

in no case be less in cross-section than No. 8 S.W.G. outdoors and No. 16 S.W.G. indoors.

#### 26. SWITCHBOARDS.

(a.) 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 rules made from time to time by the Institution of Electrical Engineers of Great Britain. No conductor at a pressure above 650 volts shall be exposed on the front of any switchboard; and access to the back of any switchboard with conductors at a pressure of 150 volts and over shall be screened and made inaccessible except to authorized persons.

(b.) All power-house and substation switchboards controlling high-pressure or extra-high-pressure circuits shall be provided with two efficient and independent earth connections, connected in parallel, to which all frames, instrument-cases, and other metal parts thereof shall be connected. Means shall be provided for testing the resistance between these two connections through the earth. Such tests shall be made at least three times per annum, and shall be recorded.

(c.) Every switch intended to be used for breaking a circuit, and every circuit-breaker, shall be 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. All enclosed switches shall have an external attachment to indicate clearly whether switch is open or closed.

(d.) All switchboard circuits shall be so arranged that the course of any main conductor may be readily identified.

(e.) Every power-house or substation switchboard shall be erected in such a position as to provide, in front and behind the switchboard, the clear and unobstructed spaces hereinafter mentioned, namely:—

(1.) Low-pressure switchboards— an overhead clearance of at least 7 ft. from the floor to any bare conductor, and a passage-way with at least 3 ft. horizontal clearance from either front or back of the switchboard or any bare conductor affixed thereto.

(2.) High-pressure and extra-high-pressure switchboards other than operating desks or panels working solely at low pressure—an overhead clearance of not less than 8 ft. from the floor to any bare conductor, and a passage-way with a horizontal width of not less than 3 ft. 6 in. from either front or back of the switchboard. All conductors must be so screened or guarded that they cannot be touched accidentally, and the prescribed passage-way at the back of the board must be measured from this screening.

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

(g.) A notice containing directions as to resuscitation of persons suffering from the effects of electric shock shall be exhibited in a conspicuous position.

(h.) Integrating wattmeters shall be installed for recording the generating-station output in Board of Trade units, and this output shall be recorded daily. In unattended generating stations a combined maximum-demand indicating and integrating type of wattmeter shall be installed.

#### 27. RUBBER GLOVES, MATS, ETC.

Rubber gloves and mats, rubber-soled boots and goloshes, and insulated platforms or stools shall be provided for use when necessary.

#### 28. CIRCUIT-BREAKERS.

All outgoing feeders and distributors from any power-house or substation shall be provided with fuses or inverse time-limit automatic circuit-breakers set to open within three seconds at a current not exceeding 100 per cent. over the normal rated load of such feeder or distributor; provided that in transformer substations of 50 kilowatt capacity or less only the high-pressure or primary side of the transformer need be fused, and special precautions shall be taken in the adjustment of such high-pressure fuses to the capacity of the transformer. Where circuit-breakers are used they shall be located in accessible positions and shall be of the loose-handle type. Each circuit-breaker shall be capable of breaking the above overload current by hand without undue arcing and with no risk of injury to the operator. Automatic trip-coils shall be provided on each phase of star-connected systems with earthed neutral.

#### 29. FUSES.

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

#### 30. OVERHEAD LINES SUBJECT TO DISCONTINUANCE.

The supply of electrical energy may be effected either by underground or overhead electric lines: Provided that 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, within such time as the Minister thinks fit, replace the overhead conductors by underground conductors, and thereupon the use of the overhead conductors shall be discontinued.

#### 31. STRANDING OF CONDUCTORS, AND MINIMUM SIZE.

(a.) Copper or galvanized iron or steel conductors may be either single or stranded. Aluminium conductors must in all cases be stranded.

(b.) The diameter of any conductor in any low-pressure electric line laid or erected for the supply of electrical energy shall be not less than 0.104 in. (No. 12 S.W.G. or 7/036 in.), except as provided in clause 38 (f); for high- or extra-high-pressure lines the diameter shall be not less than 0.128 in. (No. 10 S.W.G. or 7/044 in.): Provided that No. 14 S.W.G. or 7/029 in. may be used for service connections in spans not exceeding 66 ft. Earthing-wires shall in no case be less than No. 8 S.W.G. copper outdoors or No. 16 S.W.G. copper indoors.

#### 32. STRESSES IN OVERHEAD LINES.

The stress in overhead conductors shall not exceed the following limits: 25,000 lb. per square inch for hard-drawn copper, or 14,000 lb. per square inch for annealed copper, 12,500 lb. per square inch for hard-drawn aluminium, 34,000 lb. per square inch for steel, and 22,500 lb. per square inch for iron, in the event of a minimum temperature of 20° F. or as otherwise specified in the license and a wind-pressure of 18 lb. per square foot of diametral plane occurring simultaneously in the case of lines erected outside borough and township limits, and 12 lb. per square foot of diametral plane in the case of lines erected within borough and township limits. In the case of a composite wire the maximum stress in the above circumstances shall not exceed 75 per cent. of the stress which causes a permanent extension of 2½ per cent. when tested in tension or of previous rupture. The span between supports and the sag shall be determined to conform to the above limiting-stresses. Dynamometers for checking the tension in the wires during erection shall be provided and maintained by the licensee.

Calculations of the stresses and sag in the maximum spans for each line shall be submitted with the plans required under clauses 8 and 13.

#### 33. CLEARANCES FOR OVERHEAD LINES.

(a.) Overhead electric lines at low pressure shall not in any part thereof be at a less height than 18 ft. from the ground, except as provided in clause 52.

(b.) Overhead electric lines at high pressure shall not in any part thereof be at a less height than 20 ft. from the ground.

(c.) Overhead electric lines at extra-high pressure shall not in any part thereof be at a less height than 22 ft. from the ground.

(d.) Where low- and high-pressure or low- and extra-high-pressure lines are carried on the same poles, a minimum height of 20 ft. below the low-pressure lines shall be provided to allow telegraph crossings to pass underneath. When such lines are erected along tramway routes the low-pressure lines shall be at such a height as to permit the telegraph circuits that cross the street to pass above the trolley-wire and below the low-pressure lines.

(e.) Overhead electric lines crossing electric tramway-lines shall have a minimum clearance of 4 ft. above the trolley wire or wires.

(f.) No overhead electric lines shall come within 2 ft. of any other aerial lines or cables, except at a pole, and then only by arrangement between the respective owners of the wires.

(g.) Overhead electric lines shall be so erected as to be inaccessible to any person without the use of a ladder or other special appliance.

(h.) The maximum sag shall be computed on the assumption that the conductor is subjected to a temperature of 120° F.

(i.) Where necessary for a lineman to climb between live conductors the following minimum climbing-spaces shall be provided between conductors: Low pressure, covered, 30 in.; low pressure, bare, 36 in.; high pressure, covered, 36 in.; high pressure, bare, 48 in.

(j.) Where overhead wires cross navigable waterways, special clearances shall be provided as directed by the Minister.