.		
(4) Length of adjoining spans	Not greater than normal span ..	Not greater than one and a half times normal span.	
(5) Construction to be provided against conductor breakage		Double cross-arms at crossing; double pin, strain or approved shackle insulators at crossing; no joints in crossing or adjacent spans. Strengths of supports and ties to withstand one broken wire.	Same as high pressure, but no shackle insulators.
(6) Protection to be provided against damage by broken wires	T.B.	(*a*) Earth-guards for 1/·160, No. 8 S.W.G. conductors (but use of double cross-arms not then compulsory). (*b*) V.I.R. covering in boroughs, town districts or townships.	Same as high pressure except V.I.R. requirements

(*h*) In cases where electric lines are erected before the telegraph-lines, 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 lines to conform to the requirements of Regulations 105 to 107, and 189 hereof and of the last preceding paragraph of this regulation:

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

(*i*) In the case of electric service-lines 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 telegraph-lines erected subsequent to the electric service-lines. Conversely, in the case of telegraph-lines 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-lines to provide regulation clearances shall be borne by the Post and Telegraph Department.

(*j*) Where electric lines, braided or rubber-covered, are erected along a route and at any time thereafter it is proposed to intersect such electric lines by telegraph-lines, the cost of protecting the telegraph-lines or of any alterations to the electric lines required by the Minister of Telegraphs shall be borne by the Post and Telegraph Department.

(*k*) Where electric lines, braided or rubber-covered, are erected subsequent to telegraph-lines, and intersect or menace such telegraph-lines, the cost of protection or of any alterations considered necessary by the Minister of Telegraphs to make any such lines conform to the requirements of these regulations shall be borne by the licensee.

(*l*) Where bare electric lines outside borough, town-district, or township limits are erected subsequent to telegraph-lines, and intersect or menace such telegraph-lines, the cost of all protection or of any alteration necessary to make any such lines conform to the requirements of these regulations shall be borne by the licensee.

(*m*) Where bare electric lines intersect or menace telegraph-lines 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 lines.

(*n*) Where it is proposed to intersect a bare electric line outside borough, town-district, or township limits by telegraph-lines 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-lines 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 shall be borne by the Post and Telegraph Department.

(*o*) Where telephone service-lines and any extra-high pressure or bare high pressure electric line intersect the following conditions shall apply:—

(i) If the conductors of the electric lines are of solid wire or of stranded wire of a size smaller than that specified in regulation 106 hereof, the telephone service-lines shall be protected by earthing guards approved by the Chief Telegraph Engineer.

(ii) If the said electric lines are 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 lines the cost of providing the earthing guards shall be borne by the Post and Telegraph Department.

190. Where metal extension-pieces are used for fixing medium or any lower pressure electric lines to the top of a telegraph-pole the insulator pin or metal work shall not make contact with the metal extension-piece, and wooden cross-arms 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 cross-arms may be omitted.

191. Lamp-brackets shall not be fixed to telegraph-poles without the consent of the Minister of Telegraphs. Where span-wire construction is used for supporting street-lamps 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.

192. When work on telegraph-lines is being carried out by the Post and Telegraph Department in the proximity of bare electric lines, such electric lines shall, at a time when it will cause the least inconvenience to the licensee, be temporarily disconnected from the source of supply if the District Telegraph Engineer so requests.

193. In the event of any dispute between the licensee and the Post and Telegraph Department regarding the interpretation or application of these regulations, the matter shall be referred to the Chief Electrical Engineer of the Public Works Department for adjudication, and his decision thereon shall be final.

RAILWAY-CROSSINGS.

194. No work of any nature, authorized by the license, shall be erected or constructed upon, over, or under any part of the New Zealand Government railways until the licensee has obtained the consent of the Minister of Railways thereto.

195. (1) Where overhead electric lines cross a railway the distance between any pole and the rail nearest the pole shall not, where practicable, be less than the height of the pole: Provided that if this spacing would span greater than 100 ft. the pole, where the ground is suitable, shall be placed nearer to such rail.

(2) The span where the line crosses the railway shall be kept as short as possible, and shall not exceed 100 ft. in length where practicable. No pole shall be placed at a less distance from the nearest rail than 12 ft. without the consent of the Minister of Railways, except that in the case of sidings the distance may be reduced to 9 ft. At loading sidings sufficient space shall be allowed for a driveway between rail and pole.

196. (1) The poles when carrying transmission or distribution lines shall, on each side of the railway, be embedded in concrete to a minimum depth of 12 in. below ground-level, and with a minimum radial thickness of 12 in., or, alternatively, the pole shall be effectively blocked at heel and surface.

(2) The poles at the crossing shall be stayed when required by means of a stranded stay-wire.

197. The minimum clearance above rail-level shall be 27 ft. for all electric lines of extra-high pressure, and 24 ft. for electric lines of lower pressures.

198. (1) Where conductors cross a railway, earthing-bars of types approved by the Minister of Railways shall be provided.

(2) All conductors in the crossing span shall be bare, except that where the electric lines cross the Post and Telegraph Department's lines the electric lines shall be in accordance with the requirements of Regulation 193 hereof.

(3) Where covered wire is used, the covering shall be removed for a distance of 2 ft. at all earthing-bars at the crossing, so that, in the event of a line falling, the bare wire will make contact with the earthing-bar.

(4) The earthing-bars are required only on the pole on that side of the railway on which the railway wires are erected, and on the approach span where the crossing is at an acute angle with the railway.

199. (1) The licensee's telephone-wires erected on electric-line poles shall have a minimum clearance above the rails of 22 ft. Telephone-lines not erected on electric-line poles shall have a minimum clearance above the rails of 18 ft.

(2) The licensee's telephone-wire shall be of galvanized iron, hard drawn copper, or copper-covered steel of an area not less than 0·008 sq. in. (1/·104 No. 12 S.W.G. 7/·036 or 7/20) where they cross a railway and for a full span on each side.

200. Guard-wires shall be erected by the Railway Department over the railway wires at the expense of the licensee wherever they may be deemed to be necessary by the Minister of Railways.

201. Wherever the words "Minister of Telegraphs" or "Minister" appear in any of these regulations, the same shall, in addition, be read as "Minister of Railways" in all cases where the Railway Department's interests are affected.

202. In the event of any dispute between the licensee and the Railways Department regarding the interpretation or application of these regulations the matter shall be referred to the Chief Electrical Engineer of the Public Works Department for adjudication, and his decision thereon shall be final.

SERVICE CONNECTIONS.

203. The licensee shall be responsible for the proper erection and maintenance, in a safe condition and in all respects fit for supplying electrical energy, of 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 consumer's main switch or fuse.

204. In delivering electrical energy to a consumer's main switchboard, the licensee shall exercise all due precautions to avoid risk of causing fire on the premises.

205. For the protection of tradesmen the licensee shall, on request by the consumer or consumers and on receipt of a guarantee to pay the cost, cut off the supply to any building or otherwise render the service-lines safe where any work has to be carried out in close proximity to these lines.

206. Service-fuses shall comply with the following requirements:—

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

(*b*) Outdoor fuses 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 service may be easily disconnected when work is being carried on outside the building, and to prevent unauthorized persons from replacing blown fuses or overfusing the service.

(*c*) Outdoor fuses shall be weatherproof, and if enclosed in a metal case such case shall not be earthed.

(*d*) Indoor fuses shall be contained within a suitably locked or sealed receptacle of fireproof construction.

(*e*) In case of 400-volts or 460-volts supply the phase or outer conductor fuses shall be separated by an insulating partition, and shall be so arranged that any two conductors cannot be accidentally touched simultaneously.

INSTALLATION ON CONSUMER'S PREMISES.

207. (1) For the purpose of ensuring that the requirements of these regulations and of the Electrical Wiring Regulations, 1927, are being complied with, the licensee shall require every consumer to serve upon him notice of—

(*a*) The consumer's intention to install or have installed electric lines, wires, fittings, apparatus, and appliances on any premises;

(*b*) The consumer's intention to make or have made any additions or alterations to his present installation.

(2) The consumer shall render the licensee every reasonable facility for inspecting and testing such electric lines, wires, fittings, apparatus, and appliances during the progress of the work and on its completion.

208. Unless the requirements of these regulations and of the Electrical Wiring Regulations, 1927, and of the Electrical Wiremen's Registration Act, 1925, are complied with, the licensee shall not connect to his electric lines the electric lines, wires, fittings, apparatus, and appliances on a consumer's premises.

209. The licensee shall inspect and test the installation 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 installation the licensee may charge the contractor a fee not exceeding 10s. for each reinspection or retest.

210. In the case of any electrical installation already supplied by a private plant or by some other licensee, the licensee may connect such installation to his electric lines subject to the requirements of subclause (2) of Regulation 5 of the Electrical Wiring Regulations, 1927, being complied with.

211. Where the electrical wiring work in connection with a consumer's installation has not been carried out by a person or persons authorized under the Electrical Wiremen's Registration Act, 1925, the licensee shall take the necessary proceedings under that Act.

212. Where the licensee declines to connect a consumer's installation he shall, on request, serve upon the consumer notice stating his reasons for so declining.

213. (1) Every consumer shall maintain in a safe condition and in all respects fit for conveying and utilizing electrical energy all electric lines, wires, fittings, apparatus, and appliances belonging to him.

(2) If a consumer fails so to maintain his installation the licensee shall—

(*a*) In the case where the installation is in a dangerous condition, forthwith discontinue to supply from his electric lines:

(*b*) In all cases discontinue to supply from his electric lines after a reasonable period has been allowed in which to effect repairs, and such repairs have not been effected:

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

214. (1) For the purpose of ascertaining that a consumer's installation is in a safe condition and in all respects fit for conveying and utilizing electrical energy, the licensee shall make periodical inspections and tests of such installation at intervals of not more than five years.

(2) The licensee shall, at any time on request by the consumer and on receipt of a guarantee to pay the cost thereof, inspect and test the consumer's installation.

215. (1) Before any meter used for the purpose of ascertaining the amount to be paid by the consumer for electrical energy is connected to any consumer's electric line or wire, 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 in the case of any newly-licensed area meters may, for a period of six months after the date of commencement of supply within such area, 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 as aforesaid before being tested is found on testing to have an error exceeding 2½ per cent. as aforesaid, it shall be immediately adjusted 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.

216. (1) If any consumer considers that his meter is inaccurate 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 having an error exceeding 2½ per cent. it shall be immediately adjusted to within 2½ per cent., or 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 his meter he may appeal to the Chief Electrical Engineer of the Public Works Department, 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.

217. 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, the wires, fittings, accessories, and apparatus of that consumer may, on his application to the Minister and on payment of the cost, be inspected and tested by the Inspecting Engineer. If the Inspecting Engineer is satisfied that such wires, fittings, and apparatus may be safely used the licensee shall, upon receipt of notice to that effect from the Inspecting Engineer, forthwith supply the consumer with electrical energy.

218. Such instructions as the Minister may from time to time approve as to the treatment of persons receiving electric shocks shall 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.

219. The licensee shall at least once in each year, either by printing on the account form or by means of a separate printed leaflet, notify every consumer to the following effect:—

"(*a*) Do not permit any one except a person registered or licensed under the Electrical Wiremen's Registration Act, 1925, to repair, alter, or make additions to your electrical installation. (Penalty under above Act, £20.)

"(*b*) You must notify [*Name of licensee*] of all proposed alterations and additions to the installation, and such alteration or addition shall not be effected until approved by [*Name of licensee*]. You should ascertain that your contractor has received the necessary permit.

"(*c*) Any deterioration of, or damage to, electrical equipment or wiring shall 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 shall be notified to [*Name of licensee*].

"(*e*) Any person other than [*Name of licensee*] or his employees tampering with electric lines or other apparatus the property of the said [*Name of licensee*] is liable to a fine not exceeding £20.

"(*f*) You are warned against using any portable handlamps other than those of types which comply with the requirements of the Electrical Wiring Regulations, 1927.

"(*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, gaspipes, &c.; conducting-material consists of damp concrete floors, brick walls, &c."

MAINTENANCE AND INSPECTION OF WORKS.

220. The licensee shall make regular inspections of the whole of his works authorized by the license, and shall maintain the same in good order and condition so as to ensure at all times continuity of service, and immunity from danger.

221. (1) The Minister may, at the expense of the licensee and at any time and from time to time, order an inspection to be made of the whole or any part of the works carried out or erected by the licensee under the license. If 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 such d fective electric line, apparatus, fittings, or appliances, as the case may be, until such defect is repaired or remedied to the satisfaction of the Inspecting Engineer.

(2) Where the licensee neglects to remedy defects within sixty days after a written notification thereof from the Chief Electrical Engineer of the Public Works Department, and continues to operate the electric line the Minister may:—

(*a*) Notify the licensee to discontinue operation until such time as the necessary steps have been taken to bring the electric lines into conformity with the regulations.

(*b*) Carry out or cause to be carried out such alterations or repairs as may be necessary to bring the electric lines 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.

222. 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.

(*b*) Lend to the Inspecting Engineer necessary available instruments required by him for the purpose of making any test.

(*c*) Render every reasonable assistance to the Inspecting Engineer.

(*d*) Arrange for an officer to accompany the Inspecting Engineer when necessary.

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

	£	s.	d.
(*a*) For any installation up to and including 100 kilowatts installed capacity	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*) Maintenance and extensions to plant or lines, per inspection	2	2	0
(*f*) Any inspection exceeding two days, extra fee per day	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.

COMPLIANCE WITH REGULATIONS.

224. For the purpose of ascertaining whether these regulations are being faithfully complied with by the licensee, the Chief Electrical Engineer of the Public Works Department or any person authorized by him in writing in that behalf, may at all reasonable times enter on the lands and works used by or in the occupation of the licensee.

CONSTRUCTION OR APPARATUS NOT SPECIALLY PROVIDED FOR.

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

PART III.—Regulations providing for the Removal or Alteration of any Dangerous Line or Apparatus erected prior to the coming into force of these Regulations (whether erected pursuant to a License under the Public Works Amendment Act, 1911, or any other Act, or not) at the Expense in each case of the Owner of the Line or Apparatus :—

DANGEROUS LINES.

226. The following electric lines erected before the coming into force of these regulations shall be deemed to be dangerous lines for the purpose of Regulation 228 hereof :—

(*a*) Any electric line not having the minimum clearance above ground-level prescribed with respect to such line by Regulations 113 to 117 hereof, if the Chief Electrical Engineer of the Public Works Department 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 electric line which does not comply with the requirements of Regulations 118 to 131 hereof.

(*c*) Any line normally accessible to any person from any building or part of a building, or from any post, fence, or bank :

(*d*) Any line which, owing to defective binders, insulators, cross-arms, supports, or poles, is insecurely supported :

(*e*) Any 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 intermediate 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 line pulled up with too great a tension :

(*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 line erected on a pole carrying telegraph-wires and not supported on a cross-arm marked with distinctive red marking.

(*k*) Any overhead or underground circuit supplied from an unattended generating-station or substation 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 overhead or underground 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 or extra-high pressure star-connected system with the neutral point earthed which at any time after the expiration of two years from the coming into force of these regulations is not equipped with earth leakage relays as required by Regulation 37 hereof :

(*n*) Any service-line run on bobbin or similar insulators attached to the exterior of a building.

DANGEROUS APPARATUS.

227. The following electrical apparatus installed before the coming into force of these regulations shall be deemed to be dangerous apparatus for the purpose of the next succeeding regulation.

(*a*) Every switchboard which does not comply with the requirements of Regulations 58 to 65 hereof unless such steps as the Chief Electrical Engineer of the Public Works Department directs are taken to render it reasonably safe :

(*b*) Any door of an unattended power-house or substation which does not comply with the requirements of Regulation 67 hereof.

(*c*) Any high pressure or extra-high pressure transformer accessible to any unauthorized person :

(*d*) Any enclosed switch or circuit-breaker which has no external device to indicate clearly whether it is opened or closed :

(*e*) Any unearthed metal work (except handrails of pole substations) which is not normally connected to a circuit and which may become alive.

DANGEROUS LINES AND APPARATUS TO BE MADE SAFE.

228. On receipt of a written notice from the Minister to the effect that any line or apparatus is dangerous, the licensee or other proprietor of such line or apparatus shall immediately take steps to render it safe and make it comply with these regulations. If the licensee or proprietor fails to do so within ten days after the receipt by him of such notice the dangerous line or apparatus may be removed or altered, as the Minister may direct, at the expense of the owner of such line, and the cost of such removal or alteration shall constitute a debt due to the Crown.

PART IV.—Penalties for Breaches of Licenses and Regulations.

229. (1) If any licensee—

(*a*) Fails to use and maintain the 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, 1908, 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 and is liable for each such offence to a fine of £20.

(2) Where the Governor-General is of opinion that any offence by a licensee, as aforesaid, 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 revoke the license.

(3) 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.

(4) 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.

230. Every person, other than a licensee, who commits a breach of any of these regulations or who, without lawful authority, tampers with any electric lines or electrical apparatus subject to these regulations commits an offence and is liable to a fine of £20.

SCHEDULE.

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 = $9{\cdot}45 \times 10^{-6}$ per degree Fahrenheit; maximum allowable stress = 25,000 lb. per square inch; modulus of elasticity = 18×10^{6} lb. per square inch.

(A.) 7/·036 in. (7/20 S.W.G.).

Constants.—Area, 0·00712 sq. in.; diameter, 0·108 in.; loading factor, 3·987; maximum tension in conductor, 178 lb.; weight, 0·028 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 4	126	0 5	104	0 6	83	0 7	66	0 9	50	1 0
140 ..	141	0 6	118	0 7	97	0 8½	78	0 10½	62	1 1	49	1 5
160 ..	131	0 8	109	0 10	89	1 0	72	1 3	59	1 6	48	1 10
180 ..	119	0 11½	99	1 2	82	1 5	67	1 8	56	2 0	47	2 5

(B.) 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. 0.		Degrees Fahrenheit above Datum. 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 3¾	203	0 4⅝	169	0 5¼	137	0 6½	108	0 8½	83	0 11
140 ..	229	0 5½	195	0 6¼	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

(C.) 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. 0.		Degrees Fahrenheit above Datum. 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 3⅜	287	0 4½	243	0 5¼	200	0 6½	159	0 8	122	0 10
140 ..	334	0 5¼	282	0 6⅓	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

(D.) 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. 0.		Degrees Fahrenheit above Datum. 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 5¾	380	0 7	312	0 8½	250	0 10½	199	1 1
160 ..	515	0 6½	441	0 7¾	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

(E.) 19/·052 in.

Constants.—Area, 0·0403 sq. in.; diameter, 0·260 in.; loading factor, 1·923; maximum tension in conductor, 1008 lb.; weight, 0·1582 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 3½	846	0 4	716	0 4¾	589	0 5¾	469	0 7½	364	0 9½
140 ..	970	0 4¾	838	0 5½	709	0 6½	586	0 8	472	0 10	374	1 0
160 ..	958	0 6½	828	0 7½	702	0 8½	583	0 10½	475	1 1	383	1 4
180 ..	946	0 8	817	0 9½	696	0 11	580	1 1	478	1 4	392	1 8

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

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

Constants.—Coefficient of thermal expansion = $9{\cdot}45 \times 10^{-6}$ 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/·036 in. (7/20 S.W.G.).

Constants.—Area (copper), 0·00712 sq. in.; diameter (covered), 0·259 in.; loading factor, 5·16; maximum tension in conductor, 178 lb.; weight of covered conductor, 0·0513 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	61	1 6	54	1 9	48	1 11	43	2 2	40	2 4	37	2 6
140 ..	51	2 6	47	2 8	43	2 11	41	3 1	38	3 4	36	3 6
160 ..	46	3 7	43	3 9	41	4 0	39	4 3	37	4 5	36	4 7
180 ..	43	4 10	41	5 1	40	5 3	38	5 6	37	5 8	35	5 10

(B.) 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. 0.		Degrees Fahrenheit above Datum. 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 9½	128	0 11½	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

(C.) 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. 0.		Degrees Fahrenheit above Datum. 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 8½	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

(D.) 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. 0.		Degrees Fahrenheit above Datum. 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

(E.) 19/·052 in.

Constants.—Area (copper), 0·0403 sq. in.; diameter (covered), 0·482 in.; loading factor, 2·31; maximum tension in conductor, 1008 lb.; weight of covered conductor, 0·2324 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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, 1525 lb.; weight of covered conductor, 0·3378 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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

(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, 1935 lb.; weight of covered conductor, 0·4131 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 4¾	1600	0 5½	1360	0 6½	1127	0 8	928	0 9½	754	1 0
140 ..	1816	0 6½	1573	0 7½	1339	0 8½	1122	0 10½	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, 2570 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 4½	2160	0 5¼	1836	0 6¼	1528	0 7½	1245	0 9	1003	0 11
140 ..	2466	0 6¼	2140	0 7	1825	0 8½	1529	0 10	1263	1 0	1039	1 3
160 ..	2436	0 8½	2116	0 9½	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 = $9{\cdot}45 \times 10^{-6}$ 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/·036 in. (7/20 S.W.G.).

Constants.—Area (copper), 0·00712 sq. in.; diameter (covered), 0·259 in.; loading factor, 4·94; maximum tension in conductor, 178 lb.; weight of covered conductor, 0·0536 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 ..	63	1 6	56	1 9	50	1 11	45	2 2	41	2 4	38	2 6
140 ..	53	2 6	49	2 8	45	2 11	42	3 1	40	3 4	38	3 6
160 ..	48	3 7	45	3 10	43	4 0	41	4 2	39	4 5	37	4 8
180 ..	45	4 10	42	5 1	41	5 4	40	5 6	38	5 8	37	5 10

(B.) 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

(C.) 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 7¾	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

(D.) 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. 0.		Degrees Fahrenheit above Datum. 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

(E.) 19/·052 in.

Constants.—Area (copper), 0·0403 sq. in.; diameter (covered), 0·441 in.; loading factor, 2·18; maximum tension in conductor, 1008 lb.; weight of covered conductor, 0·2278 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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

(F.) 19/·064 in. (19/16 S.W.G.).

Constants.—Area (copper), 0·061 sq. in.; diameter (covered), 0·513 in.; loading factor, 1·85; maximum tension in conductor, 1525 lb.; weight of covered conductor, 0·3285 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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

(G.) 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, 1935 lb.; weight of covered conductor, 0·409 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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

(H.) 19/·083 in.

Constants.—Area (copper), 0·1028 sq. in.; diameter (covered), 0·663 in.; loading factor, 1·6; maximum tension in conductor, 2570 lb.; weight of covered conductor, 0·533 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 4½	2165	0 5¼	1842	0 6¼	1534	0 7½	1252	0 9	1016	0 11
140 ..	2473	0 6½	2147	0 7½	1833	0 8½	1537	0 10	1272	1 0	1048	1 3
160 ..	2445	0 8½	2126	0 9½	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 ALUMINIUM.

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

Constants.—Coefficient of thermal expansion = $13·3 \times 10^{-6}$ per degree Fahrenheit; maximum allowable stress = 12,000 lb. per square inch; modulus of elasticity = 10×10^{6} lb. per square inch.

(A.) 3/·118 in.

Constants.—Area, 0·0328 sq. in.; diameter, 0·236 in.; loading factor, 6·11 maximum tension in conductor, 394 lb.; weight, 0·0392 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	324	0 2½	239	0 3½	158	0 5¼	94	0 9	60	1 2	44	1 7
140 ..	300	0 3¾	216	0 5½	141	0 8	87	1 1	60	1 7	47	2 1
160 ..	273	0 5½	192	0 8	125	1 0	82	1 6	61	2 0	49	2 7
180 ..	242	0 8	167	0 11	111	1 5	79	2 0	62	2 7	51	3 1

(B.) 3/·132 in.

Constants.—Area, 0·0409 sq. in.; diameter, 0·264 in.; loading factor, 5·5; maximum tension in conductor, 491 lb.; weight, 0·0489 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	420	0 2½	313	0 3¼	212	0 5	126	0 8	78	1 1	56	1 6
140 ..	396	0 3½	291	0 4¾	194	0 7	120	1 0	80	1 5	61	1 11
160 ..	368	0 5	266	0 7	176	0 10½	114	1 4	82	1 10	65	2 4
180 ..	336	0 7	239	0 10	159	1 2	109	1 9	83	2 4	68	2 10

(C.) 3/·144 in.

Constants.—Area, 0·0488 sq. in.; diameter, 0·288 in.; loading factor, 5·04; maximum tension in conductor, 586 lb.; weight, 0·0584 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	517	0 2½	389	0 3¼	267	0 4¾	162	0 8	97	1 1	70	1 6
140 ..	492	0 3½	367	0 4¾	249	0 7	154	0 11	101	1 5	76	1 11
160 ..	465	0 4¾	342	0 6½	230	0 10	148	1 3	103	1 10	80	2 4
180 ..	434	0 6½	315	0 9	212	1 1	142	1 8	105	2 3	85	2 9

(D.) 7/·110 in.

Constants.—Area, 0·0666 sq. in.; diameter, 0·330 in.; loading factor, 4·27; maximum tension in conductor, 800 lb.; weight, 0·0796 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 ..	732	0 2¼	558	0 3	390	0 4½	240	0 7	142	1 0	99	1 5
140 ..	708	0 3¼	536	0 4½	372	0 6	232	0 10	148	1 4	108	1 10
160 ..	681	0 4½	511	0 6	353	0 8½	226	1 1	153	1 8	115	2 3
180 ..	651	0 6	484	0 8	334	0 11	221	1 5	158	2 0	123	2 7

(E.) 7/·122 in.

Constants.—Area, 0·0818 sq. in.; diameter, 0·366 in.; loading factor, 3·87; maximum tension in conductor, 983 lb.; weight, 0·0978 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 ..	915	0 2¼	702	0 3	494	0 4¼	307	0 7	181	1 0	125	1 5
140 ..	891	0 3¼	680	0 4¼	476	0 6	301	0 9½	189	1 3	137	1 9
160 ..	863	0 4½	655	0 5¾	458	0 8	296	1 1	196	1 7	147	2 2
180 ..	834	0 5¾	628	0 7½	438	0 11	290	1 4	200	2 0	157	2 6

(F.) 7/·134 in.

Constants.—Area, 0·0985 sq. in.; diameter, 0·402 in.; loading factor, 3·55; maximum tension in conductor, 1182 lb.; weight, 0·1178 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 ..	1114	0 2¼	857	0 3	606	0 4¼	379	0 7	224	0 11	152	1 5
140 ..	1092	0 3	837	0 4	591	0 6	376	0 9	236	1 2	168	1 9
160 ..	1063	0 4¼	810	0 5½	571	0 8	371	1 0	245	1 6	182	2 1
180 ..	1033	0 5½	784	0 7¼	552	0 10	367	1 3	254	1 10	194	2 6

(G.) 7/·144 in.

Constants.—Area, 0·114 sq. in.; diameter, 0·432 in.; loading factor, 3·32; maximum tension in conductor, 1368 lb.; weight, 0·1362 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 ..	1300	0 2¼	1001	0 3	710	0 4¼	446	0 6½	263	0 11	178	1 4
140 ..	1276	0 3	980	0 4	696	0 5¾	443	0 9	277	1 2	197	1 8
160 ..	1249	0 4¼	956	0 5½	678	0 8	442	1 0	291	1 6	214	2 0
180 ..	1217	0 5½	928	0 7	658	0 10	438	1 3	301	1 10	229	2 5

(H.) 7/·149 in.

Constants.—Area, 0·1220 sq. in.; diameter, 0·447 in.; loading factor, 3·23; maximum tension in conductor, 1463 lb.; weight, 0·1458 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 ..	1395	0 2¼	1076	0 3	765	0 4	481	0 6½	283	0 11	191	1 4
140 ..	1371	0 3	1054	0 4	749	0 5¾	479	0 9	299	1 2	212	1 8
160 ..	1344	0 4¼	1030	0 5½	732	0 7½	477	1 0	313	1 6	230	2 0
180 ..	1313	0 5½	1002	0 7	713	0 10	475	1 3	326	1 10	246	2 5

(I.) 7/·154 in.

Constants.—Area, 0·1305 sq. in.; diameter, 0·462 in.; loading factor, 3·12; maximum tension in conductor, 1567 lb.; weight, 0·156 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 ..	1499	0 2¼	1157	0 3	824	0 4	520	0 6½	305	0 11	205	1 4
140 ..	1475	0 3	1136	0 4	809	0 5¾	518	0 9	323	1 2	227	1 8
160 ..	1448	0 4¼	1111	0 5½	791	0 7½	516	0 11	338	1 6	247	2 0
180 ..	1418	0 5¼	1085	0 7	773	0 10	515	1 3	355	1 9	266	2 4

(J.) 7/·164 in.

Constants.—Area, 0·1477 sq. in.; diameter, 0·492 in.; loading factor, 2·96; maximum tension in conductor, 1772 lb.; weight, 0·1765 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 ..	1703	0 2¼	1318	0 3	938	0 4	595	0 6½	350	0 11	234	1 4
140 ..	1680	0 3	1296	0 4	925	0 5½	595	0 8½	370	1 2	260	1 8
160 ..	1653	0 4	1272	0 5¼	909	0 7½	595	0 11½	389	1 5	284	2 0
180 ..	1622	0 5¼	1245	0 7	900	0 9½	595	1 2	404	1 9	303	2 4

(K.) 7/·173 in.

Constants.—Area, 0·1643 sq. in.; diameter, 0·519 in.; loading factor, 2·82; maximum tension in conductor, 1971 lb.; weight, 0·1965 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 ..	1903	0 2¼	1473	0 3	1053	0 4	668	0 6½	392	0 11	264	1 4
140 ..	1882	0 3	1455	0 4	1041	0 5½	671	0 8½	417	1 2	291	1 8
160 ..	1853	0 4	1429	0 5¼	1024	0 7½	672	0 11	438	1 6	318	2 0
180 ..	1822	0 5¼	1402	0 7	1007	0 9½	674	1 2	458	1 9	342	2 4

TABLE V.—BARE (H.D.) COPPER.

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

Constants.—Coefficient of thermal expansion = $9{\cdot}45 \times 10^{-6}$ per degree Fahrenheit; maximum allowable stress = 25,000 lb. per square inch; modulus of elasticity = 18×10^{6} lb. per square inch.

(A.) 1/·128 in. (10 S.W.G.).

Constants.—Area, 0·01287 sq. in.; diameter, 0·128 in.; loading factor, 4·0; maximum tension in conductor, 322 lb.; weight, 0·0496 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 ..	218	0 11	181	1 1	149	1 4	122	1 8	101	2 0	86	2 4
220 ..	179	1 8	150	2 0	127	2 5	109	2 9	95	3 2	85	3 6
260 ..	146	2 10	127	3 4	112	3 9	100	4 2	91	4 7	84	5 0
300 ..	125	4 6	113	4 11	103	5 5	95	5 10	88	6 4	84	6 8
340 ..	112	6 5	104	6 11	97	7 5	91	7 10	87	8 3	82	8 9
380 ..	104	8 7	98	9 2	93	9 8	89	10 1	85	10 6	82	10 11

(B.) 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 9½	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

(C.) 7/·036 in. (7/20 S.W.G.).

Constants.—Area, 0·00712 sq. in.; diameter, 0·108 in.; loading factor, 5·86; maximum tension in conductor, 178 lb.; weight, 0·028 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 ..	64	1 9	54	2 1	46	2 6	40	2 10	36	3 2	33	3 5
220 ..	47	3 7	43	3 11	40	4 3	37	4 7	34	5 0	32	5 4
260 ..	41	5 9	37	6 5	36	6 7	34	6 11	33	7 4	31	7 7
300 ..	38	8 3	36	8 9	35	9 0	33	9 6	32	9 10	31	10 2
340 ..	36	11 3	35	11 6	34	11 11	33	12 3	32	12 7	31	13 0
380 ..	34	14 10	34	14 10	33	15 3	32	15 9	31	16 4	31	16 4

(D.) 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

(E.) 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

(F.) 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. 0.		Degrees Fahrenheit above Datum. 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

(G.) 19/·052 in.

Constants.—Area, 0·0403 sq. in.; diameter, 0·260 in.; loading factor, 2·66; maximum tension in conductor, 1008 lb.; weight, 0·1582 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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

(H.) 19/·064 in. (19/16 S.W.G.).

Constants.—Area, 0·061 sq. in.; diameter, 0·320 in.; loading factor, 2·2; maximum tension in conductor, 1525 lb.; weight, 0·2395 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 VI.—TRIPLE BRAIDED (H.D.) COPPER.

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

Constants.—Coefficient of thermal expansion = $9{\cdot}45 \times 10^{-6}$ per degree Fahrenheit; maximum allowable stress = 25,000 lb. per square inch; modulus of elasticity = 8×10^6 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/·036 in. (7/20 S.W.G.).

Constants.—Area (copper), 0·00712 sq. in.; diameter (covered), 0·259 in.; loading factor, 7·64; maximum tension in conductor, 178 lb.; weight of covered conductor, 0·0513 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	26	8 1	25	8 2	25	8 4	24	8 6	24	8 7	24	8 9
220 ..	25	12 6	24	12 7	24	12 9	24	12 11	24	13 0	23	13 2
260 ..	24	17 9	24	17 11	24	18 1	24	18 2	23	18 4	23	18 5
300 ..	24	24 0	24	24 1	24	24 2	23	24 4	23	24 6	23	24 8
340 ..	24	31 0	24	31 2	23	31 4	23	31 3	23	31 7	23	31 8
380 ..	24	38 10	23	38 11	23	39 0	23	39 2	23	39 4	23	39 5

(B.) 7/·044 in.

Constants.—Area (copper), 0·0105 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. 0.		Degrees Fahrenheit above Datum. 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

(C.) 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. 0.		Degrees Fahrenheit above Datum. 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

(D.) 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. 0.		Degrees Fahrenheit above Datum. 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

(E.) 19/·052 in.

Constants.—Area (copper), 0·0403 sq. in.; diameter (covered), 0·482 in.; loading factor, 3·27; maximum tension in conductor, 1008 lb.; weight of covered conductor, 0·2324 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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

(F.) 19/·064 in. (19/16 S.W.G.).

Constants.—Area (copper), 0·061 sq. in.; diameter (covered), 0·598 in.; loading factor, 2·84; maximum tension in conductor, 1525 lb.; weight of covered conductor, 0·3378 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 VII.—V.I.R. (H.D.) COPPER.

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

Constants.—Coefficient of thermal expansion = $9{\cdot}45 \times 10^{-6}$ 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/·036 in. (7/20 S.W.G.).

Constants.—Area (copper), 0·00712 sq. in.; diameter (covered), 0·259 in.; loading factor, 7·33; maximum tension in conductor, 178 lb.; weight of covered conductor, 0·0536 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	27	8 1	26	8 3	26	8 5	25	8 6	25	8 7	25	8 9
220 ..	26	12 6	25	12 8	25	12 10	25	12 11	25	13 0	24	13 2
260 ..	25	17 10	25	17 11	25	18 0	25	18 2	24	18 4	24	18 5
300 ..	25	24 0	25	24 2	25	24 3	24	24 5	24	24 6	24	24 8
340 ..	25	31 1	25	31 2	24	31 4	24	31 5	24	31 7	24	31 8
380 ..	25	38 10	24	39 0	24	39 1	24	39 3	24	39 5	24	39 6

(B.) 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. 0.		Degrees Fahrenheit above Datum. 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

(C.) 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

(D.) 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

(E.) 19/·052 in.

Constants.—Area (copper), 0·0403 sq. in.; diameter (covered), 0·441 in.; loading factor, 3·07; maximum tension in conductor, 1008 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

(F.) 19/·064 in. (19/16 S.W.G.).

Constants.—Area (copper), 0·0610 sq. in.; diameter (covered), 0·513 in.; loading factor, 2·55; maximum tension in conductor, 1525 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.
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	656	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 VIII.—BARE ALUMINIUM.

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

Constants.—Coefficient of thermal expansion = $13{\cdot}3 \times 10^{-6}$ per degree Fahrenheit; maximum allowable stress = 12,000 lb. per square inch; modulus of elasticity = 10×10^{6} lb. per square inch.

(A.) 3/·118 in.

Constants.—Area, 0·0328 sq. in.; diameter, 0·236 in.; loading factor, 9·18; maximum tension in conductor, 394 lb.; weight, 0·0392 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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	1 8	71	2 2	57	2 9	49	3 3	43	3 8	39	4 1
220 ..	67	3 6	58	4 1	51	4 7	47	5 1	43	5 6	40	5 11
260 ..	57	5 9	52	6 4	49	6 9	46	7 3	43	7 8	41	8 1
300 ..	53	8 4	50	8 10	47	9 4	45	9 9	43	10 3	41	10 8
340 ..	50	11 4	48	11 10	46	12 2	44	12 9	43	13 2	42	13 7
380 ..	48	14 8	47	15 2	45	15 7	44	16 0	43	16 6	42	16 11

(B.) 3/·132 in.

Constants.—Area, 0·0409 sq. in.; diameter, 0·264 in.; loading factor, 8·17; maximum tension in conductor, 491 lb.; weight, 0·0489 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	169	1 2	114	1 9	86	2 4	70	2 10	60	3 4	53	3 9
220 ..	109	2 9	88	3 4	75	3 11	66	4 6	60	5 0	55	5 5
260 ..	87	4 8	77	5 4	70	5 11	64	6 5	60	6 11	56	7 4
300 ..	78	7 1	72	7 9	67	8 2	63	8 8	60	9 2	57	9 8
340 ..	73	9 8	69	10 3	64	10 11	62	11 5	60	11 9	57	12 4
380 ..	70	12 8	67	13 3	64	13 9	62	14 3	60	14 9	58	15 2

(C.) 3/·144 in.

Constants.—Area, 0·0488 sq. in.; diameter, 0·288 in.; loading factor, 7·49; maximum tension in conductor, 586 lb.; weight, 0·0584 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	253	0 11	168	1 5	118	2 0	92	2 7	77	3 1	67	3 6
220 ..	164	2 2	124	2 10	102	3 6	87	4 1	77	4 7	70	5 0
260 ..	124	4 0	106	4 8	94	5 3	85	5 10	78	6 4	72	6 10
300 ..	107	6 2	97	6 9	89	7 4	83	7 11	78	8 5	73	8 11
340 ..	99	8 7	92	9 2	87	9 9	82	10 4	78	10 10	74	11 6
380 ..	93	11 3	89	11 11	85	12 5	81	13 0	78	13 6	75	14 0

(D.) 7/·110 in.

Constants.—Area, 0·0666 sq. in.; diameter, 0·330 in.; loading factor, 6·3; maximum tension in conductor, 800 lb.; weight, 0·0796 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	472	0 8	324	1 0	215	1 6	154	2 1	122	2 8	102	3 2
220 ..	344	1 4	241	2 0	180	2 8	145	3 4	123	3 11	108	4 5
260 ..	251	2 8	195	3 5	162	4 2	139	4 10	124	5 5	112	6 0
300 ..	202	4 5	172	5 3	151	5 11	136	6 7	124	7 2	115	7 10
340 ..	178	6 6	159	7 3	145	7 11	134	8 7	125	9 2	117	9 10
380 ..	164	8 9	151	9 6	141	10 2	133	10 10	125	11 6	119	12 1

(E.) 7/·122 in.

Constants.—Area, 0·0818 sq. in.; diameter, 0·366 in.; loading factor, 5·71; maximum tension in conductor, 983 lb.; weight, 0·0978 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	0 7½	460	0 10½	305	1 4	211	1 10	161	2 5	133	3 0
220 ..	512	1 2	357	1 8	256	2 4	198	3 0	164	3 7	142	4 2
260 ..	387	2 2	288	2 10	228	3 7	191	4 4	166	5 0	148	5 7
300 ..	306	3 7	248	4 6	211	5 3	186	5 11	167	6 7	153	7 3
340 ..	262	5 5	226	6 3	202	7 0	183	7 9	168	8 5	157	9 0
380 ..	236	7 6	213	8 4	195	9 1	181	9 9	169	10 5	159	11 1

(F.) 7/·134 in.

Constants.—Area, 0·0985 sq. in.; diameter, 0·402 in.; loading factor, 5·21; maximum tension in conductor, 1182 lb.; weight, 0·1178 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 ..	850	0 7	612	0 9½	410	1 2	271	1 9	207	2 4	168	2 10
220 ..	703	1 0	497	1 5	349	2 1	262	2 9	212	3 4	181	3 11
260 ..	559	1 9	406	2 5	310	3 3	252	3 11	216	4 7	190	5 3
300 ..	445	3 0	348	3 10	287	4 7	246	5 5	218	6 1	197	6 9
340 ..	374	4 7	313	5 5	272	6 3	240	7 1	220	7 9	202	8 5
380 ..	332	6 5	292	7 4	262	8 1	239	8 11	221	9 7	206	10 4

(G.) 7/·144 in.

Constants.—Area, 0·114 sq. in.; diameter, 0·432 in.; loading factor, 4·87; maximum tension in conductor, 1368 lb.; weight, 0·1362 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 ..	1024	0 6½	754	0 8¾	510	1 1	342	1 7	250	2 2	201	2 9
220 ..	882	0 11	631	1 4	441	1 10	324	2 7	258	3 2	217	3 10
260 ..	726	1 7	526	2 2	393	2 11	313	3 8	263	4 5	230	5 0
300 ..	591	2 7	457	3 4	362	4 3	305	5 0	267	5 9	239	6 5
340 ..	498	3 11	403	4 11	342	5 9	301	6 7	270	7 3	246	8 0
380 ..	434	5 8	373	6 7	330	7 6	297	8 3	272	9 0	252	9 10

(H.) 7/·149 in.

Constants.—Area, 0·122 sq. in.; diameter, 0·447 in.; loading factor, 4·71; maximum tension in conductor, 1463 lb.; weight, 0·1458 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 ..	1123	0 6¼	827	0 8½	562	1 1	376	1 7	273	2 2	218	2 9
220 ..	976	0 11	703	1 3	491	1 10	358	2 6	282	3 2	237	3 11
260 ..	816	1 6	591	2 1	438	2 10	345	3 7	288	4 3	250	4 11
300 ..	671	2 5	508	3 3	404	4 1	338	4 10	294	5 7	261	6 4
340 ..	564	3 9	454	4 8	382	5 6	333	6 4	297	7 1	269	7 10
380 ..	492	5 4	418	6 4	366	7 3	328	8 1	299	8 10	276	9 7

(I.) 7/·154 in.

Constants.—Area, 0·1305 sq. in.; diameter, 0·462 in.; loading factor, 4·56; maximum tension in conductor, 1567 lb.; weight, 0·156 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 ..	1260	0 6	908	0 8½	620	1 0	408	1 7	298	2 1	236	2 8
220 ..	1079	0 10½	782	1 2	545	1 9	394	2 5	308	3 1	257	3 8
260 ..	915	1 5	664	2 0	489	2 8	381	3 6	316	4 2	273	4 10
300 ..	762	2 4	573	3 1	450	3 11	373	4 9	321	5 6	285	6 2
340 ..	641	3 6	510	4 5	424	5 4	367	6 2	325	6 11	295	7 8
380 ..	559	5 0	469	6 0	407	6 11	363	7 9	329	8 7	303	9 3

(J.) 7/·164 in.

Constants.—Area, 0·1477 sq. in.; diameter, 0·492 in.; loading factor, 4·3; maximum tension in conductor, 1772 lb.; weight, 0·1765 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 ..	1437	0 6	1068	0 8	735	1 0	488	1 6	348	2 1	273	2 7
220 ..	1282	0 10	938	1 2	655	1 8	469	2 3	362	2 11	299	3 7
260 ..	1113	1 4	812	1 10	593	2 6	456	3 3	373	4 0	319	4 8
300 ..	950	2 1	706	2 10	547	3 8	447	4 5	382	5 1	337	5 11
340 ..	808	3 2	631	4 1	516	4 11	439	5 10	388	6 7	347	7 4
380 ..	703	4 6	578	5 5	494	6 5	434	7 3	391	8 2	357	8 11

(K.) 7/·173 in.

Constants.—Area, 0·1643 sq. in.; diameter, 0·519 in.; loading factor, 4·08; maximum tension in conductor, 1971 lb.; weight, 0·1965 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 ..	1635	0 5¾	1223	0 8	848	0 11	563	1 5	398	2 0	310	2 7
220 ..	1480	0 9½	1091	1 1	766	1 7	544	2 2	416	2 10	339	3 6
260 ..	1308	1 3	961	1 9	698	2 3	539	3 1	429	3 10	365	4 7
300 ..	1134	1 11	846	2 7	646	3 5	520	4 3	439	5 0	384	5 9
340 ..	979	2 11	758	3 9	610	4 8	513	5 6	447	6 4	399	7 1
380 ..	856	4 2	693	5 1	583	6 1	507	7 0	453	7 10	412	8 7

TABLE IX.—BARE STEEL-CORED ALUMINIUM.

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

Constants.—Coefficient of thermal expansion = $10{\cdot}55 \times 10^{-6}$ per degree Fahrenheit; modulus of elasticity = $12{\cdot}5 \times 10^{6}$ lb. per square inch.

NOTE.—This table is for use with wires having a breaking-strength not less than that stated for each size of wire.

(A.) 7/·0586 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

(B.) 7/·066 in.

Constants.—Area, 0·02395 sq. in.; breaking-strength, 1185 lb.; diameter, 0·198 in.; loading factor, 8·312; maximum tension in conductor, 474·0 lb.; weight, 0·036 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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, 0·030106 sq. in.; breaking-strength, 1464 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. 0.		Degrees Fahrenheit above Datum. 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 5¼	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	89	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, 1718 lb.; diameter, 0·249 in.; loading factor, 6·627; maximum tension in conductor, 687·2 lb.; weight, 0·057 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	246	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/·9035 in.

Constants.—Area, 0·048 sq. in.; breaking-strength, 2181 lb.; diameter, 0·281 in.; loading factor, 5·757; maximum tension in conductor, 872·4 lb.; weight, 0·07266 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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

(F.) 7/·102 in.

Constants.—Area, 0·05720 sq. in.; breaking-strength, 2548 lb.; diameter, 0·306 in.; loading factor, 5·409; maximum tension in conductor, 1019·2 lb.; weight, 0·08633 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	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, 3410 lb.; diameter, 0·354 in.; loading factor, 4·698; maximum tension in conductor, 1363·8 lb.; weight, 0·11566 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	1178	0 4¾	975	0 5¾	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, 4106 lb.; diameter, 0·396 in.; loading factor, 4·227; maximum tension in conductor, 1642·4 lb.; weight, 0·1446 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	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, 4886 lb.; diameter, 0·432 in.; loading factor, 3·892; maximum tension in conductor, 1954·4 lb.; weight, 0·1723 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	1744	0 5	1456	0 5¾	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	585	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

(J.) 7/·157 in.

Constants.—Area, 0·1355 sq. in.; breaking-strength, 5586 lb.; diameter, 0·471 in.; loading factor, 3·595; maximum tension in conductor, 2234·4 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, 5874 lb.; diameter, 0·483 in.; loading factor, 3·511; maximum tension in conductor, 2349·6 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, 6061 lb.; diameter, 0·498 in.; loading factor, 3·413; maximum tension in conductor, 3030·5 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 3¾	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, 6819 lb.; diameter, 0·531 in.; loading factor, 3·219; maximum tension in conductor, 3409·5 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 X.—BARE COPPER-COVERED STEEL.

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

Constants.—Coefficient of thermal expansion = $7{\cdot}2 \times 10^{-6}$ per degree Fahrenheit; modulus of elasticity = 20×10^{7} lb. per square inch.

NOTE.—This table is for use with wires having a breaking-strength not less than that stated for each size of wire.

(A.) 1/·128 in. (10 S.W.G.).

Constants.—Area, 0·0129 sq. in.; breaking-strength, 1200 lb.; diameter, 0·128 in.; loading factor, 4·315; maximum tension in conductor, 480 lb.; weight, 0·046 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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	388	0 5¾	352	0 6½	316	0 7	280	0 8	246	0 9
220 ..	397	0 8½	362	0 9¼	326	0 10	292	0 11½	258	1 1	226	1 3
260 ..	366	1 1	332	1 2	298	1 4	265	1 6	234	1 8	205	1 11
300 ..	332	1 7	299	1 9	268	1 11	238	2 2	210	2 6	186	2 9
340 ..	296	2 3	266	2 6	238	2 10	212	3 2	190	3 6	170	3 11
380 ..	261	3 2	235	3 7	212	3 11	192	4 4	174	4 9	159	5 3

(B.) 1/·162 in.

Constants.—Area, 0·02062 sq. in.; breaking-strength, 1800 lb.; diameter, 0·162 in.; loading factor, 3·475; maximum tension in conductor, 720 lb.; weight, 0·073 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	658	0 5½	600	0 6	543	0 6½	485	0 7½	430	0 8½	376	0 9½
220 ..	629	0 8½	572	0 9½	516	0 10½	460	0 11½	406	1 1	355	1 3
260 ..	594	1 0	538	1 2	484	1 3	432	1 5	381	1 7	334	1 10
300 ..	556	1 6	502	1 8	450	1 10	402	2 1	356	2 4	315	2 7
340 ..	514	2 1	464	2 3	417	2 6	373	2 10	332	3 2	297	3 7
380 ..	472	2 9	426	3 1	384	3 5	344	3 10	312	4 3	282	4 8

(C.) 1/·204 in.

Constants.—Area, 0·03278 sq. in.; breaking-strength, 2650 lb.; diameter, 0·204 in.; loading factor, 2·821; maximum tension in conductor, 1060 lb.; weight, 0·116 lb. per foot.

Span.	Datum. 0.		Degrees Fahrenheit above Datum. 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 ..	987	0 5¾	896	0 6¼	806	0 7	715	0 8	629	0 9	544	0 10½
220 ..	953	0 9	863	0 10	776	0 11	689	1 0	605	1 2	526	1 4
260 ..	914	1 1	827	1 2	740	1 4	657	1 6	580	1 8	509	1 11
300 ..	869	1 6	785	1 8	704	1 10	627	2 1	556	2 4	492	2 8
340 ..	823	2 0	744	2 3	668	2 6	596	2 10	532	3 2	476	3 6
380 ..	773	2 9	698	3 0	630	3 4	566	3 8	510	4 1	461	4 6

TABLE XI.—BARE GALVANIZED IRON.

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

Constants.—Coefficient of thermal expansion = $6{\cdot}8 \times 10^{-6}$ per degree Fahrenheit; maximum allowable stress = 22,500 lb. per square inch; modulus of elasticity = 26×10^{6} lb. per square inch.

(A.) 1/·128 in. (10 S.W.G.).

Constants.—Area, 0·01287 sq. in.; diameter, 0·128 in.; loading factor, 4·518; maximum tension in conductor, 290 lb.; weight, 0·0436 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 ..	131	1 4	109	1 8	92	1 11	80	2 3	71	2 6	64	2 9		
220 ..	102	2 7	90	2 11	81	3 3	74	3 7	69	3 10	64	4 2		
260 ..	88	4 3	81	4 7	76	4 11	71	5 2	67	5 6	64	5 9		
300 ..	80	6 1	76	6 5	73	6 9	69	7 1	67	7 5	64	7 8		
340 ..	76	8 4	73	8 7	71	8 11	68	9 4	66	9 7	64	9 11		
380 ..	73	10 9	71	11 1	69	11 5	68	11 8	66	12 0	64	12 4		

(B.) 1/·160 in. (8 S.W.G.).

Constants.—Area, 0·02012 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		

F. D. THOMSON,
Clerk of the Executive Council.

Electrical Wiring Regulations, 1927.

CHARLES FERGUSSON, Governor-General.

ORDER IN COUNCIL.

At the Government House at Wellington, this 11th day of July, 1927.

Present:

HIS EXCELLENCY THE GOVERNOR-GENERAL IN COUNCIL.

IN pursuance and exercise of the powers and authorities conferred on him by the Public Works Act, 1908, as amended by section two of the Public Works Amendment Act, 1911, and of every other power and authority enabling him in that behalf, His Excellency the Governor-General of the Dominion of New Zealand, acting by and with the advice and consent of the Executive Council of that Dominion, doth hereby make the following Regulations for the purposes of the said section two and doth hereby declare that this Order in Council shall come into operation on the date of the publication thereof in the *New Zealand Gazette*.

PRELIMINARY.

1. THESE regulations may be cited as the Electrical Wiring Regulations, 1927.

2. These regulations are divided into Divisions and Parts as follows:—

Division I.—General.

Part I. Application of and Exemptions from Regulations.
Part II. Permits for Wiring-work.

Division II.—Rules to be observed in the Permanent Wiring of Premises and the Installation of Fittings, Accessories, Appliances, and other Electrical Apparatus.

Part III. Electrical Plant—Generating, Storage, and Transforming.
Part IV. Switch-gear.
Part V. Distribution.
Part VI. Fittings and Accessories.
Part VII. Motors, Control-gear, and Lifts.
Part VIII. Heating, Cooking, and other Appliances.
Part IX. Places of Public Amusement.
Part X. High and Extra-high Pressures.
Part XI. Earthing.
Part XII. Additions and Alterations to Installations.

Division III.—Inspection and Testing.

Part XIII. Inspection and Testing.

3. (1) Throughout these regulations, unless the context otherwise requires, the following terms shall have the meanings given to them in this clause:—

"Accessory" is any appliance, other than a fitting, associated with the wiring, fittings, and consuming-devices; for example, a small switch, cut-out, plug, socket, or similar device.

"Appliance" is a consuming-device in which the electrical energy is converted into heat or drives a small electric motor forming an integral part of the device.

"Authorized Inspector" means any Inspector registered under the Electrical Wiremen's Registration Act, 1925, and employed as such by the electrical supply authority concerned, 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.

"Balanced": A three-wire system of generation or supply is said to be "balanced" when—

(*a*) In the case of direct-current or single-phase alternating-current systems of generation or supply the loads connected between the middle and each of the outer conductors are equal.

(*b*) In the case of a three-phase system of generation or supply the load carried by any combination of two conductors is equal to the load carried by any other combination of two conductors.

(*c*) In the case of a three-phase four-wire system of generation or supply, in addition to condition (*b*) above, the loads connected between the neutral and each of the "phase" conductors are also equal.

"Cable" means one or more conductors with or without insulating covering and with or without protective coverings, and also includes a wire.

"Cable, armoured": An armoured cable is one provided with a metallic covering of wires or tapes as a protection against mechanical injury.

"Cables, bunched": Cables are said to be bunched when more than one is contained within a single duct or groove, or when unenclosed cables are not separated from each other.

"Cable, flexible": A flexible cable is one in which the conductor (or conductors) exceeds 0·007 square inch in cross-section, and comprises a number of wires, the diameter of the wires and the material of the dielectric being such as to ensure flexibility.

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

"Circuit-breaker" is a device suitable for opening automatically a circuit under predetermined conditions, such as those of overload.

"Cord, flexible," is a flexible cable of cross-section not exceeding 0·007 square inch.

'Core" (of a cable) is the conductor with its insulation or dielectric, but does not include the mechanical protective covering. Two, three, or more cores may be laid up together to form a twin, three-core, or multi-core cable.

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

"Dielectric" means that portion of a core or cable which is relied upon to insulate the conductor.

"Distribution or section fuse-board" is an accessory containing fuses with or without a switch or switches arranged for the distribution to, and protection and control of, branch circuits fed from a main circuit.

"Double insulation": A conductor is said to have double insulation when it is provided with insulating-material between the conductor and its surrounding envelope or immediate support, as well as between such envelope or support and earth.

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

"Earthing-lead" is the conductor connecting the earthing-system to the metal sheathing or apparatus required to be earthed.

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

"Electrical supply authority" or "supply authority" means a licensee as defined by the Electrical Supply Regulations, 1927.

"Electrical Supply Regulations, 1927," means the regulations so intituled made under the Public Works Act, 1908, as amended by section two of the Public Works Amendment Act, 1911, by Order in Council dated the 11th day of July, 1927, and published in the *Gazette* of 12th day of July, 1927.

"Fitting" is any device for supporting or containing a lamp, together with its holder and shade or reflector; for example, a bracket, pendant and ceiling-rose, electrolier, or portable standard.

"Fuse": A fuse is the actual wire or strip of metal in a cut-out which is intended to be fused by an excessive current.

"Fuse-switch" is a switch the moving part of which carries one or more fuses.

"Live" (alive): An object is said to be alive when a difference of potential exists between it and earth, and, except in the case of a multiple earthed neutral system, all metal connected to the neutral conductor of the supply system, even if such neutral is earthed at the source of supply, shall be deemed to be alive for the purpose of these regulations.

"Machine (electrical)" is a rotating-device for converting electrical energy into mechanical energy, or *vice versa*, or for converting one form of electrical energy into another.

"Machine, drip-proof," is one which has a frame provided with openings for ventilation, so protected as to exclude falling water or dirt.

"Machine, enclosed, ventilated," is one in which the ventilating-openings in the frame are protected with wire screen, expanded metal, or other suitable perforated covers having apertures not exceeding $\frac{1}{2}$ square inch in area, but not less than $\frac{1}{50}$ square inch in area.

"Machine, flame-proof," is one in which the enclosing case can withstand, without injury, any explosion of gas that may occur in practice within it under the conditions of operation, and will prevent the transmission of sparks or flames capable of igniting any inflammable gas or particles, such as coal-dust, or flour or textile flyings, which may be present in the surrounding atmosphere.

"Machine, flame-proof slip-ring enclosure" is one in which only the slip-rings and brushes are enclosed in a flame-proof case.

"Machine, forced draught," is a pipe-ventilated machine in which the ventilating-air is supplied under pressure by means external to the machine itself.

"Machine, immersible," is one that can work when submerged under a considerable head of water for an indefinitely long period without detriment to its operation.

"Machine, induced draught," is a pipe-ventilated machine in which the ventilating-air is drawn through the machine by means external to the machine itself.

"Machine, open, end-bracket," is one which has end-bracket bearings, the bearings forming an integral part of the machine, and in which there is no restriction to ventilation other than that necessitated by good mechanical construction.

"Machine, open, pedestal," is one which has pedestal bearings, supported independently of the machine-frame, and in which there is no restriction to ventilation other than that necessitated by good mechanical construction.

"Machine, pipe-ventilated," is an enclosed machine in which the frame is so arranged that the ventilating-air may be conveyed to or from the machine through pipes or ducts attached to the frame, the ventilation being maintained by the fanning action produced by the machine itself, assisted or not by a fan or fans directly attached to the rotating parts.

"Machine, protected," is one in which the internal rotating parts and live parts are protected mechanically from accidental or careless contact, whilst ventilation is not materially obstructed.

"Machine, totally enclosed," is one so enclosed as to prevent circulation of air between the inside and outside of the case, but not to such an extent as to make the machine airtight.

"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 point of supply (that is, generating-station, substation, or transformer) 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.

"Point" is the termination of the wiring for attachment to a fitting for one or more lamps or other consuming-devices of any nature whatever.

"Pressure, extra-low," means a pressure between conductors (or between conductors and earth if the neutral is known to be earthed at the source of supply without a circuit-breaker or added resistance), normally not exceeding 30 volts in the case of alternating current and 100 volts in the case of direct current at the point at which the supply is delivered.

"Pressure, low," means a pressure between conductors (or between conductors and earth if the neutral is known to be earthed at the source of supply without a circuit-breaker or added resistance), normally exceeding 30 volts in the case of alternating current and 100 volts in the case of direct current, but not exceeding 250 volts in either case at the point at which the supply is delivered.

"Pressure, medium," means a pressure between conductors (or between conductors and earth if the neutral is known to be earthed at the source of supply without a circuit-breaker or added resistance), normally exceeding 250 volts, but not exceeding 650 volts at the point at which the supply is delivered.

"Service Fuse" is the device installed by the electrical supply authority for automatically disconnecting the installation on a consumer's premises from a service line.

"Service Main" is that portion of the wiring between the main switchboard and the electric-service line from which supply is obtained.

"Subcircuit": A subcircuit is that portion of the wiring system extending beyond the final set of fuses.

"Submain" is a branch main connecting a distribution board or fuse-board to a main switchboard.

"Switchboard": The term "switchboard" denotes an assemblage of switch-gear with or without instruments, and includes "distribution-board."

"Switch, double-pole," is a switch suitable for making or breaking a circuit on two poles or phases simultaneously, or for making or breaking two separate circuits simultaneously.

"Switch-gear" means any apparatus for controlling the distribution of electrical energy, or for controlling or protecting electrical circuits, machines, transformers, or other apparatus.

"Switches, linked," are switches linked together mechanically so as to operate simultaneously or in definite sequence.

"Switch, single-pole," is a switch suitable for making or breaking a circuit on one pole or phase only.

"Switch, triple-pole," is a switch suitable for making or breaking a circuit on three poles or phases simultaneously, or for making or breaking three separate circuits simultaneously.

"System of wiring":—

Two-wire.—A two-wire system of wiring is one 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. (Earthed concentric wiring.)

Three wire.—A three-wire system of wiring is one 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-phase Three-wire.—A two-phase three-wire system of wiring is one comprising three conductors, between one of which, known as the "common return," and the other two are maintained respectively alternating differences of potential displaced in phase by one-quarter of a period.

Two-phase Four-wire.—A two-phase four-wire system of wiring is one comprising four conductors, divided into two pairs, which have maintained between their conductors alternating differences of potential displaced in phase by one-quarter of a period.

Three-phase Three-wire.—A three-phase three-wire system of wiring is one 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-phase Four-wire.—A three-phase four-wire system of wiring is one 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.

"Weatherproof": Fittings, accessories, and consuming-devices are said to be weatherproof if they are so constructed that when installed rain, snow, and splashings are excluded.

(2.) The term "British Standard Specification" means a specification for wiring, or other materials, fittings, accessories, appliances or apparatus for electrical purposes, issued under that name by the British Engineering Standards Association, and where any such specification is prescribed in these regulations the latest revision thereof, or any specification issued in lieu thereof, by that association is implied. Particulars of the British Standard Specifications prescribed in these regulations are set out in the First Schedule hereto.

DIVISION I.—GENERAL.

PART I.—APPLICATION AND MODIFICATION OF AND EXEMPTIONS FROM REGULATIONS.

4. These regulations shall apply to all electrical installations connected with any source of supply of electrical energy operated under the authority of a license granted under the Public Works Amendment Act, 1911, or any other Act (and whether granted before or after the coming into force of these regulations), and to all electrical installations for the installing of which such a license is required (and whether granted before or after the coming into force of these regulations), but save as provided in the Electrical Supply Regulations, 1927, nothing herein shall apply to any generating plant which is subject to those regulations.

5. (1) It shall be a condition of every license granted under the Public Works Amendment Act, 1911, 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 supply authority shall not connect with its electric lines or permit any other person to connect with such lines any new installation on the consumer's premises unless and until such installation has been inspected and tested, and certified pursuant to Regulations 283 and 284 hereof.

(2) It shall also be a conditions of every such license that the electrical supply authority shall not continue to supply electrical energy to any existing installation connected with the supply authority's electric lines, 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 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.

(3) It shall not be necessary until six months after the commencement of these regulations for the supply authority to insist on the use of any materials necessary to make any nstallation comply with the requirements of these regulations if such materials are not in general use or are not readily procurable in New Zealand.

6. In any case where the electrical supply authority is also a consumer of the electrical energy supplied by it, the conditions imposed by the last preceding regulation shall apply to it in its capacity as supply authority as if it were supplying electricity 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 subclause (1) of the last preceding regulation and the dispensing-powers conferred by subclauses (2) and (3) of that regulation.

7. Where a supply authority changes over from one voltage or system to another, the Minister 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.

8. The Minister 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.

9. (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, 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 certificate by the supply authority's engineer that the application is a reasonable one and that in his opinion such modification will not 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.

PART II.—PERMITS FOR WIRING-WORK.

10. Save as provided in Regulations 13 and 14 hereof, no wiring-work shall be commenced until a written permit therefor has been obtained from the electrical supply authority.

11. (1) A supply authority may grant permits for temporary wiring.

(2) All such wiring shall be done on porcelain cleats or knob insulators, or in such other manner as may be approved in any particular case by the supply authority's engineer.

(3) 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.

(4) Joints of opposite polarity shall be kept at least 6 in. apart, and all joints shall be mechanically and electrically sound, and where rubber insulated wires are used they shall be adequately insulated with rubber and adhesive tape.

(5) Temporary wiring shall not be connected to permanent wiring except at the switchboard, and each circuit shall be controlled by a switch and fuse. A final subcircuit for lighting shall not carry more than 15 amperes.

(6) Temporary wiring shall not be connected with the source of supply until it has been inspected and passed by an authorized Inspector as having been installed in accordance with the requirements of this regulation and of the permit.

12. (1) No permit for temporary wiring shall be granted for any longer period than one month after the date on which such wiring is connected to the source of supply.

(2) On the expiration of the period for which a permit for temporary wiring is granted a further such permit may be granted for a period not exceeding one month, but the total period during which temporary wiring may be connected to the source of supply under the authority of successive permits shall not exceed twelve months from the date on which it was first connected.

13. 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, but application for such a permit must be made to the supply authority within twenty-four hours after such work is begun.

14. 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 Minister 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.

DIVISION II.—RULES TO BE OBSERVED IN THE PERMANENT WIRING OF PREMISES AND THE INSTALLATION OF FITTINGS, APPLIANCES AND OTHER ELECTRICAL APPARATUS.

PART III.—ELECTRICAL PLANT.—GENERATING, STORAGE, AND TRANSFORMING.

GENERATING PLANT.

DYNAMOS AND ALTERNATORS.

15. Where an electric supply is generated upon the consumer's premises, the generators, except in the case of extra-low-pressure plant having a capacity not exceeding 5 kilowatts, shall conform in all respects to the British Standard Specification applicable to such machines.

SITUATION OF GENERATING PLANT.

16. (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 gases cannot accumulate. In situations where inflammable or explosive materials are stored or handled generators may be placed only if adequately protected.

(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.

(3) Terminals of generators shall be so guarded that they cannot be accidentally touched or short-circuited.

17. No unprotected woodwork, other than hardwood bearers, or any combustible material shall be within a distance of 12 in. (measured horizontally) from or within 4 ft. (measured vertically) above or below the generators.

SECONDARY BATTERIES.

General Requirements for Supply from Secondary Batteries.

18. When apparatus is supplied from secondary batteries, the work of connecting such apparatus to such batteries 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.

Arrangement of Secondary Batteries.

19. Every battery shall be so arranged that a potential difference exceeding 50 volts does not exist between adjacent cells without adequate protection against electrical hazard, and that each cell shall be readily accessible from the top and from at least one side.

20. In a lead-sulphuric-acid battery having more than thirty-three cells, and in a nickel-iron alkaline battery having more than fifty-three cells, the cells shall be supported on glass or vitreous porcelain insulators. Where a battery comprises more than fifty-six lead-sulphuric-acid cells or eighty-eight nickel-iron alkaline cells the stands also shall be insulated.

21. When acid is used as an electrolyte for the cells, the battery connecting-bolts, unless of the non-corrosive type, shall be kept covered with petroleum-jelly.

22. Cells having containers not sealed or not provided with screw-down covers shall be fitted with spray-arresters.

23. Celluloid shall not be employed in the construction of non-portable batteries; and where it is used for portable batteries the charging arrangements shall be such that if the cases become ignited the risk of a fire spreading shall be minimized.

Ventilation of Secondary-battery Room.

24. The room in which batteries are placed shall be thoroughly ventilated.

Control of Secondary Batteries.

25. Suitable means shall be provided for controlling the current with which a battery is being charged. Such means shall comprise, as a minimum, an automatic cut-in and cut-out switch and fusible cut-out, or, alternatively, a circuit-breaker with overload and reverse-current trips.

STATIC TRANSFORMER AND CHOKE-COILS.

26. (1) Transformers and choke-coils, unless cased, shall be carried on supports of incombustible material, and so protected and installed that accidental contact with any part of the windings or terminals is impossible.

(2) Protecting cases or enclosures shall be of incombustible material, and the conductors shall be adequately insulated from the protecting cases, enclosures, and supports.

(3) Transformers and choke-coils shall be either amply ventilated or else oil-immersed. But in situations where inflammable or explosive gases, dust or flyings are liable to be present the transformers shall be oil-immersed.

(4) Transformers shall be in accordance with British Standard Specification No. 72.

27. All woodwork or other combustible material which is within 24 in. (measured vertically above), or 12in. (measured vertically below), or 6 in. (measured in any other direction) from the frames or cases containing transformers or choke-coils, which are not oil-immersed, shall be protected with non-ignitable material.

28. Auto-transformers, resistances or reactances shall not be used to reduce the voltage to low or extra-low pressure—

(*a*) To supply general wiring in buildings, or

(*b*) For any other purpose where the low or extra-low pressure circuit or apparatus has exposed live metal with which it is possible for any person to make contact.

PART IV.—SWITCHGEAR.

SWITCHBOARDS.

Situation and Placing of Switchboards.

29. The following provisions shall be observed in connection with the erection of switchboards, namely:—

(*a*) They shall be placed only in dry, well-ventilated situations where inflammable or explosive dust or gases cannot accumulate, and they shall be so arranged as to prevent access of acid-fumes from batteries to the boards.

(*b*) They must be so erected as to permit of ready access to the face and to all leads and fixing-bolts at the back thereof.

(*c*) They shall not be erected above gas-stoves, or in bathrooms or washhouses, or in any situation where they will be exposed to steam or weather.

(*d*) The main switchboard shall not in any case be erected in any room where cinematograph-film is stored, handled, or used.

30. Where it is necessary to have access to the back of a switchboard for wiring purposes, the board shall be so placed that there shall be a space between any immovable structure and the back of the board, or if any exposed live metal is mounted on the back, then between such structure and such metal, and the minimum such space shall be as follows:—

(*a*) 4 in. where neither the width nor height of the board exceeds 2 ft.

(*b*) 6 in. where each such measurement exceeds 2 ft. but does not exceed 3 ft.

(*c*) 8 in. where each such measurement exceeds 3 ft. but does not exceed 4 ft.

(*d*) 12 in. where each such measurement exceeds 4 ft. but does not exceed 5 ft.

(*e*) 30 in. where each such measurement exceeds 5 ft.,

and in the last-mentioned case all stays and conductors 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 where crossing over the space provided at the back of the board.

31. Switchboards mounted upon the wall shall be so arranged that the space between all sides and the wall is completely enclosed by a containing case. Where any opening is made in the wall behind for access for wiring, 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.

32. Containing cases shall, except as provided in the next succeeding regulation, be secured by screws in such a manner as to be easily removable for the purposes of inspection.

33. Non-removable cases may be used, but they shall be of sufficiently ample dimensions to allow of easy access for the attachment of cables and for conduits and fixing nuts.

General Construction of Switchboards.

34. (1) Switchboards shall be constructed wholly of durable, non-ignitable, non-absorbant materials, and all insulation shall be of permanently high electric strength and insulation resistance.

(2) No composition material shall be used in the construction of switchboards unless such material has been approved by the Chief Electrical Engineer, and to ensure mechanical strength in composition switchboards the minimum thickness of any such board shall be in accordance with such one of the following tables respecting current and area respectively as specifies the greater thickness:—

Current.		Area.	
Maximum Total Current taken to Switchboard.	Minimum Thickness.	Maximum Area.	Minimum Thickness.
10 amperes ..	$\frac{3}{16}$ in.	$1\frac{1}{2}$ sq. ft. ..	$\frac{3}{16}$ in.
20 amperes ..	$\frac{1}{4}$ in.	$2\frac{1}{2}$ sq. ft. ..	$\frac{1}{4}$ in.
50 amperes ..	$\frac{3}{8}$ in.	6 sq. ft. ..	$\frac{3}{8}$ in.
Over 50 amperes ..	$\frac{1}{2}$ in.	Over 6 sq. ft. ..	$\frac{1}{2}$ in.

35. Ironclad switch-gear may be mounted directly on a wall or on the metal framework of the switchboard.

36. Where the frames of switchboards require to be earthed in accordance with the provisions of Part XI of these regulations suitable terminals shall be provided to which the earthing lead shall be attached.

37. (1) The various exposed live parts of switchboards shall be so arranged by suitable spacing or shielding with non-ignitable insulating-materials that an arc cannot be maintained between any such parts or between such parts and earth. For pressures not exceeding 250 volts the minimum clearance between live metal parts of fuses of opposite polarity or phase, or between any live metal and any earthed metal, shall be $2\frac{1}{2}$ in. For medium pressures the clearance shall not be less than 4 in. Fuses which on blowing expel the gas parallel to the axis of the fuse, and which are of opposite polarity or phase, may be mounted one above the other if an insulating-shield is fixed between them.

(2) The arrangement of all parts shall be such that the connections to all instruments and apparatus can be readily traced.

(3) All parts, including connections, shall be readily accessible; and no fuse, circuit-breaker, or switch other than an isolating switch shall be fixed on the back of the switchboard panel if it is necessary to operate the same from behind.

(4) All nuts or parts carrying over 25 amperes, and fixed at the back of switchboards, shall be effectively locked so that they cannot become loose.

(5) All bus-bars and connections on switchboards shall be in accordance with British Standard Specification No. 159.

(6) Where a scheme of colouring is employed to distinguish switchboard bus-bars and connections to individual poles or phases, such scheme of colouring shall be in accordance with British Standard Specification No. 158.

(7) The arrangement of bus-bars carrying alternating currents shall be in accordance with British Standard Specification No. 158.

38. Conductors must be symetrically placed and spaced apart, and so arranged that the course of every conductor may be easily traced.

39. All circuits, instruments, and important apparatus shall be clearly and indelibly labelled for identification.

40. Switches shall be so arranged that their blades or moving parts are disconnected from the supply in the "off" position. They shall be so mounted that the top of the handle is at a height not exceeding 7 ft. 6 in. above floor-level.

41. In every case in which the switches and fuses are fitted on the same pole or phase these switches shall preferably be so arranged that the fuses are disconnected from the supply when their respective switches are in the "off" position.

42. In all cases panel switchboards shall be mounted on iron brackets or standards extending vertically the full length of the board, and of such dimensions as to adequately support the board. The minimum size of brackets shall be $\frac{3}{4}$ in. by $\frac{1}{8}$ in. Brackets shall be fitted at points not greater than 24 in. apart, measured horizontally, unless the board is, in the opinion of the Authorized Inspector, of such strength and thickness as to ensure rigidity when the devices mounted thereon are operated.

43. Where meters, service-fuses, or other apparatus belonging to the supply authority are to be mounted on a switchboard, loops shall be left in the leads of sufficient length to allow the ends of the conductors to be properly connected by the supply authority.

DISTRIBUTION AND SECTION BOARDS.

44. The general design and construction of distribution and section boards shall conform to the requirements of Regulations 29 to 43 and 66 hereof so far as they are applicable. The fuses fitted in such boards shall conform to the requirements of Regulations 68 to 70 hereof.

45. (1) Every distribution or section board shall be controlled by a switch mounted thereon, and shall be contained within a case.

(2) Containing cases shall, except as provided in the next succeeding regulation, be secured by screws in such a manner as to be easily removable for the purpose of inspection.

46. The cases of distribution and section boards, if not removable, shall be of sufficiently ample dimensions to allow of easy access for the attachment of cables and for conduits and fixing nuts.

47. If glass fronts be provided they shall be clear of all live parts by not less than 1 in., and such fronts may be regarded as insulating-shields.

48. All cases in positions exposed to the weather, to drip, or to an abnormally moist atmosphere shall be weatherproof, and shall be provided with cable glands or bushings, or be adapted to receive screwed conduit, according to the way in which the cables entering the cases are run.

49. (1) In earthed concentric wiring systems distribution-boards shall, in addition to complying with the foregoing requirements, be contained in cases in which provision is made for the following:—

(*a*) If of metal, the attachment to the case of all external conductors of the concentric cables entering it.

(*b*) If of wood, a sheet of incorrodible metal, of the same area and shape as the base of the case, interposed between it and the wall or other support to which it is attached.

(2) The sheet of metal required by paragraph (*b*) of the last preceding subclause shall be not less than $\frac{1}{16}$ in. in thickness, and be electrically and mechanically connected to all the external conductors of the concentric cables entering the case, by means of a metal bar, or rod, or bare wire conductor, of which the resistance shall be not greater than that of the inner conductor of the cable feeding the board.

50. The design, construction, and arrangement of the cut-outs and the metal case (if any) shall be such that an arc cannot be set up to the case or between poles or phases when the fuse is melted by a short-circuit current.

51. (1) All self-contained subcircuit fuse-cases made of wood other than jarrah or teak shall be lined with non-ignitable insulating-material, which shall be clear of all live parts by not less than 1 in.

(2) When any such case is not provided with a back forming an integral part thereof, a non-ignitable insulating-shield shall be fixed between the contents of the case and any ignitable structure to which it may be fixed.

52. Where cut-outs are grouped on a board they shall be fixed vertically, and a shield of non-ignitable insulating-material shall be inserted between cut-outs of opposite polarity or phase when placed one above the other, if the fuses are of a type which on blowing expel the gas parallel to the axis of the fuse.

MAIN SWITCH-GEAR.

53. (1) Every main switchboard shall be fitted, as a minimum, with such of the switch-gear mentioned in Part I of the Second Schedule hereto as is appropriate to the particular system of wiring.

(2) Where the supply is from an external source the service-fuse installed by the supply authority may take the place of the fuse mentioned throughout the said Schedule in connection with the control of main supply, provided that the supply authority's service-fuse is used solely for the one consumer.

(3) Where more than one generator is installed, the generators not being arranged to run in parallel, or where the supply is derived from a duplicate service from an external source, double-throw switches shall be provided in suitable positions to prevent the generators or services being connected together.

(4) In the case of submains or circuits of 50 amperes connected load or less the switches specified in the said Part of the Second Schedule hereto may be omitted.

(5) In the case of a non-earthed system where double-pole circuit-breakers are specified in the said Schedule only one overload trip shall be necessary.

(6) Where a separate fuse and switch or separate fuses and linked switches are specified in the said Part I of the Second Schedule hereto a fuse-switch or linked fuse-switches, as the case may be, may be used.

DISTRIBUTION SWITCH-GEAR.

CONTROL OF SUPPLY.

54. Every installation shall be adequately protected by suitable controlling-apparatus (as required by the last preceding regulation) easily accessible to the consumer and situated as near as possible to—

(*a*) The point or points of entry of the service-main in the case of a public supply: or

(*b*) The generator in the case of a private plant.

55. (1) In the case of an overhead supply, service-fuses shall be fixed either outside the building or in a permanently accessible position free from combustible material within a building and as near the point of entry as possible. They shall not be placed between ceiling and roof.

(2.) When the supply is from an underground source the service-fuses shall be as near the point of entry as possible and in a permanently accessible position free from combustible materials.

56. (1) All supply from an underground source shall be controlled by a master-switch placed in a conveniently accessible position as near an entrance or exit-door as circumstances permit.

(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 clear glass or wooden front. If the front is of wood it shall have the words "Master Switch" painted thereon in block letters not less than 1 in. in height.

57. In all cases when more than one consumer is connected to a service the various consumers' switchboards shall be distinctly labelled for purposes of identification.

58. (1) The service-fuses of any building to which Part IX hereof applies shall not be used for the supply of current to any other electrical installation whatever.

(2) Where failure of light might cause panic, or be otherwise dangerous, the lighting shall be controlled by independent service-fuses, and no apparatus other than permanent lighting shall be connected to this service.

59. In the case of a private plant where the building containing the generator is isolated from the building in which the electricity is consumed, a main switch shall be installed at the point at which the main cables enter the latter building. Where more than one building is supplied from a common main, main fuses shall also be installed at each building.

60. In installations in which the normal-working current in any circuit or circuits exceeds 100 amperes there shall be provided a circuit-breaker with overload trips. This device shall be set to operate with any prescribed value of current

provided that such value does not exceed 200 per cent. of the normal full load.

61. In every case in which single-pole switches are required by these regulations they shall be fitted on the same pole or phase throughout the installation.

62. No lamp, portable heater, or portable domestic appliance shall be supplied at a nominal pressure in excess of 230 volts, and where the nominal pressure between the outer conductors of the three-wire D.C. system exceeds 230 volts, and the three wires of the system are brought into the premises, the circuits connected between the negative and neutral or middle conductor shall be kept apart throughout from those connected between the positive and neutral or middle conductor.

INSTRUMENTS.

Service-meters and Instrument Transformers.

63. Where service-meters are not mounted on the main switchboard they shall be mounted on a substantial base.

64. Where instrument transformers are used, and are easily accessible, all live metal shall be efficiently insulated.

Switchboard Instruments.

65. Every generator switchboard, when the supply is not derived from an external source, shall be provided, as a minimum, with the instruments required by Part II of the Second Schedule to these regulations with respect to the particular system of wiring used in the installation.

SWITCHES, CIRCUIT-BREAKERS, AND CUT-OUTS.

Switches and Circuit-breakers.

66. Every switch, fuse-switch, and other device for breaking circuit shall comply with the following requirements :—

(*a*) All parts shall be so proportioned that when the normal working current for which they are designed flows through them continuously their temperature shall not rise above that of the surrounding air more than 36° F. in the case of switches rated below 100 amperes and 54° F. in the case of switches rated at 100 amperes or above.

(*b*) Each fuse-switch when opening the circuit as a switch, and each switch, shall break the circuit without permitting an arc to be maintained when a current 50 per cent. greater than that for which it is rated is flowing under a pressure 50 per cent. in excess of the pressure of supply. Each fuse-switch when opening the circuit as a fuse, and each circuit-breaker, shall comply with Regulations 68 and 69 hereof for cut-outs.

(*c*) Every circuit-opening device shall be so constructed and arranged that when placed in the off position it cannot accidentally move sufficiently to close the circuit.

(*d*) If the current to be interrupted is sufficiently large to cause damage to the main contacts, suitable arrangements shall be made for the easy renewal of the parts on which the arc is formed.

(*e*) The handles and their attachments shall be mechanically strong, and where switches and circuit-breakers are readily accessible to unskilled persons they shall be so designed and arranged that the hand of the operator cannot accidentally touch live metal, or be injured through an arc from the switch or the blowing of an adjacent fuse, and they shall not operate through unprotected slots.

(*f*) The bases shall be of durable, non-ignitable, non-absorbent insulating-material. Semi-hygroscopic materials such as slate or marble, if used, shall be free from metallic veins, cracks, or other defects. The slabs shall be planed all over, and, if of slate, treated, after drying, with a damp-proof medium, all holes being similarly treated.

(*g*) Switches of the all-insulated type shall have covers made of strong incombustible material other than porcelain.

(*h*) In positions in which they are liable to mechanical injury the covers, unless of rigid metal, shall be protected by suitable guards. Metal cases shall be kept well clear of live parts.

(*i*) All switches fixed in positions exposed to the weather, to drip, or to an excessively moist atmosphere shall be contained in weather-proof cases, which shall be provided with cable glands or bushings, or be adapted to receive screwed conduit, according to the manner in which the cables entering the fittings are run.

(*j*) In strong-rooms, and freezing-chambers and the like, the switches shall be grouped outside and adjacent to the door, and, except in the case of a multiple-earthed neutral system, the switches shall be double pole.

(*k*) (i) Every electro-magnetic circuit-breaker shall be provided with suitable means of adjustment for determining the current at which it shall open, and shall be so arranged that it cannot be held in against this current.

(ii) The maximum setting of the circuit-breaker shall not exceed the carrying-capacity of the smallest cable which the circuit-breaker controls.

(iii) In the case of all apparatus, other than motors, in which the current under normal operating-conditions does not exceed the full load current, the circuit-breaker shall be set to operate at not more than 150 per cent. of full-load current.

(iv) No circuit-breaker need be set to operate at a current less than 7 amperes.

(v) In the case of motors the circuit-breaker shall be set to operate within one minute at 200 per cent. of full-load current.

(*l*) Circuit-breakers shall be so arranged and placed that no combustible materials is endangered by their operation, and any resulting arc shall not come into contact with any live metal of opposite polarity or phase, nor with instrument-cases or earthed metal.

(*m*) Flush-type switches shall in all cases be contained in metal boxes suitable for screwed conduit.

67. No pendant switch other than of a type approved by the Chief Electrical Engineer shall be used in any installation.

Cut-outs.

Extra-low Pressure.

68. For extra low pressure every cut-out shall comply with the following requirements :—

(*a*) All parts other than the fusible metal shall be so proportioned that their temperature shall not rise more than 54° F. above that of the surrounding air when the normal working current for which they are designed flows through them continuously.

(*b*) (i) The fusing-current shall be not more than double the current-carrying capacity of the smallest cable which the fuse controls, provided that no fuse smaller than one rated to blow at 8 amperes need be inserted in any final subcircuit.

(ii) The fusing-current in free air shall be taken as that specified in column 3 of Tables XIII and XIV in the Third Schedule hereto.

(iii) For the purposes of this paragraph the carrying-capacity of a flexible cable or cord shall be that specified in Table XVI in the Third Schedule hereto.

(*c*) In the case of fuses controlling individual pieces of apparatus they shall be set to blow within one minute at 200 per cent. of full-load current.

(*d*) The base shall be of durable, non-ignitable, non-absorbent insulating-material.

(*e*) The circuit contacts and their terminals shall be so spaced or shielded that an arc cannot be maintained when the fuse blows.

(*f*) The fuse 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.

(*g*) Fuses shall not be placed in ceiling-roses, in wall plugs or sockets, or in switches other than fuse-switches or those of the metal-covered type which comply with the other requirements of these regulations. A fuse rated at not more than 5 amperes may, however, be placed in an approved intermediate device designed for insertion into a wall-socket and for receiving the pins of a smaller plug connected to a consuming-device taking 5 amperes or less, provided that in all cases the wall socket or sockets shall be protected by subcircuit fuses mounted in accordance with paragraph (*h*) of this regulation. Where such a device is used it shall not be sunk below the surface of the wall, and its base shall comply with the requirements of paragraph (*d*) of this regulation.

(*h*) When cut-outs are not fixed on a main switch-board they shall be grouped on distribution-boards, or, unless completely enclosed, shall be contained within cases conforming in all respects to the requirements specified in Regulations 44 to 52 hereof.

(*i*) Except as provided in paragraph (*g*) of this regulation cut-outs in which the fuses are without removable carriers may be used only on extra-low pressure subcircuits, and may then only if,—

(i) They are protected by close-fitting covers; and

(ii) They are ventilated in such a manner that fused metal cannot be ejected; and

(iii) The maximum generating-plant capacity does not exceed 5 kilowatts.

Low and Medium Pressure.

69. For low and medium pressure every cut-out shall comply with the following requirements in addition to the requirements of paragraphs (*a*) to (*h*) of the last preceding regulation :—

(*a*) It shall be provided with a suitable incombustible and insulating carrier for the fuse 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 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 fuses shall be so shielded as to protect a person against contact with live metal when the fuse-carrier is being inserted or removed.

70. Where iron-clad fuses 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 fully opened.

PART V.—DISTRIBUTION.

SUBDIVISION OF CIRCUITS.

71. (1) The maximum number of points that may be connected in parallel to a final subcircuit shall be as follows :—

Where the total rating of the points supplied from the subcircuit does not exceed—6 amperes, 10 points ; 8 amperes, 6 points ; 10 amperes, 4 points ; 20 amperes, 2 points.

Final subcircuits supplying one lamp or appliance are not limited as to current-carrying capacity.

(2) For the purpose of calculating the current of a lighting circuit no lamp shall be rated at less than 60 watts, lamps of larger wattage (if any) being allowed for in full.

(3) For the purpose of calculating the current of a heating circuit each plug shall be rated at not less than 5 amperes ; consuming-devices of larger capacity, if any, being allowed for in full. The minimum size of cable shall be 3/·036 in.

(4) When the fusing-current of the fuse controlling the final subcircuit exceeds 7 amperes the smallest cable or flexible cord which is used for any purpose on such circuit shall be capable of carrying continuously a current not less than half of such fusing-current. For the purposes of this subclause the carrying-capacity of a flexible cable or cord shall be considered to be that specified in Table XVI in the Third Schedule hereto.

72. Every final subcircuit shall be connected to a switch board and be controlled by—

(*a*) Fuses or circuit-breakers as specified in Part I of the Second Schedule hereto, where the connected load does not exceed 50 amperes.

(*b*) Circuit-breakers or switches and fuses as specified in Part I of the Second Schedule hereto, where the connected load exceeds 50 amperes.

CONDUCTORS OF CABLES.

MATERIAL OF CONDUCTORS.

73. All conductors 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.

74. When the insulating covering of the conductor may contain sulphur, each wire shall be adequately and uniformly coated with tin free from all impurities.

STANDARD SIZE OF CONDUCTORS.

75. (1) The sizes of solid and stranded conductors and resistances set out in Table I in the Third Schedule hereto shall be the standard sizes for the purposes of these regulations.

(2) The sizes of conductors and resistances for flexible cables set out in Table III in the Third Schedule hereto shall be the standard sizes for the purposes of these regulations.

(3) The sizes of conductors and resistances for flexible cords set out in Table VII in the Third Schedule hereto shall be the standard sizes for the purposes of these regulations.

MINIMUM SIZE OF CONDUCTORS.

76. No cable having a conductor of nominal sectional area less than 0·0015 square inch (1/·044 in.), and no flexible cord having a conductor of nominal sectional area less than 0·001 square inch (23/·0076 in.), shall be used except for wiring fittings, for which a conductor having a nominal sectional area not less than 0·001 square inch (1/·036 in.) may be employed : Provided that where the design of a fitting renders it impossible to use a conductor of this size, a flexible cord having a conductor of nominal sectional area not less than 0·0006 square inch (14/·0076 in.) may be used.

77. (1) Service mains shall be stranded, and shall have a carrying-capacity not less than the maximum demand of the installation, but in no case shall they be smaller than 7/·029 in.

(2) Where the maximum demand is not readily ascertainable it shall be assessed as follows :—

Lighting	Two-thirds of connected load.
Heating (including cooking)	Three-quarters of connected load.
Power—	
One motor ..	Total connected load.
Two motors ..	Three-quarters of connected load
Exceeding two and not exceeding five	Two-thirds of connected load.
Exceeding five ..	One-half of connected load.

(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.

78. (1) The earthing-lead shall be stranded cable or flat strip, the latter not less than ¾ in. wide by No. 18 gauge. No conductor of a less cross-sectional area than 0·0045 square inch (7/·029 in.) shall be used as an earthing-lead, provided that where the cross-sectional area of portable leads is less than 0·0045 square inch the earthing-conductor in the portable lead may be equal in cross-sectional area to the live conductor.

(2) The minimum size of such conductor (0·0045 square inch) shall be deemed sufficient for installations not exceeding 50 amperes working current.

(3) The effective area of the earthing-lead shall be increased by 0·0045 square inch for each 50 amperes or part thereof.

MAXIMUM SIZE OF SINGLE WIRE.

79. No single wire having a nominal sectional area exceeding 0·0015 square inch (1/·044 in.) shall be used as a conductor.

CURRENT-CARRYING CAPACITY OF CONDUCTORS.

80. The size of conductors shall be so selected that—

(*a*) For lighting and heating, the fall in pressure from the terminals of the main switch of the main switchboard controlling the various circuits to any and every point on 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.

(*b*) In no case, whether for lighting, heating, or power, shall the current exceed that given in Tables IV and V in the Third Schedule hereto for each size of conductor when the maximum current referred to in the last preceding paragraph is being carried.

81. In the case of flexible cables and flexible cords the values shown in Table VI and column 9 of Table VIII in the Third Schedule hereto respectively shall be adopted.

INSULATION AND PROTECTIVE COVERING OF CONDUCTORS.

INSULATION OF CONDUCTORS.

82. Except as provided in Regulation 122 with respect to earthed concentric wiring, all conductors shall be insulated, either by being carried on insulators (as provided by Regulation 102) or by the use of insulated cables.

TYPES OF INSULATION AND PROTECTIVE COVERING.

83. Cables shall be single, twin, three-core, four-core, concentric, or triple concentric in accordance with the dimensions and other requirements of British Standard Specification No. 7, and only the types mentioned in the next succeeding regulation and such other types as may from time to time be approved by the Chief Electrical Engineer shall be employed.

84. The following types of insulation and protective covering are hereby declared to be approved types for the purposes of these regulations :—

Vulcanized Rubber-insulated Cables.

(*a*) Taped as in Regulation 87 and compounded.

(*b*) Taped as in Regularion 87 and braided.

(*c*) Sheathed with a closely fitting seamless covering of commercially pure lead having a smooth exterior surface and of uniform radial thickness in accordance with British Standard Specification No. 7.

(*d*) 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) to be in accordance with British Standard Specification No. 7.

(*e*) Bedded and armoured, with or without serving or braiding over the armour; the bedding, armouring, and serving or braiding (if any) to be in accordance with British Standard Specification No. 7.

(*f*) 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 (*c*) of this regulation.

(*g*) Covered with tough rubber compound in accordance with the requirements of Regulation 94 hereof.

Paper-insulated Cables.

(*h*) Sheathed with a closely fitting seamless covering of commercially pure lead having a smooth exterior surface and of uniform radial thickness in accordance with British Standard Specification No. 7.

(*i*) 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) to be in accordance with British Standard Specification No. 7.

(*j*) 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 (*h*) of this regulation.

85. (1) If it is desired to use types of cables insulated otherwise than specified in the last preceding regulation, sample lengths shall be submitted to the Chief Electrical Engineer together with a report from a recognized testing authority (such as the National Physical Laboratory in England) as to the behaviour, properties, and life of the insulating-materials employed, for consideration by him with a view to their use being permitted, provisionally or otherwise, if found satisfactory.

(2) Evidence of insulation resistance alone will not be considered to be sufficient for the purpose of this regulation.

86. (1) Of the types of cables specified in paragraph (*a*) of Regulation 84 hereof, 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 cables of the types referred to in Regulation 84 (*c*), (*f*), (*h*), and (*j*) are used for alternating current the lead and return shall be placed as near as possible to each other.

VULCANIZED-RUBBER-INSULATED CABLES, EXCEPT FLEXIBLE CORDS.

87. (1) Vulcanized-rubber-insulated cables shall be insulated with a layer of pure rubber next to the conductor, an intermediate layer of vulcanizing-rubber, and an outer jacket of vulcanizing-rubber. These three layers shall together constitute the dielectric, and its radial thickness shall be in accordance with British Standard Specification No. 7. The dielectric shall be surrounded by a layer of tape, and the whole shall be vulcanized together. The maker's name and grade of insulation shall be legibly and continuously printed on the tape under the outer braiding.

(2) In the case of cables having an outer protective covering of "tough rubber" in accordance with Regulation 94 hereof the tape may be omitted, in which case the maker's name and grade of insulation shall be clearly marked on the cable at intervals not exceeding 3 ft.

88. Braided cables shall have an exterior braiding of hemp, cotton, or jute, thoroughly impregnated with a protective compound that will not have any deleterious action on the rubber or armouring, as the case may be. The finish of the braiding shall be smooth and uniform.

PAPER-INSULATED CABLES.

89. Paper-insulated cables shall be insulated with a covering of paper impregnated with a chemically neutral insulating-compound. The radial thickness of dielectric shall be in accordance with British Standard Specification No. 7.

INSULATION OF FLEXIBLE CORDS.

90. Two kinds of insulation for flexible cords shall be recognized as standard for the purposes of these regulations—namely high insulation and medium insulation.

91. (1) High-insulation flexible cords, the conductors of which are composed of plain copper wires, shall be insulated by being lapped with cotton and two layers of pure rubber overlapped with cotton.

(2) High-insulation flexible cords, the conductors of which are composed of tin-coated copper wires, shall have such conductors uniformly and adequately coated with tin free from all impurities and insulated with one layer of pure rubber and two layers of vulcanizing-rubber.

(3) The radial thickness of rubber insulation as aforesaid shall be not less than that specified in column 2 or column 3 of Table VIII in the Third Schedule hereto, as may be required by the insulating-material used.

(4) Where conductors other than copper are used in flexible cords they shall be insulated in such manner as the Chief Electrical Engineer approves.

92. The insulation of medium-insulation flexible cords shall be similar to that of high-insulation flexible cords, save that in the case of tin-coated conductors the layer of pure rubber prescribed by subclause (2) of the last preceding regulation may be omitted, and the radial thickness of rubber insulation shall be not less than that prescribed in column 4 or column 5 of the said Table VIII, as may be required by the insulating material used.

PROTECTIVE COVERING OF FLEXIBLE CABLES AND CORDS.

93. Flexible cables and cords shall be provided with one of the following protective coverings, but none of the coverings mentioned in paragraphs (*a*), (*b*), (*c*), and (*g*) of this regulation shall be used where the cable or cord is liable to the risk of mechanical damage:—

(*a*) Natural or non-ignitable artificial silk braiding.

(*b*) Glace cotton braiding.

(*c*) Hemp, cotton, or jute braiding thoroughly compounded.

(*d*) Wire armouring, comprising a flexible braiding of galvanized steel or phosphor-bronze wire, in addition to the covering specified in the last preceding paragraph.

(*e*) Hard-cord braiding in addition to the covering specified in paragraph (*c*) of this regulation.

(*f*) Tough rubber compound in accordance with Regulation 94 hereof applied directly to the insulated core or to two or more such cores laid up together.

(*g*) Asbestos or fire-resisting braiding approved by the Chief Electrical Engineer.

TOUGH RUBBER COMPOUND.

94. (1) Tough rubber compound, when used as a protection to vulcanized-rubber-insulated cables, shall form a closely fitting sheath filling the external irregularities of the laid-up cores in the case of multicore cables and concentric with the conductor when single core, and shall be capable of offering a high degree of resistance to abrasion, acids, oils, and alkalis.

(2) The radial thickness of this sheath shall not be less than that specified in British Standard Specification No. 7.

TESTS OF DIELECTRIC OF CABLES.

95. (1) Except in the case of flexible cords, the dielectric of cables, insulated with vulcanized rubber or impregnated paper, shall withstand the pressure test and other tests specified in British Standard Specification No. 7. 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, shall not be less than that given in Table IX in the Third Schedule hereto.

(2) In addition, and subject to the tests prescribed by the last preceding subclause, vulcanized rubber insulated cables shall be submitted to the following tests: A sample of the vulcanized rubber, not less than 4 in. in length, shall be cut from the cable with a sharp knife held tangent to the conductor. Marks shall be placed on the sample 2 in. apart. The sample shall be stretched until the marks are 6 in. apart, and then immediately released. One minute after such release the distance between the marks made as aforesaid shall be measured, and if the distance between them is then more than 2⅝ in. the cable shall not be used. If such distance is not more than the said 2⅝ in. the sample shall then be stretched, and if it breaks before the marks are at least 9 in. apart it shall not be used.

96. The insulation resistance of each insulated conductor of a multicore cable, except flexible cords, shall not be less than that given in the said Table IX for single conductors of the same sectional area.

97. The insulation resistance of the dielectric 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.

98. (1) Except in the case of high-insulation cords with vulcanized-rubber insulation as specified in Regulation 91 hereof, the dielectric of multicore flexible cords shall withstand for fifteen minutes the alternating pressure and frequency set out in column 3 of Table X in the Third Schedule hereto for the respective kinds of insulation indicated therein. The test shall be made between conductors, and the flexible cord shall be in a dry state at the time of test.

(2) In the case of high-insulation cords with vulcanized-rubber insulation the test shall be made between each conductor and earth. Any conductor not under pressure shall

be earthed, and the cords shall be immersed in water at the time of the test and for twenty-four hours immediately prior thereto.

(3) Subsequent to the above test the insulation resistance of flexible cords with vulcanized-rubber insulation shall not be less than that given in Table XI in the Third Schedule hereto. This latter test shall be made after one minute's electrification at a pressure of not less than 500 volts and at a temperature of 60° F., and in the case of high-insulation cords the test shall be made while they are still immersed in water as aforesaid.

(4) The pressure for all the above tests shall be derived from a source having a rated output of not less than 5 kilowatts.

(5) Cables and flexible cords which have to be tested when immersed in water may be tested before the protective coverings are applied, or they may be tested as finished cables, in which case the protective coverings will be damaged by the water, and shall be replaced before use.

(6) The dielectric of flexible cords shall also withstand the tests specified by subclause (2) of Regulation 95 hereof.

IDENTIFICATION OF CABLES BY COLOUR.

99. In all cables, including flexible cords, red shall distinguish the live conductor, and black the neutral or common return. This applies throughout the installation to the current-consuming device.

INSTALLING AND FIXING OF CONDUCTORS AND CABLES.

SERVICE MAINS.

100. Service mains shall in all cases be—

(*a*) Enclosed in screwed conduit (Class T in the Second Schedule hereto) which includes no other cables; or

(*b*) Armoured cables (Class R in the Second Schedule hereto); or

(*c*) Lead-covered cable embedded in bitumen.

BARE CONDUCTORS AND AERIALS.

Bare Conductors.

101. Bare conductors may be used as collector or trolly wires for travelling-cranes and similar appliances and for battery connections.

102. They shall be supported upon insulators, and so spaced that risk of accidental contact between the conductors themselves or between conductors and walls or any other conducting structure is reduced to a minimum.

103. At each straining-point—*i.e.*, at the ends of each conductor—efficient straining-gear fitted with double insulation shall be provided.

104. The circuit supplying current to such bare conductors shall, except in the case of the regulating cells of batteries, be protected either by a suitable circuit-breaker or by a suitable switch and fuse.

105. Bare conductors extended to positions liable to lightning-discharge shall be fitted with lightning-arresters on each pole or phase.

106. Wall rosettes or brackets used as supports for span-wires shall not be fixed within 12 in. of any gas-pipe.

107. Except as hereinbefore specified, bare conductors shall be used only in positions not ordinarily accessible to unauthorized persons and under such circumstances as may be sanctioned by the Authorized Inspector.

Aerials.

108. (1) Where the length of an aerial line does not exceed 2 chains, the conductors shall consist of not less than seven strands, and the minimum size of conductor shall be 7/·029 in.

(2) The wires shall be covered with rubber insulation in accordance with Regulation 87 hereof, and be braided, except that a multiple-earthed neutral may be bare.

(3) Where the length of an aerial line exceeds 2 chains the provisions of the Electric Supply Regulations, 1927, shall apply.

109. (1) In no case shall aerials be run at any less height than 9 ft. above the ground level.

(2) They shall be at a height above ground-level of at least—

(*a*) 10 ft. in any part of the premises used by private passenger motor-cars; and

(*b*) 11 ft. in any part of the premises used by vehicles of any description other than private passenger motor-cars.

(3) Where the length of any aerial line exceeds 2 chains the provisions of the Electrical Supply Regulations, 1927, shall apply.

110. Spans shall conform to the requirements of the Electrical Supply Regulations, 1927. When the span does not exceed 30 ft. soft-drawn copper conductors may be used.

111. Aerial lines shall be efficiently supported on insulators. Bobbin-insulators shall not be used for this purpose in places where they will be exposed to the weather.

112. Leading-in wires shall in no case be sweated on to hard-drawn wires where these latter are in tension, but shall, unless a mechanical connector is used, be sweated to the ends of the aerial lines away from that part in tension.

113. Each aerial circuit shall be run as a separate circuit from the main or distribution switchboard, and the leads of such circuit within a building shall be not less than 3/·029 in.

114. Aerial electric lighting, heating, or power wires shall not cross over or under in close proximity to any wireless aerial, or any stay-wire in connection therewith, or be erected in such a position that it is possible for them to make contact with a wireless aerial or stay-wire, or for any person to make simultaneous contact with any such wire and a wireless aerial or stay-wire.

CABLES.

115. (1) Conductors or their insulating-material, metallic sheathing, or conduit, whether earthed or not, shall not be in metallic contact with gas-pipes, telephone, bell, or other wires not forming part of the system nor shall they be placed at a less distance than 1 in. therefrom, except at crossings.

(2) 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.

USE OF TWIN FLEXIBLE CORDS.

116. Twin flexible cords may be used for connection to lifts, subject to their being supported by porcelain insulators and to their being of such length that they will not come into contact with the bottom of the lift-well when the lift is at the lowest point of its run.

117. Flexible cords shall be installed in accordance with the requirements of Table XV in the Third Schedule hereto.

118. (1) Unarmoured flexible pendants shall be hung clear of shop fixtures or fittings, goods, and materials, and in no case shall flexible wiring support anything except the electrical fittings associated with it.

(2) Flexible pendants shall not be used under verandas or doorways, or in any place exposed to the weather.

119. No flexible extension shall be taken more than 6 ft. across a ceiling to a drop-light. Such flexible shall be supported by an insulated hook fixed to the ceiling.

120. Flexible cords in shop-windows and show-cases shall be installed in strict accordance with these regulations.

121. The maximum weight carried by a twin twisted flexible cord shall be as follows:—

Number and Diameter of Wires comprising Conductor.	Maximum Permissible Weight.
14/·0076 in.	3 lb.
23/·0076 in.	5 lb.
40/·0076 in.	10 lb.

EARTHED CONCENTRIC WIRING.

122. Earthed concentric wiring may be used only after approval has been given by—

(*a*) The electrical supply authority where the supply is obtained from an Electric-power Board or other public body.

(*b*) The Chief Electrical Engineer in any other case.

123. The use of earthed concentric wiring shall in all cases be subject to the following conditions:—

(*a*) When the supply is derived from a supply authority's mains it shall be taken from the secondary side of transformers or converters so arranged that the public supply system is electrically insulated therefrom.

(*b*) Every earthed concentric installation shall be so arranged that the internal conductor is protected by a single-pole circuit-breaker or switch and fuse placed in a position easily accessible to the consumer and situated as near as possible to—

(i.) The point or points of entry of the service main or to the secondary of the transformer, in the case of a public supply; or

(ii) The generator in any other case.

(*c*) Regulation 59 hereof shall apply to earthed concentric installations.

(*d*) When the supply is direct current the external conductor shall always be the one nearest to earth potential and shall, where possible, be negative to the inner conductor; and the difference of potential between any two points in the external conductor shall not exceed—

(i) Seven volts if the internal conductor is connected to the positive pole of the system; or

(ii) One and a half volts if the internal conductor is connected to the negative pole of the system.

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

(*f*) Where the metal sheathing of a cable is used as one conductor the resistance of the sheathing shall not be greater than that of the inner conductor when measured at a temperature of 60° F.

(*g*) Joints in the external conductor, however made, shall be of such a nature that the conductivity of the conductor is not reduced.

(*h*) All circuits, lamps, and appliances shall be controlled and protected by single-pole circuit-breakers, or switches and fuses, which shall be inserted in the internal conductor of the circuit. No circuit-breaker, switch, or fuse shall be included in the external conductor.

(*i*) Ordinary accessories may be used, but if lampholders having central contacts are employed such central contacts shall be connected to the internal conductor.

(*j*) Lamp-fittings may be wired with two separate wires, one being insulated and connected to the internal conductor and the other to the metal-work of the fitting.

(*k*) Twin flexible cords may be used between fixed points and portable or pendant fittings. If such flexible cords terminate in plug-and-socket connections these connections shall be of either the concentric or the two-pin polarized type.

Wiring-system having Extra-low pressure control Circuits.

124. The control-circuit wiring and accessories in wiring systems having extra-low-pressure control shall comply with the following requirements:—

(*a*) Remote controlled switches shall have their live parts enclosed in non-combustible and non-absorbent cases. They shall be fixed in full view in readily accessible positions. The insulation resistance between the supply terminals and the control terminals of the switch shall be not less than 100 megohms.

(*b*) All control wiring shall be run entirely apart from the supply wiring.

(*c*) The pressure of the control circuit shall not exceed 12 volts. Transformers shall be double-wound with one side of the secondary earthed and shall be mounted on the switch or distribution board, and be controlled by a switch and fuse on the primary side.

(*d*) Conductors shall be not less than 1/·036 in., having an insulation resistance of 300-megohm grade, unless the transformer complies with Regulation 133, in which case ordinary bell-wire may be used.

(*e*) Where subject to mechanical injury conductors shall be protected. When unenclosed they shall be secured with clips having rounded edges or insulated staples, but two or more conductors shall not be secured under the same staple.

(*f*) Between roof and ceiling conductors may be fastened to the sides of joists or battens without further protection. Where buried in plaster or concrete they shall be enclosed in an approved metallic sheathing. All joints shall be accessible, and be efficiently soldered and insulated.

(*g*) Pushes shall be of substantial mechanical construction and of a type approved by the Chief Electrical Engineer. The conductors shall terminate in suitable terminals and be secured by a metal thread screw.

(*h*) Heating-circuits shall not be controlled by this system unless fitted with an indicating-device approved by the Chief Electrical Engineer.

Wiring in Special Situations.

Where Inflammable Goods, or Explosive Dust or Gas is present.

125. (1) In places where highly inflammable goods—*e.g.*, cinematograph-films and petrol are stored or packed, or where inflammable or explosive dust or gas is liable to be present, incandescent lamps (not exceeding 60 watts) only shall be used, and they with their holders shall be enclosed in fittings having thick glass globes.

(2) Where inflammable or explosive dust or gas is liable to be present the fittings shall be gas-tight.

126. (1) The wiring shall be run in screwed steel conduit, and where inflammable or explosive dust or gas is liable to be present it shall be rendered gas-tight by painting all threads with white-lead, red-lead, or graphite pipe-jointing compound before screwing into fittings, and all conduit-fittings shall be gas-tight.

(2) The conduit shall in all cases be screwed into the lamp-fittings, and no flexible pendant, ceiling-roses, or portable apparatus shall be used.

(3) Where corrosive gases or liquids are also present, the proposed system of wiring shall be submitted to the Chief Electrical Engineer for approval.

127. Switches, fuses, and all accessories liable to arc shall, where practicable, be located outside such places as aforesaid, but where this is impracticable they shall be of the ironclad type, and where inflammable or explosive dust or gas is liable to be present they shall be flame-proof.

128. All generators, motors, starters, and their terminals and connections shall be enclosed in incombustible cases, which shall be flame-proof where inflammable or explosive dust or gas is liable to be present.

129. No conductors other than those required for the supply and use of current in such places as aforesaid shall be installed.

Freezing-chambers and Cool Stores.

130. (1) Section and distribution boards shall not be fixed in freezing or cooling chambers.

(2) Switches shall not be fixed in freezing or cooling chambers.

(3) No conductors other than those required for the supply and use of current therein shall be installed in freezing-chambers and cool stores.

Situations Subject to Excessive Heat.

131. (1) Cables insulated with rubber shall not be used in situations where the temperature of the conductor would exceed 135° F. for short periods, or 120° F. for long periods.

(2) Cables insulated with paper or fibre shall not be used in situations where the temperature of the conductor would exceed 176° F.

(3) Where higher temperatures are liable to be experienced, the wiring shall be in accordance with the requirements of the Authorized Inspector.

(4) In all cases where the air-temperature does not exceed 80° F. the current density for any size of wire shall not exceed that prescribed by Table IV or Table V in the Third Schedule hereto with respect to that size. Where that temperature is exceeded the current density shall be reduced so that the maximum temperature of the conductor does not exceed that stated in subclause (1) or subclause (2), as the case may be, of this regulation.

Bell and Telephone Circuits.

132. Cables which are used in connection with the electric bells, telephone and signalling apparatus, &c., in a building shall be kept away from and not be installed in the same casing or conduit as the cables used for the distribution of the electrical supply throughout the building.

133. Bell and signalling circuits (except telephone circuits) may be operated from the electric-lighting, heating, or power-supply mains, provided that they are connected to the secondary side of double-wound transformers, having a secondary voltage not exceeding 12 volts, and further provided that—

(*a*) Each transformer is mounted on the main switch-board.

(*b*) Each transformer is protected on the primary side by a single pole switch and fuse, and one side of the secondary winding is earthed.

(*c*) The conductors when unenclosed are secured individually by means of insulated staples, and where subject to mechanical injury the conductors are adequately protected.

(*d*) Joints in the conductors are, as far as practicable, avoided, but where they are unavoidable they are staggered, soldered, and efficiently insulated.

(*e*) The conductors are insulated with vulcanized india-rubber not less than 300 megohm grade, save that ordinary bell-wire may be used if the transformers are of a capacity not exceeding 50 watt and so designed that on sustained short circuit their impedance is such as to limit the current to such a value as will not burn out the transformer.

Selection of Cable Runs.

134. (1) Cables shall be fixed as far as possible in accessible positions, so chosen that thay 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 damage.

(2) All cables shall be installed in such a manner as will not damage or weaken the building unnecessarily, and with the least possible cutting-away of any structural work.

135. (1) The runs shall be selected to accord with the following requirements:—

(*a*) That no rubber-insulated cable shall be bent to a radius shorter than twice its overall diameter if unarmoured, or to a radius shorter than three times its overall diameter if lead-covered or armoured.

(*b*) That no paper-insulated cable (whether armoured or not) shall be bent to a radius shorter than six times its overall diameter.

(2) The foregoing represent the permanent bends; the arrangement of the runs must be such that the cable is not subjected to bends of this kind during drawing-in or erection.

BUNCHING OF CABLES.

136. When installed in wooden casing, cables carrying direct or alternating current may, if desired, be bunched, whatever their polarity or phase provided that—

(*a*) The number of cables bunched is not more than—

10 if the sectional area of each cable does not exceed 0·007 square inch (7/·036 in.);

6 if the sectional area of any cable exceeds 0·007 square inch (7/·036 in.), but does not exceed 0·0225 square inch (7/·064 in.);

4 if the sectional area of any cable exceeds 0·0225 square inch (7/·064 in.), but does not exceed 0·1 square inch (19/·083 in.);

3 if the sectional area of any cable exceeds 0·1 square inch (19/·083 in.).

(*b*) The size of the casing is sufficient to accommodate the cables without injury, but does not exceed that necessary to accommodate the maximum number of cables permissible.

137. (1) When installed in metal conduits cables carrying direct current may, if desired, be bunched, whatever their polarity; but if carrying alternating current the lead and return wires of a single-phase circuit, and all phase-wires with the neutral wire (if any) of a three-phase circuit, shall be bunched. All wires of several single-phase or three-phase circuits from the same source of supply may, if desired, be bunched.

(2) When cables are bunched, the number of cables so bunched and the run of conduit shall be such that it is possible to withdraw any one cable and draw in another of equal size in its place without injury.

(3) The number of cables installed in any one conduit shall not exceed that prescribed in Table XII in the Third Schedule hereto.

CABLE-SOCKETS AND OTHER CONNECTIONS.

138. The ends of all conductors having a sectional area greater than 0·01 square inch (7/·044 in.) shall be provided with a soldering-socket (preferably made in accordance with British Standard Specification No. 91) of such a size that all the strands of the conductor can enter the socket simultaneously, provided that where a binding-post is used the socket may be omitted.

139. Where a cable socket or terminal is used the cable shall be so supported that there is no appreciable stress on the socket or terminal.

140. Soldering-fluxes containing acid or other corrosive substances shall not be used.

141. When soldering or securing the ends of conductors to sockets or terminals the dielectric shall not be removed farther than is necessary to allow the conductor to enter and completely fill the socket or terminal and to be properly soldered. Dielectric 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 dielectric.

142. The braid, lead, or other covering over the dielectric, including the tape in contact therewith, shall be cut back at least ½ in. from the end of the dielectric.

143. In the case of paper-insulated cables the exposed conductor and dielectric shall be protected from moisture by being suitably sealed with insulating-compound.

144. The ends of stranded conductors unprovided with cable-sockets shall be made solid by soldering in the case of all conductors insulated with paper, and in the case of those insulated with rubber when the cables are fixed in damp situations. Where the strands are not soldered together they shall be taken under a washer of such size as will ensure full contact being made with all strands, or, alternatively, all strands shall be taken into a binding-post or terminal and there held by one or more suitable metal screws.

CONNECTION BETWEEN CABLES.

145. Subcircuit wiring of a smaller area than 0·0045 square inch (7/·029 in.) shall be carried out on the "loop-in" system. In all other cases the loop-in system shall be employed where practicable, and where not practicable connections between cables shall be made either by soldered joints or by mechanical connectors approved by the Chief Electrical Engineer.

146. Joints shall be readily accessible and mechanically and electrically sound. The conductors shall be soldered together, a flux free from acid or other corrosive substances being employed, and the resistance of the soldered joint shall be not greater than that of an equivalent length of the largest conductor included in the joint. In the case of rubber-insulated cables the joint shall be lapped with rubber to a thickness not less than that of the dielectric and with waterproofed protecting tapes so as to render it moisture-proof.

147. Every joint shall be enclosed in a joint-box complying with Regulation 149 hereof, the protective cover of the cable being maintained up to a point situated within that box. In the case of paper-insulated cables the joint, after being insulated with suitable impregnated tapes, 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, being filled with an insulating-compound impervious to moisture.

148. Connections between cables and flexible cords shall in every case be made by means of a ceiling-rose or an "Era" or other connector approved by the Chief Electrical Engineer fixed within a suitable receptacle. In the case of heavy fittings which cannot be fixed by the above method, the proposed method of fixing shall be approved by the Authorized Inspector.

149. Joint-boxes shall be constructed wholly of durable, non-ignitable, non-absorbent materials, and all insulation shall be of permanently high electric strength and insulation resistance. The live parts shall be so arranged by suitable spacing or shielding with non-ignitable insulating-materials that conductors of opposite polarity or different phase cannot be readily short-circuited. If used in damp situations joint-boxes shall be weather and moisture resisting.

PART VI.—FITTINGS AND ACCESSORIES.

FITTINGS.

CONSTRUCTION OF FITTINGS.

150. Fittings shall be so designed and constructed that the passages for the insulated conductors are of ample size, and are free from rough projections and sharp angles or bends. All outlets shall have well-rounded edges or be bushed.

151. Fittings shall be so designed, and the insulated conductors so installed that no stress can be applied by the conductors to any terminal to which they may be connected.

152. Fittings shall be so designed and fixed that neither dust nor moisture can readily accumulate on live parts.

153. Where a hanging fitting exceeds 10 lb. in weight it shall be supported by a metal chain, tube, or rod, or by several flexible cords in such a manner that the maximum weight to which any cord is subjected shall be not greater than that specified in Regulation 121.

154. Open-type fittings shall not be furnished with inflammable shades unless such shades are kept free from contact with the lamps by suitable guards or supports. Celluloid shall not be used for shades or candle-tubes or in any situation near a lamp.

155. Enclosed-type fittings shall be provided with a removable glass receptacle arranged to enclose the lamp completely, and of such size or construction as to prevent undue heating of the lamp; and if the position of the fitting be such that the glass receptacle is liable to mechanical damage, the glass shall be protected by a suitable wire guard.

156. Fittings, whether fixed or portable, shall, wherever exposed to rain, drip, or externally condensed moisture, be of the weather-proof type.

ENCLOSED FITTINGS.

157. Enclosed fittings shall be used—

(*a*) In places where inflammable or explosive dust or gas is liable to be present or where inflammable goods are stored, and they shall be of strong construction, having airtight external globes of thick glass provided with substantial guards.

(*b*) In positions in which the lamp is either near to or can swing into contact with readily combustible materials.

PORTABLE FITTINGS AND APPLIANCES.

158. Every hand-lamp, except a hand-lamp made entirely of metal provided with a watertight glass and earthed as provided in Part XI hereof, shall have the metal parts of the holder and any metal in contact therewith shrouded by in-

or repaired, plugs and sockets shall be placed ... 5 ft. above the floor-level unless an interlocked plug and gas-tight switch is used.

192. (1) Adapters for use in lamp-holders shall be constructed of tough non-ignitable, non-conducting, non-hygroscopic material other than hardwood.

(2) Adapters for use in screw holders shall be of one or other of the following types, namely—

(*a*) Combined adapter with pull-out plug;

(*b*) Adapter with a loose screw to prevent twisting of the flexible conductor.

ELECTRIC SIGNS.

193. Every electric sign shall comply with the following requirements:—

(*a*) It shall be readily accessible for inspection and attention.

(*b*) The sign shall be connected to the main supply by independent wiring, and shall be controlled by a fuse and switch on each live conductor. When more than one switch is required the switches shall be linked.

(*c*) Where elaborate switching and flashing apparatus is installed, a special non-ignitable enclosure shall be provided.

(*d*) If fixed in the open air—

(i) It shall be weather-proof, or, alternatively, the wiring and lamp-holders shall be weather-proof.

(ii) Only non-ignitable materials shall be used in its construction, except for letters and designs, for which hardwood is permissible.

(iii) All external wiring shall be of Class R, Class S, or Class T, as specified in Part III of the Second Schedule hereto, and in the case of Class T the conduits shall be galvanized.

(iv) External electric outline lighting, when the lamp-holders are not enclosed, or of the weather-proof type, shall be supplied at extra-low pressure.

terminal box.

(2) Trailing cables used in connection with portable motors shall have their protective sheathing terminating in and properly secured to the motor terminal box.

CONTROL OF MOTORS.

202. Every motor shall be controlled by a switch or circuit breaker 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.

203. (1) Every motor shall be provided with an efficient switch or circuit-breaker for starting and stopping, so placed as to be easily operated by the person controlling the motor, and every motor having a rating exceeding ½ horse-power for direct current, or 3 horse-power for alternating current, shall in addition be provided with—

(*a*) Means for automatically opening the circuit if the supply-pressure falls sufficiently to cause the motor to stop:

(*b*) In the case of direct-current motors, a starter or switch for limiting the amount of current taken when starting and accelerating:

(*c*) In the case of alternating-current motors, a starter or switch which shall limit the amount of current taken, when starting and accelerating, to the value (if any) required by the electrical supply authority:

(2) Every motor rated at over 3 horse-power shall be provided with an approved time-lag automatic over-load release in addition to the low-voltage release.

204. (1) Motors of 3 horse-power or under shall, when the starting-current is over 200 per cent. of full-load current, be provided with time-lag cut-outs or automatic time-lag release approved by the Authorized Inspector, in addition to the

sulation to prevent contact between such metal and the metal guard, or when the lamp is in position and the guard is removed between such metal and the user.

159. 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 non-ignitable composite insulating material capable of withstanding rough usage in service.

160. Where portable fittings, appliances, or accessories are likely to be used, the pressure between any two points in one room or compartment shall not exceed 250 volts, unless the fittings, appliances, 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, alternatively, unless the metal frames and sheathings of all such portable appliances and accessories are earthed.

161. (1) Flexible conductors of portable fittings or apparatus consuming not over 1 ampere shall be connected through wall-plugs or adapters fitted to lamp-holders.

(2) If over 1 ampere they shall be connected through wall-plugs only.

BASE-BLOCKS.

162. Fittings shall be mounted on a base-block.

ACCESSORIES.

FIXING OF ACCESSORIES.

163. Accessories other than fuses shall be mounted on a base-block unless thay are completely enclosed in metallic casing, and where the surface on which it is mounted is liable to become damp the base-block shall be rendered impervious to moisture.

CEILING-ROSES.

164. (1) Ceiling-roses shall not be used for pressures exceeding 250 volts.

(2) Not more than two twin flexible cords shall be attached to one ceiling-rose unless it is specially designed for multiple pendants.

(3) Ceiling-roses shall comply with the requirements of British Standard Specification No. 67.

LAMP-HOLDERS.

165. Lamp-holders shall comply with the appropriate British Standard Specification. Lamp-holders in weather-proof portable hand-lamps shall have their uninsulated metal parts in metallic contact with the frames of such fittings.

166. (1) Switch lamp-holders shall not be used unless they are of the types approved by the Chief Electrical Engineer.

(2) Switch lamp-holders shall be controlled by a wall-switch in groups of not more than ten, every such group having at least one lamp in the room or compartment controlled solely by the wall-switch.

167. In the case of screw lamp-holders, the live conductor shall be connected to the centre contact.

174. The resistance and solenoid 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.

175. In positions where inflammable or explosive dust or gases are liable to be present mercury-vapour lamps shall not be used.

ARC LAMPS.

176. Arc lamps shall have the whole of their live parts insulated from the frame or case, and the case shall be insulated from earth. The lamps shall be so fixed that they cannot swing into contact with any substances metallic or otherwise, that might connect them with earth.

177. (1) Where the floor immediately underneath an arc lamp is formed of combustible material, or where heated particles of carbon might fall and constitute a danger to persons walking underneath, every such arc lamp, except as provided in the next succeeding regulation, shall be provided with a globe or lantern arranged to intercept such falling particles of carbon.

(2) Globes of 12 in. diameter and over shall be contained within wire netting of not greater than 3 in. mesh, so arranged as to prevent pieces of broken glass falling therefrom.

178. In all situations in which an open arc is essential, as in photographic work—

(*a*) When the lamp is fixed, the floor, unless of incombustible material, immediately underneath the lamp shall be protected from falling particles of carbon by an incombustible covering.

(*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 under-side of the lamp.

(*c*) The terminals of all lamps when less than 8 ft. from the floor, and the terminals of all portable lamps, shall be so guarded that they cannot be accidentally touched or short-circuited.

(*d*) If fitted in situations where combustible material is present, open inverted arc lamps shall have metal reflectors rigidly attached beneath the arc, which at all times shall be below the level of the upper edge of the reflector. This reflector shall project radially at least 15 in., and in hazardous risks 21 in., measured horizontally beyond the arc.

(*e*) Arc lamps shall not be fitted in positions in which explosives or inflammable dust or gases may accumulate.

(*f*) Every arc-lamp circuit shall be controlled by a fuse and switch on each live conductor. Where more than one switch is required on any such circuit the switches shall be linked.

208. All live parts shall be so guarded as to prevent accidental contact therewith.

209. The frame of every resistance and control gear shall be provided with a suitable terminal to which the earthing-lead can be connected.

210. Resistances shall be so proportioned and placed that they do not rise to such a temperature as to impair their durability, and they shall be so disposed within their cases that no accessible part of such cases shall rise to a temperature higher than 176° F.

211. Internal connections the temperature rise of which may exceed 86° F. shall not be soldered, and all such connections, unless self-supporting or rigidly fixed in position, shall be continuously insulated with non-ignitable material or beads.

212. Suitable terminals with cable-sockets (preferably made in accordance with British Standard Specification No. 91) shall be provided for the attachment of external leads, and shall be so situated that such leads enter the case below the resistances, and are not exposed at any point to a high temperature.

69. POSITION.

213. Nothing in Regulations 214 and 215 hereof shall apply to apparatus having a capacity of less than 60 watts.

214. (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:

(*b*) In well-ventilated spaces in which inflammable or explosive gases or dust cannot 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 gases or dust, control gear shall be flame-proof.

215. All woodwork or other combustible material which is within a distance of 24 in. (measured vertically) above, or 12 in. (measured vertically) below, or 6 in. (measured in any other direction) from the frames or cases containing resistances shall be protected with non-ignitable material.

ELECTRIC LIFTS.

REQUIREMENTS AS TO LIFTS.

216. Every electrically operated lift shall be operated from a circuit which is independent of the lighting installation.

217. The trailing-cable shall be multicore, and shall comprise the requisite number of conductors to keep the wiring of the control and each set of safety-devices entirely separate.

218. All cables in the lift or hoist shaft, except trailing-cables, shall be enclosed in Class T metal conduits, the control and motor leads being in separate conduits.

PART VIII.—HEATING, COOKING, AND OTHER APPLIANCES.

HEATING AND COOKING APPLIANCES.

GENERAL CONSTRUCTION.

219. All heating and cooking appliances shall be so constructed and mounted that their supports and those parts which have necessarily to be handled in their operation cannot become heated to a temperature exceeding 130° F. The heating elements shall be of materials durable at the

223. (1) The hot-plates of all electric ranges operated above 110 volts to earth shall be ironclad, and the oven elements shall be so guarded that the cooking-utensils cannot be brought into contact with them, and so that accidental personal contact cannot be made.

(2) On pressures of 110 volts or lower, open-type elements may be used; provided that if the pressure is reduced from a voltage higher than 110 volts a double-wound transformer shall be used.

(3) This regulation shall come into force on the 1st day of January, 1928.

224. (1) Each element shall be protected and controlled by a switch and fuse on the live side.

(2) When a plug-socket is fitted to the appliance it shall have a switch and fuse on the live side, and be so mounted as to secure freedom from electrical hazard. This plug shall have a separate contact connected to earth, and any portable apparatus used from this plug shall be earthed in accordance with the requirements of Part XI hereof.

CONTROL.

225. (1) Appliances shall be protected by a fuse on each live conductor.

(2) Appliances shall be controlled as a whole by a switch on each live conductor and such switch shall be mounted on the wall adjacent to and within easy reach of such appliance. If more than one switch is so used for any one appliance, all such switches shall be linked.

(3) The wiring to fixed appliances shall be in screwed conduit connected mechanically and electrically to the metal frame of the appliance: Provided that flexible metallic conduit may be used between the wall and the appliance if connected mechanically to the screwed conduit and the metal frame of the appliance.

(4) For the purpose of this regulation a fixed appliance is one which is obviously intended by size, weight, and construction to be secured in a fixed position.

PORTABLE APPLIANCES.

226. Portable appliances shall be of such shape or be so weighted that they cannot be easily overturned.

227. (1) Heating-points shall each be rated at not less than 1,000 watts, and shall be controlled by a switch of not less than 8 amperes capacity mounted in accordance with the requirements of subclause (2) of Regulation 179 hereof. For appliances over 1,800 watts the heating-points shall, except in the case of a multiple-earthed neutral system, be controlled by a double-pole switch.

(2) The minimum size of conductor for any heating-point shall be 3/·036 in.

(3) Switches for heating-points shall not be fixed at a less distance than 12 in. from any switch controlling lighting.

228. All portable heating-appliances shall have at least one section of the heating element controlled solely by a wall-switch.

ELECTRIC WATER-HEATERS.

229. (1) The electric heater shall not be in direct contact with any combustible material, and where the heating element is mounted at a less distance than 6 in. from the bottom of the cylinder the cylinder shall be supported on incombustible material.

(2) Every heater shall be controlled by a switch fixed in a readily accessible position.

(3) Conductors to the heater connection-box shall be enclosed in screwed or flexible metallic conduit. Where the conductors are subject to temperatures exceeding those speci-

usage in service, and so arranged that the cover will automatically close over the contacts when the plug is withdrawn.

185. The bases of sockets shall be of tough non-ignitable, non-conducting, non-hygroscopic material other than hardwood. The contacts shall be of spring-clip type, or such other type as may be approved by the Chief Electrical Engineer.

186. The covers of sockets and plugs shall be made of heat-resisting insulating material other than hardwood, or of rigid metal, which shall be kept well clear of all live parts, or provided with an insulating-lining.

187. (1) Weather-proof plugs and sockets shall be used wherever exposed to rain, drip, or externally condensed moisture.

(2) Such accessories shall be of specially robust construction, and be provided with efficient means to keep the sockets weather-proof 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 chain.

(3) When the plug is inserted in its socket, the combined fitting and its interlocking-switch (if any) shall also be weather-proof.

188. If concentric sockets are used on an earthed concentric system of wiring, the centre contact of the socket shall be connected to the insulated conductor.

189. Where tough rubber-sheathed flexible cord is used, a suitable clamp shall be provided to grip the protecting covering of the flexible cord.

190. When sockets and plugs have provision for earthing, the current-carrying capacity of the earthing-contact shall comply with the requirements of Part XI hereof with respect to earthing.

191. In places where petrol-driven conveyances are stored or repaired, plugs and sockets shall be placed not less than 5 ft. above the floor-level unless an interlocked plug and gas-tight switch is used.

192. (1) Adapters for use in lamp-holders shall be constructed of tough non-ignitable, non-conducting, non-hygroscopic material other than hardwood.

(2) Adapters for use in screw holders shall be of one or other of the following types, namely—

(*a*) Combined adapter with pull-out plug;

(*b*) Adapter with a loose screw to prevent twisting of the flexible conductor.

ELECTRIC SIGNS.

193. Every electric sign shall comply with the following requirements:—

(*a*) It shall be readily accessible for inspection and attention.

(*b*) The sign shall be connected to the main supply by independent wiring, and shall be controlled by a fuse and switch on each live conductor. When more than one switch is required the switches shall be linked.

(*c*) Where elaborate switching and flashing apparatus is installed, a special non-ignitable enclosure shall be provided.

(*d*) If fixed in the open air—

(i) It shall be weather-proof, or, alternatively, the wiring and lamp-holders shall be weather-proof.

(ii) Only non-ignitable materials shall be used in its construction, except for letters and designs, for which hardwood is permissible.

(iii) All external wiring shall be of Class R, Class S, or Class T, as specified in Part III of the Second Schedule hereto, and in the case of Class T the conduits shall be galvanized.

(iv) External electric outline lighting, when the lamp-holders are not enclosed, or of the weather-proof type, shall be supplied at extra-low pressure.

(v) For electric signs, outline, and decorative wiring, when in use outside a building, the final subcircuits shall not exceed 10 amperes.

PART VII.—MOTORS, CONTROL GEAR AND LIFTS.

MOTORS.

TYPES.

194. Motors may be of any of the types enumerated in British Standard Specification No. 168, or of the immersible type, and all motors rated at more than 1 brake horse-power shall conform in all respects to that specification.

195. Terminals of motors shall be so guarded that they cannot be accidentally touched or short-circuited.

POSITION AND SAFETY PRECAUTIONS.

196. Motors shall, wherever possible, be placed in well-ventilated spaces in which inflammable gases cannot accumulate. Where that is not practicable the motors shall be of the flame-proof or pipe-ventilated type, with inlet and outlet connected to the outer air.

197. Motors fixed in situations in which the surrounding air exceeds the limit of temperature permitted for the cooling air in the appropriate British Standard Specification shall be of special construction, or, alternatively, of the pipe-ventilated, forced-draught, or induced-draught type, connected by ventilating-ducts to a source of cool-air supply.

198. Motors shall, wherever possible, be placed in positions in which they are not exposed to risk of mechanical injury or to damage from water, steam, or oil. Motors necessarily exposed to such conditions shall have suitable types of enclosing frames selected from the standard "types of enclosure" specified in British Standard Specification No. 168.

199. Pipe-ventilated, forced-draught, and induced-draught motors shall be supplied with air as cool as possible, and the air-intakes shall be guarded against the admission of dirt or moisture.

200. No unprotected woodwork or other combustible material shall be within a distance of 12 in. (measured horizontally) from or within 4 ft. (measured vertically) above any motor, unless such motor be of the totally enclosed, flame-proof, or pipe-ventilated type with inlet and outlet connected to the outer air. A metal plate or tray extending 12 in. beyond the base of the machine shall be placed under every open-type machine which is mounted on or over a floor consisting of wood or other combustible material.

201. (1) Where conductors are run in conduit, or where metal-sheathed cables are used, the conduit or metal sheath, as the case may be, shall terminate in and be properly secured to the motor terminal box; provided that flexible metallic conduit may be used between screwed conduit and the motor terminal box.

(2) Trailing cables used in connection with portable motors shall have their protective sheathing terminating in and properly secured to the motor terminal box.

CONTROL OF MOTORS.

202. Every motor shall be controlled by a switch or circuit breaker 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.

203. (1) Every motor shall be provided with an efficient switch or circuit-breaker for starting and stopping, so placed as to be easily operated by the person controlling the motor, and every motor having a rating exceeding ½ horse-power for direct current, or 3 horse-power for alternating current, shall in addition be provided with—

(*a*) Means for automatically opening the circuit if the supply-pressure falls sufficiently to cause the motor to stop:

(*b*) In the case of direct-current motors, a starter or switch for limiting the amount of current taken when starting and accelerating:

(*c*) In the case of alternating-current motors, a starter or switch which shall limit the amount of current taken, when starting and accelerating, to the value (if any) required by the electrical supply authority:

(2) Every motor rated at over 3 horse-power shall be provided with an approved time-lag automatic over-load release in addition to the low-voltage release.

204. (1) Motors of 3 horse-power or under shall, when the starting-current is over 200 per cent. of full-load current, be provided with time-lag cut-outs or automatic time-lag release approved by the Authorized Inspector, in addition to the circuit fuses.

(2) The number of such devices to be provided for each motor shall be not less than—

(*a*) D.C. or A.C. single-phase .. .. .. One.

(*b*) Two-phase or three-phase .. .. .. Two.

205. In every place in which a machine is being driven by a motor the control of which is inaccessible from the machine, and where no means for mechanically stopping the machine exist, there shall be provided some readily accessible means for switching off the motor.

RESISTANCES AND MACHINE-CONTROL GEAR.

68. GENERAL CONSTRUCTION.

206. Nothing in Regulations 207 to 212 hereof shall apply to apparatus having a capacity of less than 60 watts.

207. The general construction of all resistances and machine-control gear shall be in accordance with the appropriate British Standard Specifications.

208. All live parts shall be so guarded as to prevent accidental contact therewith.

209. The frame of every resistance and control gear shall be provided with a suitable terminal to which the earthing-lead can be connected.

210. Resistances shall be so proportioned and placed that they do not rise to such a temperature as to impair their durability, and they shall be so disposed within their cases that no accessible part of such cases shall rise to a temperature higher than 176° F.

211. Internal connections the temperature rise of which may exceed 86° F. shall not be soldered, and all such connections, unless self-supporting or rigidly fixed in position, shall be continuously insulated with non-ignitable material or beads.

212. Suitable terminals with cable-sockets (preferably made in accordance with British Standard Specification No. 91) shall be provided for the attachment of external leads, and shall be so situated that such leads enter the case below the resistances, and are not exposed at any point to a high temperature.

69. Position.

213. Nothing in Regulations 214 and 215 hereof shall apply to apparatus having a capacity of less than 60 watts.

214. (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:

(*b*) In well-ventilated spaces in which inflammable or explosive gases or dust cannot 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 gases or dust, control gear shall be flame-proof.

215. All woodwork or other combustible material which is within a distance of 24 in. (measured vertically) above, or 12 in. (measured vertically) below, or 6 in. (measured in any other direction) from the frames or cases containing resistances shall be protected with non-ignitable material.

ELECTRIC LIFTS.

Requirements as to Lifts.

216. Every electrically operated lift shall be operated from a circuit which is independent of the lighting installation.

217. The trailing-cable shall be multicore, and shall comprise the requisite number of conductors to keep the wiring of the control and each set of safety-devices entirely separate.

218. All cables in the lift or hoist shaft, except trailing-cables, shall be enclosed in Class T metal conduits, the control and motor leads being in separate conduits.

PART VIII.—HEATING, COOKING, AND OTHER APPLIANCES.

HEATING AND COOKING APPLIANCES.

General Construction.

219. All heating and cooking appliances shall be so constructed and mounted that their supports and those parts which have necessarily to be handled in their operation cannot become heated to a temperature exceeding 130° F. The heating elements shall be of materials durable at the highest temperature to which they attain during use, and be so arranged that they can be readily replaced.

220. The support and frame of every fixed appliance shall be provided with a suitable terminal to which the earthing-lead shall be connected. The conduit shall not be considered as an earthing-lead in this case.

221. (1) The connections between heating elements shall be effected either by parts of the elements themselves or by material having heat-resisting properties similar to those of the elements.

(2) The junction between the elements and switches or external connecting-leads shall be effected without solder by connectors of types approved by the Chief Electrical Engineer, which shall be so placed that the temperature of no part of the switch or terminal connections can rise above 176° F.

222. All connections between elements or between elements and main terminals shall, unless self-supporting or rigidly fixed in position, be continuously insulated with suitable non-ignitable material.

223. (1) The hot-plates of all electric ranges operated above 110 volts to earth shall be ironclad, and the oven elements shall be so guarded that the cooking-utensils cannot be brought into contact with them, and so that accidental personal contact cannot be made.

(2) On pressures of 110 volts or lower, open-type elements may be used; provided that if the pressure is reduced from a voltage higher than 110 volts a double-wound transformer shall be used.

(3) This regulation shall come into force on the 1st day of January, 1928.

224. (1) Each element shall be protected and controlled by a switch and fuse on the live side.

(2) When a plug-socket is fitted to the appliance it shall have a switch and fuse on the live side, and be so mounted as to secure freedom from electrical hazard. This plug shall have a separate contact connected to earth, and any portable apparatus used from this plug shall be earthed in accordance with the requirements of Part XI hereof.

Control.

225. (1) Appliances shall be protected by a fuse on each live conductor.

(2) Appliances shall be controlled as a whole by a switch on each live conductor and such switch shall be mounted on the wall adjacent to and within easy reach of such appliance. If more than one switch is so used for any one appliance, all such switches shall be linked.

(3) The wiring to fixed appliances shall be in screwed conduit connected mechanically and electrically to the metal frame of the appliance: Provided that flexible metallic conduit may be used between the wall and the appliance if connected mechanically to the screwed conduit and the metal frame of the appliance.

(4) For the purpose of this regulation a fixed appliance is one which is obviously intended by size, weight, and construction to be secured in a fixed position.

Portable Appliances.

226. Portable appliances shall be of such shape or be so weighted that they cannot be easily overturned.

227. (1) Heating-points shall each be rated at not less than 1,000 watts, and shall be controlled by a switch of not less than 8 amperes capacity mounted in accordance with the requirements of subclause (2) of Regulation 179 hereof. For appliances over 1,800 watts the heating-points shall, except in the case of a multiple-earthed neutral system, be controlled by a double-pole switch.

(2) The minimum size of conductor for any heating-point shall be 3/·036 in.

(3) Switches for heating-points shall not be fixed at a less distance than 12 in. from any switch controlling lighting.

228. All portable heating-appliances shall have at least one section of the heating element controlled solely by a wall-switch.

Electric Water-heaters.

229. (1) The electric heater shall not be in direct contact with any combustible material, and where the heating element is mounted at a less distance than 6 in. from the bottom of the cylinder the cylinder shall be supported on incombustible material.

(2) Every heater shall be controlled by a switch fixed in a readily accessible position.

(3) Conductors to the heater connection-box shall be enclosed in screwed or flexible metallic conduit. Where the conductors are subject to temperatures exceeding those specified in Regulation 131 hereof, the conduit shall terminate in a junction-box approved by the Authorized Inspector, and fixed in an accessible position near the heater. Heat-resisting conductors approved by the Authorized Inspector shall be used between the junction-box and the heater.

230. All water-heaters shall be so arranged and connected that the water entering into or issuing from them is at earth potential.

Protection of Combustible Materials.

231. Heating and cooking appliances shall not be fixed near combustible materials unless the latter are suitably protected.

MEDICAL AND DENTAL APPLIANCES.

232. Medical and dental appliances shall not be connected direct to circuits of a voltage more than 5 per cent. above the operating voltage of the apparatus. The supply voltage

shall not be reduced by means of a resistance or resistances in circuit with the apparatus, but by double-wound transformers or motor generators.

PART IX.—PLACES OF PUBLIC AMUSEMENT.

GENERAL.

233. (1) The regulations in this Part shall apply to theatres, music-halls, motion-picture theatres, and public halls, and embody special requirements in addition to any other requirements of these regulations.

(2) In case of any dispute as to whether a place is a public hall the matter shall be submitted to the Chief Electrical Engineer, whose decision shall be final.

234. All fixed wiring shall be enclosed in Class T metal conduits as specified in Part III of the Second Schedule hereto.

235. (1) The stage-switchboard shall be either of the dead-front type, or the accessories shall be of the totally enclosed type.

(2) A metal hood approved by the Authorized Inspector and extending the full length of the board shall be fitted at the top of the switchboard to protect it from falling objects.

(3) The switchboard shall be fixed in a convenient position, preferably overlooking the stage, and inaccessible to all but the switchboard operator.

(4) A platform with proper means of access shall be provided for the switchboard operator. The platform shall be of fire-resisting material, with a hardwood or other insulating floor. The handrail of the platform, if of metal, shall not be connected directly or indirectly to earth.

(5) Switchboards and fuse-boards shall be fixed in accessible positions where they will not obstruct passages or exitways.

236. (1) Resistances shall be mounted on incombustible bases, 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) The resistances shall be provided with adequate ventilation.

237. Stage-lighting, including footlights, border-lights, and proscenium side lights, shall be so wired that the maximum current on each circuit shall not exceed 10 amperes.

238. Cables to battens and floats 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 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 covered with a slow-burning braiding approved by the Chief Electrical Engineer; or

(*d*) Flexible cables covered with asbestos or fire-resisting braiding approved in accordance with paragraph (*g*) of Regulation 93 hereof; or

(*e*) Flexible cables covered with hard cord braiding.

239. Stage-plugs shall be of a design approved by the Chief Electrical Engineer, so constructed that dirt and dust cannot accumulate in the socket, and so that the contact surfaces cannot be readily short-circuited.

240. (1) Lamps on battens, footlights, &c., shall be protected by stiff wire guards so arranged that no scenery or other inflammable material can come in contact with the lamps, and shall be properly protected from everything liable to cause short-circuit.

(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.

241. Every electrical fitting or apparatus of any description shall be so fixed or arranged that under no circumstances can it interfere with the proper working of the safety-curtain.

242. (1) Portable lamps for the orchestra or similar lighting shall be connected to a subcircuit or subcircuits to which no other lighting is connected.

(2) Outline or exterior lighting shall be connected to a subcircuit or subcircuits to which no other lighting is connected.

SPECIAL AS TO MOTION-PICTURE THEATRES.

243. Conductors from the switchboard in the projection-room to the cinematograph machine shall be enclosed in screwed conduit, and terminate in a terminal-box approved by the Authorized Inspector. Conductors from such box to the lamp shall be covered with fire-resisting material.

244. (1) The conductors for cinematograph machines and accessories shall be taken as a separate circuit from the source of supply, or from the supply side of the main fuses in the general lighting-circuit; and there shall be efficient switches and fuses inserted at the point where the supply is taken, and in addition an efficient double-pole switch shall be fitted in the conductors within the projection-room.

(2) The maximum potential difference across the carbons of the lamp or between any part of the arc-circuit on the cinematograph machine and earth shall not exceed 110 volts under any circumstances.

(3) Resistances for cinematograph machines shall be placed inside the projection-room.

PART X.—HIGH AND EXTRA-HIGH PRESSURES.

HIGH AND EXTRA-HIGH PRESSURE APPARATUS.

245. The regulations in this Part shall apply to high and extra-high pressure apparatus within consumers' premises, and embody special requirements in addition to any other requirements of these regulations or of the Electrical Supply Regulations 1927.

246. Transformers shall not be installed in buildings except by permission of the supply authority's Electrical Engineer.

247. Oil circuit-breakers shall be of the loose-handle type, and provision shall be made to isolate the oil circuit-breaker from the supply.

248. (1) High or extra-high pressure wiring shall consist of earthed metal-sheathed cable protected from mechanical injury.

(2) The cable shall be in accordance with British Standard Specification No. 7, or other types approved by the Chief Electrical Engineer, and shall terminate at each end in a terminal-box filled with compound.

249. Motors shall not be installed in situations other than motor-rooms specially constructed for the purpose, without the approval of the supply authority's Electrical Engineer.

250. (1) Every motor and converter shall be protected and controlled by efficient means, suitably placed and so connected that all pressure may thereby be cut off from the motor or converter, as the case may be, and from all apparatus in connection therewith.

(2) Efficient means shall be provided outside the motor-room for stopping the motor in case of accident.

251. In this Part of these regulations the term "supply authority's Electrical Engineer" shall mean the Chief Electrical Engineer in cases where the supply authority is not an Electric-power Board, County Council, Borough Council, or Town Board.

PART XI.—EARTHING.

SPECIFYING WHAT SHALL BE EARTHED.

GENERAL.

252. The following shall be effectively earthed to the satisfaction of the Authorized Inspector:—

(*a*) Metal sheathings of Class M cable.

(*b*) Metallic envelopes of Class R armoured cables.

(*c*) Screwed conduit, Class T.

(*d*) The bed-plates and frames of generating plant.

(*e*) The frames of all motors and starters of machines of 1 horse-power or over.

(*f*) The frames of all motors and starters of machines of under 1 horse-power where it is possible for a person touching the frames to make contact simultaneously with earth.

(*g*) All cases, frames, or metal enclosures of static transformers and choke-coils.

(*h*) One side of the secondary winding of double-wound transformers used in connection with wiring systems having extra-low-pressure control circuits, and all metal protecting cases of such transformers.

(*i*) One side of the secondary winding of double-wound bell-ringing transformers and all metal protecting cases of such transformers.

(*j*) Metal cases and metal framework (if any) of ironclad switch-gear.

(*k*) The support and frame of every fixed heating and cooking appliance.

(*l*) Ironclad elements of all electric ranges.

(*m*) The metal framework of electric signs.

(*n*) All metal liable to become alive from any cause when such metal is in damp situations or in places where the conditions are such that a person touching it would be likely to be simultaneously making contact with earth.

(*o*) All metal liable to become alive from any cause when such metal is so situated that there is risk of accidental contact with earthed metal (other than earthed metal mounted on a switchboard).

(*p*) The exposed metal of any switch operating at any pressure other than extra-low, if such switch is so situated that any person operating it is liable to make contact with earth.

(*q*) All exposed metal in bathrooms which is liable to become alive and which is within reach of a person standing in or on or otherwise in contact with the bath.

SPECIAL AS TO STEEL CONSTRUCTION AND MACHINERY.

253. (1) In buildings containing steel construction, earthed metal forming part of the electric installation shall be earthed independently of the structural steelwork, but may be secured to it, provided that such steelwork is itself earthed.

(2) Where the structural steelwork is not earthed, metal which is not earthed and which is liable to become alive should the insulation become defective shall be protected from contact with the structure.

254. Where electrical apparatus is mounted on machinery—*e.g.*, cranes and lifts—the metal covers and frames of such apparatus, and the metal conduits or sheathings of the conductors, shall be connected to the machinery, which shall itself be earthed.

METHODS OF EARTHING.

255. All Class T metal conduits shall be earthed as near as practicable to the point of entry of the supply.

256. When the metallic conduits or sheathings of cables have to be earthed, or are themselves used as earthing connections, every joint in such conduit or sheathing shall be so made that the current-carrying capacity of the joint shall not be less than that of the conduit or sheathing itself.

257. 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.

258. Every fixed heating and cooking appliance shall, for the purpose of earthing, be provided with a suitable terminal to which the earthing-lead shall be connected.

259. In the case of fixed heating and cooking appliances, and of motors of over 5 horse-power, an earthing-lead other than the conduit shall be taken direct from the appliance or motor to the nearest earth.

260. (1) In all cases where portable metal fittings or appliances have to be earthed in accordance with paragraph (*n*) or paragraph (*o*) of Regulation 252 hereof, all metal parts shall be connected to earth by means of an additional conductor contained within the flexible cord, and connected to a separate terminal on the plug. If this flexible cord has a metal armouring, it shall, in addition to such additional conductor, be efficiently connected electrically at one end to the metal frame of the fitting, and at the other end to the earthed metal of the plug-and-socket connection.

(2) Such fittings shall have strong metal guards in metallic contact with the exposed metal of these fittings.

(3) The connection to earth shall be made automatically when the plug on the flexible conductor is connected to the supply circuit.

261. (1) Where the multiple earthed neutral system is used, the earthing-lead shall be taken from the neutral bar or stud, and the conduit shall (in addition to being itself earthed) be connected to this earthing-lead.

(2) Save as provided in the last preceding subclause the neutral wire of any system shall not be used as an earthing-lead.

PRECAUTIONS IN EARTHING.

262. Great care shall be taken to secure as far as possible that the earthing systems used shall be such that the combined resistance of the earthing-lead and of the earthing system itself is low enough to permit the passage of the current necessary to operate the fuse, circuit-breaker, or the earth leakage trip of the circuit-breaker protecting the circuit, and the earthing-lead shall be as short as possible.

263. (1) Where an efficiently earthed water-supply with metal-to-metal joints is available, the earthing-lead shall be connected to the pipes of such water-supply as near as practicable to the point of entry of such pipes to the consumer's building.

(2) Where an efficiently earthed water-supply system is not available, a galvanized-iron water pipe or pipes of not less than ¾ in. (internal diameter) shall be driven vertically into the ground to such a depth as to ensure adequate contact with the moist subsoil. The minimum length of the driven pipe shall be 4 ft. Alternatively, an earth plate or plates approved by the Authorized Inspector may be used. The earth-wire shall be placed in such a position and in such a manner that it cannot be accidently damaged or cut.

264. Pipes conveying gas, hot water, or an inflammable liquid shall not be used as an earthing system.

265. Where the metal cases of switches, distribution-boards, or other apparatus have to be earthed, special precautions shall be taken to guard against the risk of shock or burning to any one when working on live conductors in or adjacent to such apparatus.

EARTHING-LEADS.

266. Every conductor used as an earthing-lead shall be of high-conductivity copper, protected by tinning or otherwise against corrosion and against mechanical injury.

267. All connections of the earthing-lead to the installation and to the earthing system itself shall be readily accessible.

268. If more than one plate or tubular earth is employed for one earthing system they shall be efficiently and permanently connected together.

269. (1) Whenever an earthing-lead is connected to a pipe, conduit, cable-sheath, armour, or other cylindrical earth a substantial tinned-metal clip of not less than No. 18 guage, 1 in. wide, of incorrodible metal, or any other earthing-device approved by the Chief Electrical Engineer, shall be used.

(2) For armoured cables such clips shall be so designed as to grip firmly the whole of 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.

270. The ends of all earthing-leads, unless of flat strip not less than ¾ in. wide, shall be provided with a soldering-socket of such a size that all the strands of the conductor can enter the socket simultaneously, or, alternatively, the earthing-leads shall be taken into a binding-post or terminal fitting of a type approved by the Chief Electrical Engineer.

271. In the case of a multiple earthed neutral system the earthing-lead and the neutral main shall be sweated together into a cable-socket, which shall be efficiently connected to the neutral bus-bar. The area of this earthing-lead shall not be less than one-half the area of the neutral main.

PART XII.—ADDITIONS TO AND ALTERATIONS OF INSTALLATIONS.

272. Before an addition is made to any installation care shall be taken to ascertain whether the existing conductors and accessories affected by the proposed addition are of sufficient capacity for the augmented current which they may have to carry.

273. Where alternative plug positions are provided for electric heating appliances, it shall be ascertained whether the existing conductors are of sufficient size to allow of the simultaneous use of apparatus connected to more than one plug.

274. All dead or disused wires, fittings, accessories, and apparatus 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.

275. 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 such alteration or addition.

DIVISION III.—INSPECTION AND TESTING.

PART XIII.—INSPECTION AND TESTING.

GENERAL.

276. (1) On the completion of any installation the registered electrical wireman in charge of the work shall sign in ink a label to be provided by the contractor carrying out the work.

(2) Such label shall bear the name and registration number of the said wireman and the date of completion of the work, and shall be securely tied by him to the main switchboard.

(3) Such label may be removed from the switchboard only by the Authorized Inspector.

277. The contractor carrying out any installation shall notify the Electrical Supply Authority in writing of the completion thereof, and, except as provided in Regulation 284 hereof, shall not allow the current to be switched on from the source of supply until the installation has been duly inspected and he has been notified that a certificate has been issued pursuant to Regulation 283 hereof.

278. (1) Manholes not less than 16 in. by 14 in. in area shall be provided in ceilings to facilitate access to the roof of every building for the purposes of inspection.

(2) Traps shall be provided at all inspection fittings and draw-in boxes, and such traps shall be securely fastened by means of screws.

TESTS TO BE MADE.

279. (1) The Authorized Inspector shall, on the installation as a whole and on the individual circuits thereof, make a test of insulation resistance between conductors and between conductors and earth.

(2) Such test shall be deemed to be satisfied if the insulation resistance is not less in megohms than the result of dividing the number 30 by the number of points under test.

280. (1) In the case of lighting circuits a test of insulation resistance between conductors and earth shall be made by the Authorized Inspector when the whole of the lamps and accessories have been connected to the conductors, and such test shall be carried out with all switches in the "on" position and all fuses in circuit.

(2) Such test shall be deemed to be satisfied if the insulation resistance to earth is not less in megohms than the result of dividing the number 25 by the number of lamps in circuit.

281. (1) A test shall be made by the Authorized Inspector of the insulation resistance between the case or framework and every live part of each individual dynamo, motor, or arc lamp, and of each electrical appliance, complete with its control gear or other accessory apparatus.

(2) Such test shall be deemed to be satisfied if the insulation resistance is not less in each case than 1 megohm.

282. (1) In all cases where metal conduits or metallic sheathing or cables are used for the mechanical protection of electrical conductors such conduits and envelopes shall be tested for electrical continuity.

(2) The test shall be carried out between a point near the main switch and any other point of the completed installation.

(3) The test shall be deemed to be satisfied if the electrical resistance of such conduit or sheathing does not exceed 2 ohms.

CERTIFICATION.

283. (1) After having inspected and tested an installation, the Authorized Inspector, if satisfied that the work has been done in a workmanlike manner in accordance with the requirements of these regulations, and if the tests made as required by the foregoing provisions of this Part of these regulations have been satisfied, shall certify in writing to the Electrical Supply Authority that the installation has been duly inspected and tested and may be safely connected with the source of supply.

(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.

284. (1) Notwithstanding anything to the contrary in the foregoing provisions of this Part of these regulations, the supply authority may, in case of urgency, on the recommendation of the Authorized Inspector, permit an installation to be temporarily connected with the source of supply 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, or for a longer period than one month; provided, further, that the Chief Electrical Engineer, on the recommendation of the supply authority, may extend 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 of supply, unless before such expiration the Authorized Inspector has issued his certificate pursuant to the last preceding regulation.

WHERE SUPPLY AUTHORITY IS WIRING CONTRACTOR.

285. Where an electrical supply authority itself contracts to carry out any installation for a consumer, the following special provisions shall apply:—

(*a*) The notice required by Regulation 277 hereof need not be given.

(*b*) The certificate to be issued pursuant to Regulation 283 hereof shall be a certificate by the Supply Authority to the Chief Electrical Engineer.

INSPECTION ON BEHALF OF MINISTER.

286. (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) 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 disconnect the consumer's installation from the source of supply.

SCHEDULES.

FIRST SCHEDULE.

LIST OF BRITISH STANDARD SPECIFICATIONS REFERRED TO IN THE REGULATIONS.

(Obtainable from the British Engineering Standards Association, 28 Victoria Street, S.W. 1, or Messrs. Crosby, Lockwood, and Son, 7 Stationers' Hall Court, Ludgate Hill, E.C. 4, price 1s. 2d. post free.)

Title.	Specification No.
Bus-bars and connections, marking for ..	158—1924
Bus-bars and connections, specification for ..	159—1924
Ceiling roses, two and three plate, specification for	67—1914
Circuit-breakers, air-brake, for voltages not exceeding 660 volts, specification for ..	110—1923
Circuit-breakers, flame-proof air-break, for voltages not exceeding 660 volts, specification for	127—1923
Circuit-breakers, totally enclosed air-break, for voltages not exceeding 660 volts, specification for	130—1923
Conduits, steel, and fittings for electrical wiring, specification for	31—1923
Controllers, contactor, and resistances for use therewith for electric motors, specification for	129—1923
Controllers, drum, and resistances for use therewith for electric motors, specification for ..	118—1923
Copper conductors, insulated annealed, for electric power and light, dimensions of	7—1922
Copper wire, bare annealed, for electrical machinery and apparatus, dimensions and resistances of	128—1922
Cut-outs, electric (low pressure, type O), specification for	88—1919
Fittings, watertight, for incandescent electric lamps, specification for	97—1920
Generators, industrial electric, and motors with class A insulation, electrical performance of, specification for	168—1923
Glands, watertight, for electric cables, specification for	94—1920
Indicating ammeters, voltmeters, wattmeters, frequency and power-factor meters, specification for	89—1919
Lamp-caps and lampholders, goliath, specification for	98—1919
Lampholders, ordinary size bayonet, specification for	52—1924
Lamps, electric, normal type vacuum and gas-filled tungsten filament, specification for ..	161—1924
Motors, electric, starters for, specification for ..	82—1919
Motors, industrial electric, and generators with class A insulation, electrical performance of, specification for	168—1923
Resistance materials, metallic, for electrical purposes, specification for	115—1921
Slate slabs for electrical purposes, specification for	160—1923
Sockets, electric-cable soldering, specification for	91—1921
Starters, auto-transformer (hand-operated pattern) for electric motors, specification for ..	167—1923
Starters, contactor, for electric motors, specification for	155—1923
Starters, drum, for electric motors, specification for	117—1923

Title.	Specification No.
Starters, liquid, for electric motors, specification for	140—1923
Starters, multiple-switch, for electric motors, specification for	147—1923
Starters, switch (star-delta and series-parallel), for electric motors, specification for ..	141—1923
Switches, air-break knife and laminated brush, for voltages not exceeding 660 volts, specification for	109—1923
Switches, flame-proof air-break, for voltages not exceeding 660 volts, specification for ..	126—1923
Switches, oil-immersed, and circuit-breakers, specification for	116—1923
Switches, totally enclosed air-break, for voltages not exceeding 660 volts, specification for ..	124—1923

SECOND SCHEDULE.

Part I.—Minimum Switch-gear Equipment for Main Switchboards.

A. Three-phase Four-wire Systems.

1. To control the main supply a triple-pole circuit-breaker with an overload trip in each phase, or a triple-pole switch with a fuse on each phase shall be provided.

2. To control each outgoing submain or circuit from the switchboard in the case of a three-conductor circuit to which a supply is given from three phases, either a triple-pole circuit-breaker with an overload trip on each phase or a triple-pole switch with a fuse on each phase shall be provided.

3. (1) To control each outgoing submain or circuit from the switchboard in the case of a three-conductor circuit to which a supply is given from two phases and the neutral—

(*a*) When the neutral is multiple-earthed, either a double-pole overload circuit-breaker, controlling the phase conductors or a double-pole switch controlling the phase conductors with a fuse in each phase shall be provided.

(*b*) When the neutral conductor is not multiple-earthed, either a triple-pole circuit-breaker with overload trips on each phase or a triple-pole switch with a fuse on each phase shall be provided.

(2) A triple-pole switch controlling any circuit shall not connect the outer conductors to the supply before connecting the neutral, or open the neutral before the outer conductors have been opened.

4. To control each outgoing submain or circuit from the switchboard in the case of a two-conductor circuit to which a supply is given from one of three phases and the neutral—

(*a*) When the neutral is multiple-earthed, either a single-pole overload circuit-breaker on that pole which is connected to the phase or a single-pole switch and a single-pole fuse on that pole which is connected to the phase shall be provided.

(*b*) When the neutral is not multiple-earthed, either a double-pole overload circuit-breaker or a double-pole switch with a fuse on each pole shall be provided; but where the neutral is known to be earthed at the source of supply without a circuit-breaker or added resistance the fuse in the neutral may be omitted.

5. To control each outgoing submain or circuit from the switchboard in the case of a four-wire circuit, either a triple-pole circuit-breaker with an overload trip on each phase or a triple-pole switch with a fuse on each phase shall be provided.

6. A fuse or unlinked switch or unlinked circuit-breaker shall not in any case be included in the neutral conductor, but this requirement shall not prohibit the provision of an isolating-link for testing purposes.

B. Three-phase Three-wire Systems.

1. For each generator or for each service-main the supply for which is derived from an external source, either a triple-pole circuit-breaker with overload trips on each phase, or two overload and one earth-leakage trips, or a triple-pole switch with a fuse on each phase shall be provided.

2. For each outgoing three-conductor submain or circuit from the switchboard, either a triple-pole circuit-breaker with overload trips on each phase, or two overload and one earth-leakage trips, or a triple-pole switch with a fuse on each phase shall be provided.

3. For each outgoing two-wire submain or circuit from the switchboard to which a supply is given from any two of the three conductors, either a double-pole overload circuit-breaker or a double-pole switch with a fuse on each conductor shall be provided.

C. Two-wire Systems.

1. When the supply is from one generator, or when the supply is derived from a single two-wire service from an external source—

(*a*) To control the main supply there shall be provided—

(i) In the case of a two-conductor multiple-earthed system of wiring, either a single-pole overload circuit-breaker or a single-pole switch with a single-pole fuse on the insulated pole.

(ii) In the case of other two-wire systems of wiring (excepting concentric), either a double-pole overload circuit-breaker or a double-pole switch with a fuse on each pole; but where the system is known to be earthed at the point of supply without a circuit-breaker or added resistance the fuse in the conductor so earthed may be omitted.

(*b*) To control each outgoing submain or circuit from the switchboard, there shall be provided—

(i) In the case of a two-conductor multiple-earthed system of wiring, either a single-pole overload circuit-breaker or a single-pole switch with a single-pole fuse on the insulated pole.

(ii) In the case of other two-wire systems of wiring (excepting concentric), either a double-pole overload circuit-breaker or a double-pole switch with a fuse on each pole; but where the system is known to be earthed at the point of supply without a circuit-breaker or added resistance the fuse in the conductor so earthed may be omitted.

2. When the supply is from more than one generator, the generators being arranged to run in parallel, there shall be provided—

(*a*) To control each shunt-wound generator, a circuit-breaker with overload and reverse-current trips, the circuit-breaker being single pole in the case of a two-conductor multiple-earthed system of wiring, and double pole in the case of other two-wire systems of wiring.

(*b*) To control each compound-wound generator, a circuit-breaker with overload and reverse-current trips as aforesaid, and a single-pole equalizer switch.

(*c*) To control each outgoing submain or circuit from the switchboard—

(i) In the case of a two-conductor multiple-earthed system of wiring, either a single-pole overload circuit-breaker or a single-pole switch with a single-pole fuse on the insulated pole.

(ii) In the case of other two-wire systems of wiring (excepting concentric), either a double-pole overload circuit-breaker or a double-pole switch with a fuse on each pole; but where the system is known to be earthed at the point of supply without a circuit-breaker or added resistance, the fuse in the conductor so earthed may be omitted.

(iii) A fuse or unlinked switch or unlinked circuit-breaker shall not in any case be included in the earthed conductor, but this requirement shall not prohibit the provision of an isolating-link for testing purposes.

D. Three-wire Systems (D.C. or Single-phase.)

1. To control the main supply there shall be provided—

(*a*) Where the neutral conductor is multiple-earthed, either a double-pole overload circuit-breaker controlling the outer conductors or a double-pole switch controlling the outer conductors, with a fuse in each outer.

(*b*) Where the neutral conductor is not multiple-earthed, either a triple-pole circuit-breaker with overload trips in the outer conductors only or a triple-pole switch with a fuse in each outer.

2. (1) To control each outgoing submain or circuit from the switchboard in the case of a three-conductor circuit there shall be provided—

(*a*) When the neutral is multiple-earthed, either a double-pole overload circuit-breaker controlling the outer conductors or a double-pole switch controlling the outer conductors with a fuse on each outer.

(*b*) When the neutral conductor is not multiple-earthed, either a triple-pole circuit-breaker with overload trips on the outers only or a triple-pole switch with a fuse on each outer.

(2) A triple-pole switch controlling any three-conductor circuit shall not connect the outer conductors to the supply before connecting the neutral, or open the neutral before the outer conductors have been opened.

3. (1) To control each outgoing submain or circuit from the switchboard in the case of a two-conductor circuit taken from a multiple-earthed neutral and one outer there shall be

provided in the outer conductor either a single-pole overload circuit-breaker on that pole which is connected to the outer conductor, or a single-pole switch and single-pole fuse.

(2) Where the neutral-conductor is not multiple-earthed, there shall be provided either a double-pole overload circuit-breaker or a double-pole switch with a fuse on each pole, but where the neutral is known to be earthed at the source of supply without a circuit-breaker or added resistance, the fuse in the neutral may be omitted.

(3) For all two-conductor submains or circuits taken from the outers, either a double-pole overload circuit-breaker or a double-pole switch with a fuse on each pole shall be provided.

(4) A fuse or unlinked switch or unlinked circuit-breaker shall not in any case be included in the neutral conductor, but this requirement shall not prohibit the provision of an isolating-link for testing purposes.

E. TWO-PHASE THREE-WIRE SYSTEMS.

1. For each generator or service main there shall be provided—

(*a*) Where the common return is multiple-earthed, either a double-pole overload circuit-breaker controlling the outer conductors or a double-pole switch controlling the outer conductors with a fuse in each outer.

(*b*) Where the common return is not multiple-earthed, either a triple-pole circuit-breaker with overload trips in the outer conductors only or a triple-pole switch with a fuse in each outer.

2. (1) To control each outgoing submain or circuit from the switchboard in the case of a three-conductor circuit there shall be provided—

(*a*) When the common return is multiple-earthed, either a double-pole overload circuit-breaker controlling the outer phase conductors or a double-pole switch controlling the outer phase conductors with a fuse in each conductor except the common return.

(*b*) When the common return conductor is not multiple-earthed, either a triple-pole circuit-breaker with overload trips on each phase or a triple-pole switch with a fuse on each conductor except the common return.

(2) A triple-pole switch controlling any three-conductor circuit shall not connect the outer conductors to the supply before connecting the common return, or open the common return before the outer conductors have been opened.

3. (1) To control each outgoing submain or circuit from the switchboard in the case of a two-conductor circuit taken from the multiple-earthed common return and one outer there shall be provided in the outer conductor either a single-pole overload circuit-breaker or a single-pole switch and a single-pole fuse.

(2) Where the common return conductor is not multiple-earthed, there shall be provided either a double-pole overload circuit-breaker or a double-pole switch with a fuse on each pole, but where the common return is known to be earthed at the source of supply without a circuit-breaker or added resistance the fuse in the common return may be omitted.

4. A fuse or unlinked switch or unlinked circuit-breaker shall not in any case be included in the common return conductor, but this requirement shall not prohibit the provision of an isolating-link for testing purposes.

F. TWO-PHASE FOUR-WIRE SYSTEMS.

1. For each generator or service main, when the supply is derived from an external source, there shall be provided either a four-pole circuit-breaker with overload trips on each phase or a four-pole linked switch with a fuse on each conductor.

2. For each outgoing four-conductor submain or circuit from the switchboard, there shall be provided either a four pole circuit-breaker with overload trip on at least one conductor of each phase or a four-pole linked switch with a fuse on each conductor.

3. For each outgoing two-wire submain or circuit from the switchboard, there shall be provided either a double-pole circuit-breaker with overload trip on at least one conductor or a double-pole switch with a fuse on each conductor.

Part II.—Minimum Requirements as to Instruments to be provided for Generator Switchboards.

A. TWO-WIRE SYSTEMS.

1. When only one generator is installed, one ammeter and one voltmeter shall be provided.

2. When more than one generator is installed, the generators not being arranged to run in parallel, an ammeter for each generator and one voltmeter for use on any generator shall be provided. The voltmeter shall be fitted with a double-pole multiple-way switch or plug.

3. (1) When more than one generator is installed, the generators being arranged to run in parallel, an ammeter for each generator, and two voltmeters shall be provided, and if the current be alternating a synchronizing-device for paralleling purposes shall also be provided.

(2) For compound wound generators the ammeter shall be connected on the pole opposite to that to which the equalizer connection is made.

(3) When more than two generators are installed, one of the voltmeters shall be fitted with a double-pole multiple-way switch or plug for use on any generator. The other voltmeter shall be permanently connected to the bus-bars.

B. THREE-WIRE SYSTEMS (D.C. OR SINGLE-PHASE).

1. In addition to the instruments required for two-wire systems a voltmeter shall be connected between the neutral and each outer-bus bar.

2. There shall also be provided in the main neutral conductor a central zero ammeter if direct current, or a central zero wattmeter if alternating current.

C. TWO-PHASE AND THREE-PHASE SYSTEMS.

1. When only one generator is installed, an ammeter on each phase, or one ammeter with a two- or three-phase transfer-switch, as the case may require, and one voltmeter shall be provided.

2. When more than one generator is installed, the generators being arranged to run in parallel, for each generator an ammeter on each phase, or one ammeter with a two- or three-phase transfer-switch, as the case may require, shall be provided.

3. There shall also be provided two voltmeters and a synchronizing device for paralleling purposes. One of these voltmeters shall be fitted with a double-pole multiple-way switch or plug for use on any generator. The other voltmeter shall be permanently connected to one phase of the bus-bars. All these voltmeter connections shall be made to the same phase in each case.

Part III.—Conditions governing the Use of certain Types of Cables and of Steel Screwed Conduit and Wood Casing.

CLASS L.—TAPED AND BRAIDED CABLES.

1. In no case shall Class L wiring be used unless permission in writing is first obtained from the electrical supply authority, which shall give such permission only in respect of the use of such wiring in situations where the use of encased wiring is not practicable.

2. Taped and braided cables such as are specified in paragraph (*b*) of Regulation 84 of these regulations may be used without the further protection of conduit or casing, provided that—

(*a*) They are open to view throughout their length, and, in particular, are not installed under floors or within partitions or buried in plaster.

(*b*) They are kept away from all structural metal-work.

(*c*) They are adequately protected in any position in which they would be liable to mechanical damage, and wherever they are within 6 ft. above the floor.

(*d*) They are not in electrical or mechanical contact with gas or water pipes.

(*e*) They are secured by porcelain cleats or insulators, which are so spaced as to prevent any two or more cables coming into contact, and which have smooth or rounded edges that will not indent or damage the braiding.

(*f*) In all situations they are spaced not less than ½ in. from walls, ceilings, or other structures to which they are attached by means of porcelain cleats or insulators, which are of non-absorbent material and the fixings of which are of non-absorbent non-rusting material.

(*g*) When passing through floors, walls, partitions, or ceilings they are protected by being enclosed in metal, porcelain, or non-absorbent, non-ignitable conduits, the ends of which are bushed or so arranged as to prevent abrasion, such conduits, when in damp situations, being bitumen-filled.

(*h*) When passing through party walls or fire-resisting floors, 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.

CLASS M.—METAL-SHEATHED CABLES.

1. Metal-sheathed cables, as specified in paragraphs (*h*) and (*j*) of Regulation 84 of these regulations are suitable for power-work, and may be used for that purpose only.

2. The types of cables specified in paragraphs (*c*) and (*f*) of Regulation 84 of these regulations may, with the written permission of the electrical supply authority, be used in situations where conduit would be subject to corrosive action, if the wiring is in full view, conductors are "looped in," and junction boxes or fittings are not used.

CLASS R.—ARMOURED CABLES.

1. Armoured cables such as are specified in paragraphs (*a*), (*e*), and (*i*) of Regulation 84 of these regulations may be used without the further protection of conduit or casing, provided that they are installed in accordance with paragraphs (*d*) and (*h*) of clause 2 of the conditions governing the use of Class L cables, and paragraphs (*a*), (*b*), (*e*), and (*f*) of the conditions governing the use of Class S cables.

2. In addition to the foregoing conditions, the following shall apply to the use of Class R cables, namely—

(*a*) Effectual means shall be taken to ensure that all metallic envelopes of cables are efficiently earthed and made electrically continuous throughout their length by means of soldered joints, or, alternatively, by bonding-clamps specially designed for the purpose of forming part of joint-boxes and similar fittings in which the cables terminate.

(*b*) The electrical resistance of the metallic envelope of cables in a complete installation, measured between such envelope at a point near the main switch and any other point of the installation, shall not exceed 2 ohms.

CLASS S.—CABLES COVERED WITH TOUGH RUBBER COMPOUND.

1. Cables protected in accordance with paragraph (*g*) of Regulation 84 of these regulations may be used without the further protection of conduit or casing, provided that they are installed in accordance with paragraphs (*c*) and (*d*) of clause 2 of the conditions governing the use of Class L cables, and provided that—

(*a*) They are secured at intervals (sufficiently short to prevent appreciable sagging of the cable) by clips, saddles, or clamps constructed of such material as will not be liable to set up an electrolytic action, and having smooth or rounded edges which will not indent or damage the sheathing.

(*b*) When vertical, they are fixed by the same means, with supports at the same intervals as when horizontal, unless they be inaccessible, when a length not exceeding 10 ft. may be allowed between the supports, if the upper support firmly grips the cable, and that where there is a change of direction from horizontal to vertical they are brought over a rounded support of a radius not less than six times the external diameter of the sheathing.

(*c*) Where laid across the ceiling-joists at any angle, they are attached to the side of soft wood strips of not less than 1 in. by 1 in. dimensions; that where laid parallel with the joists they are attached to the side thereof, and that clips or saddles are not spaced more than 18 in. apart.

(*d*) They are protected by wood or metal casing or conduit where exposed to mechanical injury, as on walls up to a distance of 6 ft. from the floor; and that clips or saddles are spaced not more than 9 in. apart on ceilings, or more than 12 in. apart on vertical runs.

(*e*) If liable to mechanical damage they are adequately protected, having regard to the nature of their sheathing or casing.

(*f*) In damp situations, and where exposed to the weather, the saddles and fixings are of non-rusting material.

(*g*) When passing through steel or iron structural work, the holes through which they pass are bushed to prevent abrasion.

(*h*) Under no circumstance shall they be used to pass through party walls, or as service mains, or for power or on pressures exceeding 250 volts to earth.

(*i*) When under floors and 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 the wiring shall be securely screwed down in such a manner that they will not damage the cable and so that they can be removed for inspection. When running parallel with joists they may be laid flat on the ceiling.

(*j*) At all outlet points the sheathing is efficiently anchored before the base-block or other device is mounted.

2. Connection-boxes of types approved by the Chief Electrical Engineer may be used.

CLASS T.—SCREWED CONDUITS.

All classes of cable specified in Regulation 84 of these regulations may be enclosed in screwed steel conduits, provided that the conduits are installed in accordance with paragraphs (*d*) and (*h*) of clause 2 of the conditions governing the use of Class L cables and in accordance with paragraphs (*e*) and (*f*) of the conditions governing the use of Class S cables, and also provided that—

(*a*) The conduits are made in accordance with British Standard Specification No. 31 and are of heavy gauge, and that the conduit fittings are to British Standard Specification No. 31, but terminal fittings may be used in which the length of thread for conduit is less than that specified in the said specification, in which case either a taper male thread or lock-nuts shall be used.

(*b*) The conduits are mechanically and electrically continuous across all joints therein, and are earthed in accordance with Part XI of these regulations.

(*c*) 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.

(*d*) 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.

(*e*) The conduits of each circuit are erected complete before the cables are drawn in, that conduits of less than 1 in. diameter are secured at least every 4 ft., and conduits of 1 in. diameter and over are secured at least every 6 ft. (except where they are used between supports placed more than 6 ft. apart, in which case they shall be secured to the satisfaction of the Authorized Inspector), and that all conduits are secured by means of approved saddles, which in the case of surface work must be fixed with screws.

(*f*) Bell mouths or other approved metal outlets are fitted to the ends of all conduits to prevent abrasion of the covering of cables emerging therefrom, and that galvanized conduit at all external outlet-points is set down not less than 45°, and terminates with a non-corroding bell-mouth.

(*g*) The ends of conduits where terminating at accessories and fittings are screwed thereto, or secured with lock-nuts if screwing is impracticable, or provided with metal outlet-boxes, save that metal outlet-flanges approved by the Chief Electrical Engineer may be used in place of outlet-boxes, except in the case of buildings of concrete or brick; and provided that the ends of all conduits where terminating at tees, elbows, junction-boxes, or other outlet-points are reamed out and do not project into the box beyond the thread of the box or the lock-nut.

(*h*) All elbows and tees are of the inspection type, and that all bends have a radius not less than two and a half times the outside diameter of the conduit save that—

(i) At the ends of conduits immediately behind fittings or accessories plain conduit fittings may be used.

(ii) In surface wiring where the conduit turns to pass through a wall a plain elbow may be used if the conditions are such that the use of an inspection elbow or normal bend would be impracticable.

(iii) In an inaccessible position such as in a hollow partition a plain elbow may be used if it is impracticable to use a normal bend.

(*i*) In damp situations where exposed to the weather (even if only during building-construction) or the action of corrosive fumes or liquids, conduits together with their fittings are galvanized.

(*j*) In all cases where galvanized conduit is used the threads where the galvanizing has been removed are adequately protected by painting with white-lead, red-lead, or graphite pipe-jointing compound before screwing into fittings.

(*k*) Galvanized conduits are not buried in damp ground or in ground likely to contain acids.

(*l*) Where it is necessary to enclose wires in metal pipes in damp ground, galvanized water-pipe (free from internal fins and burrs) or other metal approved by the Authorized Inspector is used.

(*m*) Where it is necessary to enclose wires in metal pipes in ground likely to contain acids the wires are enclosed in lead pipes.

CLASS W.—WOOD CASING.

All types of cables specified in Regulation 84 of these regulations as approved types may be enclosed in wood casing, provided that such casing be of kaikawaka or other timber approved by the Chief Electrical Engineer; and, further, that—

(*a*) Wood casing may be used only in dry situations and on the surface.

(*b*) It may not be fixed in contact with gas-pipes or water-pipes, or immediately below the latter, or in places where liable to be damaged by rodents, and that in no case shall it come within 12 in. above a floor.

(*c*) The capping is secured by incorrodible screws.

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

(*e*) Wood casing shall be so constructed that the width of the fillet between the grooves is at least $\frac{1}{2}$ in., and the thickness of the outside at least $\frac{1}{4}$ in.

(*f*) Wood casing shall be supported continuously and enclose the conductors throughout their entire length, the joints being close-fitted and all angles mitred.

(*g*) Under no circumstances shall wood casing be used for power, or on pressures exceeding 250 volts to earth, or for enclosing service-mains or passing through party walls.

THIRD SCHEDULE.

Tables.

The following is a list of the tables and of the regulations in which they are referred to:—

TABLE I.—DIMENSIONS, WEIGHT, AND RESISTANCE OF SOLID AND STRANDED CIRCULAR CONDUCTORS.

Nominal Area.	Calculated Area.	Number and Diameter (In.) of Wires comprising Conductor.	Over-all Diameter of Conductor.	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.
Sq. in.	Sq. in.		In.	lb.	Ohms.	Ohms.	Ohms.
0·001	0·001018	1/·036	0·036	11·77	23·59	24·29	24·53
0·0015	0·001521	1/·044	0·044	17·58	15·79	16·26	16·42
0·002	0·001943	3/·029	0·062	23·37	12·36	12·61	12·85
0·003	0·002994	3/·036	0·078	36·02	8·019	8·180	8·260
0·003	0·003217	1/·064	0·064	37·20	7·463	7·687	7·761
0·0045	0·004546	7/·029	0·087	54·39	5·281	5·387	5·493
0·007	0·007005	7/·036	0·108	83·81	3·427	3·496	3·530
0·01	0·01046	7/·044	0·132	125·2	2·294	2·340	2·363
0·0145	0·01462	7/·052	0·156	174·9	1·643	1·675	1·692
0·0225	0·02214	7/·064	0·192	264·9	1·084	1·106	1·117
0·03	0·02840	19/·044	0·220	340·4	0·8468	0·8637	0·8721
0·04	0·03960	19/·052	0·260	475·5	0·6063	0·6184	0·6244
0·06	0·05999	19/·064	0·320	720·3	0·4002	0·4082	0·4122
0·075	0·07592	19/·072	0·360	911·6	0·3162	0·3225	0·3257
0·1	0·1009	19/·083	0·415	1211·0	0·2380	0·2427	0·2451
0·12	0·1168	37/·064	0·448	1403·0	0·2056	0·2097	0·2118
0·15	0·1478	37/·072	0·504	1776·0	0·1625	0·1657	0·1673
0·2	0·1964	37/·083	0·581	2360·0	0·1223	0·1247	0·1259
0·25	0·2465	37/·093	0·651	2963·0	0·09738	0·09933	0·1003
0·3	0·3024	37/·103	0·721	3635·0	0·07939	0·08098	0·08177
0·4	0·4064	61/·093	0·837	4886·0	0·05908	0·06026	0·06085
0·5	0·4985	61/·103	0·927	5994·0	0·04816	0·04913	0·04961
0·6	0·6062	91/·093	1·023	7290·0	0·03961	0·04040	0·04079
0·75	0·7435	91/·103	1·133	8942·0	0·03229	0·03294	0·03326
0·85	0·8459	127/·093	1·209	10175·0	0·02838	0·02895	0·02923
1·0	1·0376	127/·103	1·339	12481·0	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.	
New Nominal Area in Sq. In.	Number and Diameter (In.) of Wires comprising Conductor.	Number and Gauge or Diameter (In.) of Wires in Conductor.	Old Nominal Area in Sq. In.
1.	2.	3.	4.
0·001	1/·036	1/20 S.W.G.	0·001
0·0015	1/·044		
		1/18 ,,	0·0018
		3/22 ,,	0·0018
0·002	3/·029		
		7/25 ,,	0·0022
0·003	3/·036	3/20 ,,	0·003
		7/23 ,,	0·0031
0·003	1/·064	1/16 ,,	0·0032
		7/22 ,,	0·0042
0·0045	7/·029		
		7/21½ ,,	0·0049
0·007	7/·036	7/20 ,,	0·007
		7/19 ,,	0·0086
0·01	7/·044		
		7/18 ,,	0·0125
0·0145	7/·052		
		7/17 ,,	0·017
0·0225	7/·064	7/16 ,,	0·022
0·03	19/·044		
		19/18 ,,	0·034
		7/14 ,,	0·035
0·04	19/·052		
		19/17 ,,	0·046
0·06	19/·064	19/16 ,,	0·06
0·075	19/·072	19/15 ,,	0·075
		19/14 ,,	0·094
0·1	19/·083		
0·12	37/·064	37/16 ,,	0·117
		19/13 ,,	0·125
0·15	37/·072	37/15 ,,	0·15
		37/14 ,,	0·182
0·2	37/·083	37/·083″	0·2
0·25	37/·093	37/·092″	0·25
0·3	37/·103	37/·104″	0·3
0·4	61/·093	61/·092″	0·4
0·5	61/·103	61/·104″	0·5
0·6	91/·093	61/·112″	0·6
0·75	91/·103	91/·101″	0·75
0·85	127/·093		
1·0	127/·103	127/·101″	1·0

TABLE III.—FLEXIBLE CABLES: DIMENSIONS AND RESISTANCE OF CONDUCTORS.

Number and Diameter of Wires comprising Conductor.					Resistance per 1,000 Yards at 60° F.		
Nominal Area.	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.
0·01	140/·010	97/·012*	—	—	2·29	2·34	2·39
0·0145	195/·010	—	60/·018*	—	1·64	1·68	1·71
0·0225	296/·010	—	91/·018*	—	1·08	1·11	1·13
0·03	—	266/·012	117/·018*	—	0·847	0·864	0·881
0·04	—	368/·012	163/·018*	—	0·606	0·618	0·631
0·06	—	557/·012	248/·018*	—	0·400	0·408	0·416
0·075	—	705/·012	313/·018	121/·029*	0·316	0·323	0·329
0·1	—	—	416/·018	160/·029*	0·238	0·243	0·247
0·12	—	—	482/·018	186/·029*	0·206	0·210	0·214
0·15	—	—	610/·018	235/·029*	0·163	0·166	0·169
0·2	—	—	810/·018	312/·029*	0·122	0·125	0·127
0·25	—	—	1017/·018	392/·029*	0·0974	0·0993	0·101
0·3	—	—	—	481/·029	0·0794	0·0810	0·0826
0·4	—	—	—	646/·029	0·0591	0·0603	0·0614
0·5	—	—	—	792/·029	0·0482	0·0491	0·0501

* For trailing-cables and similar purposes.

The areas of the conductors in Table III are given in nominal figures, an addition having been made to the number of wires to give resistances as nearly as possible corresponding to those for the same areas in Table I.

TABLE IV.—VULCANIZED-RUBBER CABLES: CURRENT-CARRYING CAPACITY (SUBJECT TO VOLTAGE-DROP) AND CORRESPONDING FALL IN PRESSURE.

Nominal Area of Conductor.	Number and Diameter (In.) of Wires comprising Conductor.	Single Cables run in Pairs.	Concentric or Twin Cable.	Three-core Cable.	Approximate Total Length in Circuit (Lead and Return) for 1-volt Drop with Maximum Permissible Current (Col. 3).
1.	2.	3.	4.	5.	6.
Sq. in.		Amps.	Amps.	Amps.	Ft.
0·001	1/·036	4·1	3·5	—	30
0·0015	1/·044	6·1	5·2	—	30
0·002	3/·029	7·8	6·7	—	30
0·003	3/·036	12·0	10·3	—	29
0·003	1/·064	12·9	11·1	—	29
0·0045	7/·029	18·2	15·7	13·6	28
0·007	7/·036	24·0	20·6	18·0	33
0·01	7/·044	31·0	26·6	23·2	39
0·0145	7/·052	37·0	32·0	27·8	45
0·0225	7/·064	46·0	39·0	34·0	55
0·03	19/·044	53·0	46·0	40·0	61
0·04	19/·052	64·0	55·0	47·0	71
0·06	19/·064	83·0	71·0	59·0	83
0·075	19/·072	97·0	83·0	69·0	90
0·1	19/·083	118·0	100·0	83·0	98
0·12	37/·064	130·0	118·0	90·0	103
0·15	37/·072	152·0	126·0	105·0	112
0·2	37/·083	184·0	149·0	126·0	123
0·25	37/·093	214·0	170·0	146·0	132
0·3	37/·103	240·0	188·0	—	145
0·4	61/·093	288·0	220·0	—	162
0·5	61/·103	332·0	249·0	—	172
0·6	91/·093	384·0	—	—	181
0·75	91/·103	461·0	—	—	185
0·85	127/·093	512·0	—	—	190
1·0	127/·103	595·0	—	—	200

The figures given in Table IV apply to single cables run in pairs 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.

The maximum permissible currents (subject to voltage-drop) for the various sizes of conductors up to 1 square inch in cross-sectional area are shown in columns 3, 4, and 5 of the table, which allow for a rise in temperature of 20 degrees F. for rubber-insulated cables. For sizes below 0·007 square inch the table is based on a current density of 4,000 amperes per square inch.

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 for a short period 130° F. The figures, therefore, in the latter case allow of a margin of 30 degrees F.

Where the temperature of the air exceeds 80° F. the permissible current should be reduced so that the maximum temperature of the rubber-insulated cables does not exceed the figures given above.

The further limitation of the size of conductor by the permissible drop in voltage is dealt with in Regulation 80 (*a*).

TABLE V.—IMPREGNATED-PAPER AND LEAD-COVERED CABLES: CURRENT CARRYING CAPACITY (SUBJECT TO VOLTAGE-DROP) AND CORRESPONDING FALL IN PRESSURE.

Nominal Area of Conductor.	Number and Diameter (In.) of Wires comprising Conductor.	Single Cables run in Pairs.	Concentric or Twin Cable.	Three-core Cable.	Approximate Total Length in Circuit (Lead and Return) for 1-volt Drop.*
1.	2.	3.	4.	5.	6.
Sq. in.		Amps.	Amps.	Amps.	Ft.
0·001	1/·036	4·1	3·5	—	30
0·0015	1/·044	6·1	5 2	—	30
0·002	3/·029	7·8	6·7	—	30
0·003	3/·036	12·0	10·3	—	29
0·003	1/·064	12·9	11·1	—	29
0·0045	7/·029	18·2	15·7	13·6	28
0·007	7/·036	28·0	24·0	21·0	27
0·01	7/·044	42·0	36·0	31·0	27
0·0145	7/·052	57·0	49·0	43·0	28
0·0225	7/·064	75·0	65·0	56·0	32
0·03	19/·044	87·0	76·0	66·0	35
0·04	19/·052	104·0	89·0	76·0	41
0·06	19/·064	135·0	116·0	97·0	48
0·075	19/·072	157·0	135·0	111·0	52
0·1	19/·083	191·0	162·0	134 0	57
0·12	37/·064	210·0	177·0	146·0	60
0·15	37/·072	246·0	204·0	170·0	65
0·2	37/·083	296·0	240·0	203·0	72
0·25	37/·093	343·0	285·0	233·0	78
0·3	37/·103	385·0	302·0	258·0	85
0·4	61/·093	464·0	354·0	—	95
0·5	61/·103	540·0	405·0	—	100
0·6	91/·093	624·0	—	—	105
0·75	91/·103	738·0	—	—	109
0·85	127/·093	815·0	—	—	116
1·0	127/·103	932·0	—	—	121

* With maximum permissible current (Col. 3).

The figures given in Table V apply to single cables run in pairs and to concentric, twin, and three-core cables run singly.

The maximum permissible currents (subject to voltage drop) for the various sizes of conductors up to 1 square inch in cross-sectional area are shown in columns 3, 4, and 5 of the table, which allows for a rise in temperature of 50 degrees F. for impregnated-paper cables. For sizes below 0·017 square inch the table is based on a current density of 4,000 amperes per square inch.

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 degrees F.

Where the temperature of the air exceeds 80° F., the permissible current should be reduced so that the maximum temperature of the impregnated-paper lead-covered cables does not exceed the figures given above.

The further limitation of the size of conductor by the permissible drop in voltage is dealt with in Regulation 80 (*a*).

TABLE VI.—RUBBER-INSULATED FLEXIBLE CABLES FOR USE WITH PORTABLE APPLIANCES: CURRENT-CARRYING CAPACITY.

Nominal Area of Conductor.	No. and Diameter (in Inches) of Wires comprising Conductor.	Maximum Current Permissible (Subject to Voltage Drop.)	
		Two Conductors.	Three Conductors.
Sq. in.		Amps.	Amps.
0·01	140/·010	20	17
0·0145	195/.010	24	20
0·0225	296/·010	30	25
0·03	266/·012	35	30
0·04	368/·012	42	35

An earth-wire, 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.

Nominal Area.	Ordinary Flexible Cords.				Flexible Cords with Tough Rubber Sheathing.		
	Number and Diameter (In.) of Wires comprising Conductor.	Resistance per 1,000 Yards at 60° F.			Number and Diameter (In.) of Wires comprising Conductor.	Resistance per 1,000 Yards at 60° F.	
		Standard.	Maximum allowable for Plain Wires.	Maximum allowable for Tinned Wires.		Standard.	Maximum allowable.
1.	2.	3.	4.	5.	6.	7.	8.
Sq. in.		Ohms.	Ohms.	Ohms.		Ohms.	Ohms.
0·0006	14/·0076	39·7	40·5	41·3	7/·012*	40·5	41·3
0·001	23/·0076	24·2	24·6	25·1	11/·012†	24·6	25·1
0·0017	40/·0076	13·9	14·2	14·4	16/·012‡	14·2	14·4
0·003	70/·0076	7·94	8·10	8·26	28/·012‡	8·10	8·26
0·0048	110/·0076	5·05	5·15	5·25	44/·012‡	5·15	5·25
0·007	162/·0076	3·43	3·50	3·57	65/·012‡	3·50	3·57

* 5 tinned copper; 2 tinned steel. † 9 tinned copper; 2 tinned steel. ‡ All tinned copper.

TABLE VIII.—FLEXIBLE CORDS: THICKNESS OF INSULATION AND CURRENT-CARRYING CAPACITY.

Number and Diameter (in inches) of Wires comprising Conductor.	Minimum Thickness of Dielectric (Ordinary Flexible Cords).				Flexible Cords with Tough Rubber Sheathing.			Maximum Current permissible (subject to Voltage-drop).
	High Insulation (Kind 1).		Medium Insulation (Kind 2).		Thickness of Tough Rubber.	Over-all Diameter.		
	Pure Rubber.	Pure and Vulcanizing Rubber.	Pure Rubber.	Vulcanizing Rubber.		250 Volts.	600 Volts.	
1.	2.	3.	4.	5.	6.	7.	8.	9.
Sq. in.	In.	In.	In.	In.	In.	In.	In.	Amps.
14/·0076	0·020	0·033	0·015	0·028	0·050	0·200	0·244	1·8
23/·0076	0·020	0·034	0·015	0·029	0·050	0·214	0·255	3·0
40/·0076	0·020	0·035	0·015	0·030	0·050	0·227	0·267	5·0
70/·0076	0·020	0·036	0·015	0·031	0·050	0·248	0·290	8·5
110/·0076	0·020	0·038	0·015	0·032	0·050	0·268	0·308	13·0
162/·0076	0·020	0·039	—	—	0·050	0·288	0·328	17·0

An earth-wire, whether insulated or not, forming part of a flexible cord is not deemed to be a conductor for the purpose of this table.

TABLE IX.—INSULATION RESISTANCE OF CABLES.

Conductor.		Minimum Insulation Resistance, Megohms for a Mile Length at 60° F.			
		Rubber-insulated Cables.			
Nominal Area of Cable.	Number and Diameter (In.) of Wires.	600-megohm Grade.*	2 500-megohm Grade.*	660-volt Grade.†	Paper-insulated Cables.
1.	2.	3.	4.	5.	6.
Sq. in.		Megohms.	Megohms.	Megohms.	Megohms.
0·001	1/·036	2 000	5 000	5 000	140
0·0015	1/·044	2 000	5 000	5 000	140
0·002	3/·029	1 250	4 500	4 500	140
0·003	3/·036	1 250	4 500	4 500	140
0·003	1/·064	2 000	5 000	5 000	140
0·0045	7/·029	1 250	4 500	4 500	140
0·007	7/·036	900	4 000	4 000	140
0·01	7/·044	900	4 000	4 000	140
0·0145	7/·052	900	4 000	4 000	140
0·0225	7/·064	900	3 500	3 500	130
0·03	19/·044	750	3 500	3 500	125
0·04	19/·052	750	3 000	3 000	115
0·06	19/·064	750	3 000	3 000	100
0·075	19/·072	600	3 000	3 000	85
0·1	19/·083	600	3 000	3 000	80
0·12	37/·064	600	3 000	3 000	75
0·15	37/·072	600	3 000	3 000	60
0·2	37/·083	600	2 500	2 500	55
0·25	37/·093	600	2 500	2 500	50
0·3	37/·103	600	2 500	2 500	50
0·4	61/·093	600	2 500	2 500	50
0·5	61/·103	600	2 500	2 500	45
0·6	91/·093	600	2 500	2 500	40
0·75	91/·103	600	2 500	2 500	40
0·85	127/·093	600	2 500	2 500	35
1·0	127/·103	600	2 500	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 660 volts.

TABLE X.—TEST PRESSURES FOR FLEXIBLE CORDS.

Kind.	Insulating-material.	Test Pressure and Frequency.	Nature of Test.
1.	2.	3.	4.
		Volts.	
High insulation (1) ..	Pure rubber	1 500 at 25–100 ~ ..	Between conductors, in dry state.
Medium insulation (2) ..	Pure rubber	1 000 at 25–100 ~ ..	
Medium insulation (2) ..	Vulcanizing rubber ..	1 500 at 25–100 ~ ..	
High insulation (1) ..	Pure and vulcanizing rubber	1 000 at 25–100 ~ ..	In water, after 24 hours' immersion.

TABLE XI.—INSULATION RESISTANCE OF FLEXIBLE CORDS HAVING VULCANIZED-RUBBER INSULATION.

Nominal Area of Conductor.	Number and Diameter (In.) of Wires comprising Conductor.	Minimum Insulation Resistance, Megohms for a Mile Length at 60° F.	
		High Insulation.	Medium Insulation.
1.	2.	3.	4.
Sq. in.		Megohms.	Megohms.
0·0006	14/·0076	1 250	300
0·001	23/·0076	1 250	300
0·0017	40/·0076	1 250	300
0·003	70/·0076	1 250	300
0·0048	110/·0076	1 250	300
0·007	162/·0076	900	300

TABLE XII.—PERMISSIBLE NUMBER* OF CONDUCTORS IN CONDUITS, AND CAPACITY OF CONDUITS (TYPE B, SCREWED, B.S.S. No. 31) FOR THE DRAWING-IN OF CONDUCTORS.

Size of Conduit	⅜ in.	¾ in.	1 in.	1¼ in.	1½ in.	2 in.	2½ in.
Internal Diameter (Approximate) ..	0·498 in.	0·606 in.	0·856 in.	1·106 in.	1·34 in.	1·816 in.	2·316 in.

Nominal Area of Conductor.	Number and Diameter(In.) of Wires comprising Conductor.	Approximate Over-all Diameter.	Maximum Number of Conductors.						
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Sq. in.		In.							
0·0015	1/·044	0·173	5	8	11	—	—	—	—
0·002	3/·029	0·195	4	6	10	—	—	—	—
0·003	3/·036	0·215	3	5	8	—	—	—	—
0·0045	7/·029	0·226	2	4	6	9	—	—	—
0·007	7/ 036	0·259	—	3	5	8	—	—	—
0·01	7/·044	0·287	—	2	4	7	—	—	—
0·0145	7/·052	0·317	—	—	3	5	7	—	—
0·0225	7/·064	0·359	—	—	2	4	7	—	—
0·03	19/·044	0·393	—	—	—	3	5	7	8
0·04	19/·052	0·441	—	—	—	2	4	7	8
0·06	19/·064	0·513	—	—	—	—	3	5	6
0·075	19/·072	0·596	—	—	—	—	—	4	4
0·1	19/·083	0·663	—	—	—	—	—	3	4
0·12	37/·064	0·702	—	—	—	—	—	2	3
0·15	37/·072	0·768	—	—	—	—	—	2	2

* These numbers shall not be exceeded.

The table applies to 250-volt, vulcanized-rubber, braided cables in accordance with British Standard Specification No. 7, and to conduits type B screwed, which comply with British Standard Specification No. 31.

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 should be reduced to ensure that the cables are not overheated.

For 650-volt, vulcanized-rubber, braided cables take one size larger up to and including 7/·052.

It shall be possible to withdraw any conductor and draw in another of equal size in its place without injury (see Regulation 137 (2)).

TABLE XIII.—APPROXIMATE FUSING CURRENTS OF COPPER WIRES IN FREE AIR.*

Diameter of Wire.	Equivalent S.W.G. Size.	Fusing Current.	Maximum Safe-working Current.*
1.	2.	3.	4.
In.		Amps.	Amps.
0·0092	34	8·6	4·3
0·010	33	9·8	4·9
0·0108	32	11·0	5·5
0·0120	—	12·8	6·4
0·0124	30	13·5	6·8
0·0148	28	17	8·6
0·018	26	22	11
0·022	24	30	15
0·028	22	41	21
0·029	—	43	22
0·036	20	62	31
0·040	19	73	37
0·044	—	86	43
0·048	18	98	49
0·052	—	111	56
0·056	17	125	63
0·064	16	156	78
0·072	15	191	96
0·080	14	229	115

* See note under Table XIV.

TABLE XIV.—APPROXIMATE FUSING CURRENTS OF LEAD-TIN ALLOY (LEAD 75 PER CENT., TIN 25 PER CENT.) WIRES IN FREE AIR.

Diameter of Wire.	Equivalent S.W.G. Size.	Fusing Current.	Maximum Safe-working Current (see Note).
1.	2.	3.	4.
In.		Amps.	Amps.
0·020	25	3	2·0
0·022	24	3·5	2·3
0·024	23	4	2·6
0·028	22	5	3·3
0·032	21	6	4·1
0·036	20	7	4·8
0·048	18	10	7·0
0·064	16	16	11·0

Tables XIII and XIV refer to wires in free air and of the following lengths: *Copper*, 2½ in. to 3½ in. for wires up to 0·018 in. diameter, and not less than 4 in. for larger wires; *lead-tin alloy*, 2½ in. to 3½ in.

The values given in the tables may be taken to be correct where the fuse wire passes through an asbestos tube and does not closely touch the tube, but they do not apply where a substantial length of the wire is in contact with a porcelain holder. The tendency of the latter design is to increase the working-capacity of the fuse—*i.e.*, more current is required to melt the fuse—and if great accuracy is required the fusing current should be determined for the fuse-holder in question.

For copper wires, the values of the currents given in Table XIII are those necessary to fuse the wire in one minute, and are not appreciably different for other periods (the current required to fuse the wire in two hours being, in general, over 90 per cent. of that required to fuse the wire in one minute).

For the lead-tin alloy the currents given in Table XIV are those necessary to fuse the wire in two minutes.

In every case the relation between the fusing current and the maximum safe-running current is based on values which will not produce an excessive temperature under normal running conditions. The actual temperature-rise at the hottest part of the fuse wire will be from 212 to 302 degrees F. for copper and 122 to 167 degrees F. for the lead-tin alloy.

TABLE XV.—FLEXIBLE CORDS: TYPES TO BE USED.

Use.	Type of Covering (Regulation 93).		Grade of *Insulation* (Regulations 91 and 92).
	Type.	Twisted, Oval, or Circular Section.	
Pendants in dry places (domestic)	(a), (b), (c), (d), (e), (f), or (g)	T., O., or C.	Medium or high.
Portable lamp-standards in dry places	(a), (b), (c), (d), (e), (f), or (g)	T., O., or C.	High.
All shops, public dining-rooms, and kitchens, if flexible conductors are likely to be exposed to the action of flies or other insects, and in all premises such as stables, hide and tallow stores, and in all such other places where flies or other insects are prevalent	(d),* (e), or (f)	O. or C. ..	Pendants, medium or high; all others high.
Pendants in damp places or over earthed floors	(d)* or (f)	O. or C. ..	Medium or high.
Portable lamp-standards over earthed floors	(d),* (e), or (f)	O. or C. ..	High.
Portable appliances in dry places (domestic)	(d), (e), (f), or (g)	O. or C. ..	High.
Portable appliances in dry places (industrial)	(d), (e), or (f)	O. or C. ..	High
Portable appliances in damp situations or over earthed floors (domestic and industrial)	(d)* or (f)	O. or C. ..	High.
Trailing cables for lifts	(f)	O. or C. ..	High.
Where subject to hard or rough usage	(d),* (e),† or (f)	O. or C. ..	High.

* Provided the insulation is not pure rubber when used in damp situations.
† Not to be used in damp situations.

(i) The use of flexible cords made up to a circular or oval section is recommended for all portable fittings. (ii) Portable appliance includes portable hand-lamp.

TABLE XVI.—FLEXIBLE CABLES AND CORDS: CARRYING-CAPACITY FOR FUSING PURPOSES.

Flexible Cables.		Flexible Cords.	
No. and Diameter (In.) of Wires comprising Conductor.	Carrying-capacity for Fusing Purposes.	No. and Diameter (In.) of Wires comprising Conductor.	Carrying-capacity for Fusing Purposes.
	Amps.		Amps.
140/·010	31	14/·0076	2·5
195/·010	37	23/·0076	4·1
296/·010	46	40/·0076	7·0
266/·012	53	70/·0076	12·0
368/·012	64		

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