

such high or extra-high pressure cables shall be subject, in so far as applicable, to the regulations for the time being in force under section 2 of the Public Works Amendment Act, 1911. 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; provided that where a permanent connection can be made with the tramway-track rails at the station the earth-plates may be dispensed with. Means shall be provided for testing the resistance between the two connections through the earth. The connection between the general mass of earth and the earth-plates, together with the spacing between plates, must be such that the resistance between them shall not exceed 2 ohms. Such tests shall be made at least once a month and recorded.

2. All switchboards shall be made of and mounted on material that is not inflammable, and the maximum permissible current and temperature in any conductor mounted thereon or leading thereto shall not exceed the values permitted under the rules of 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 the back of any switchboard carrying exposed conductors at a pressure over 650 volts shall be screened off and accessible only to authorized persons.

3. 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.

4. All switchboard circuits shall be so arranged that the course of any main conductor can be readily identified.

5. Adequate means of access, free from danger, shall be provided for every switchboard passage-way, and the following provisions shall apply to all switchboard working-platforms and passage-ways, unless the bare conductors, whether overhead or at the sides of the passage-ways, are otherwise adequately protected against danger by divisions or screens or other suitable means:—

(a.) Passage-ways constructed for low-pressure switchboards shall have an overhead clearance of 7 ft. between the conductors and the floor, and a clear width measured from bare conductor of not less than 3 ft.

(b.) Passage-ways constructed for high-pressure and extra-high-pressure switchboards, other than operating desks or panels working solely at low pressure, shall have an overhead clearance of not less than 8 ft., and a clear width measured from bare conductor of not less than 3 ft. 6 in.

(c.) Bare conductors shall not be exposed on both sides of the switchboard passage-way unless either (1) the clear width of the passage is, in the case of low pressure, not less than 4 ft. 9 in., and, in the case of high pressure, not less than 8 ft., in each case measured between bare conductors; or (2) the conductors on one side are so guarded that they cannot accidentally be touched.

6. Suitable means, such as rubber mats and gloves, shall be provided and used when necessary adequately to prevent danger.

7. The frames of all electrical machinery, metal casings, and all apparatus connected therewith shall be efficiently earthed.

#### *Overhead Line and Feeders.*

8. The maximum difference of potential between trolley-wire and the ground or between trolley-wire feeders and the ground shall not exceed 650 volts.

9. The overhead trolley-wires shall not in any part thereof be at a less height than 18 ft. above the track; provided that where sufficient clearance is not obtainable in tunnels or under bridges the consent of the Minister, in writing, shall be first had and obtained. The trolley-wires shall be suspended in such a way as to provide a double insulation between them and earth. The spacing of the points of support shall not exceed 2 chains.

10. A service telephone system for emergency purposes shall be provided, having connecting-boxes placed every half mile; provided that if the public telephone service is available the Minister may grant exemption, in writing, from the provisions of this clause.

11. Trolley-wire feeder cables, if carried overhead, shall be covered with weatherproofed triple braiding; provided that, where circumstances permit, the Minister may approve of bare conductors being used; and provided that where electric lines intersect the Post and Telegraph Department's lead-covered cables, vulcanized-indiarubber insulation of not less than 600-megohm grade shall be substituted for weatherproofed triple braiding.

12. Guard-wires, guard-hooks, and other similar protective devices shall be erected wherever required by the Minister of Telegraphs, and at the cost of the tramway authority. Any special provisions deemed to be necessary by the Minister of Telegraphs at intersections or as a protection to telegraph lines generally shall be borne by the tramway authority when the telegraph lines are erected before the electric lines, and in cases where the electric lines are erected before the telegraph lines the tramway authority, on receipt of notice from the District Telegraph Engineer of the Post and Telegraph Department, or his deputy, that it is proposed to run a telegraph line along the route, shall forthwith make the necessary changes required to comply with this clause, the cost of such changes being borne by the Post and Telegraph Department.

13. All feeder-cables, test-wires, and service telephone lines shall be carried as far as possible on one side of the street, and on the opposite side to that occupied by the Post and Telegraph Department's lines; provided that in special circumstances this condition may be varied with the approval of the Minister. In all cases the tramway authority and the Minister of Telegraphs shall give to each other reasonable facilities for the joint use of poles.

14. All supports shall be designed with a factor of safety of 4 if of steel, and 5 if of wood, against all forces to which they are subject, including wind-pressure on supports and conductors of 20 lb. per square foot of plane surface and 12 lb. per square foot diametral plane on a cylindrical surface.

15. The stresses in overhead conductors shall not exceed the following limits: 25,000 lb. per square inch for hard-drawn 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 32 degrees Fahrenheit and a wind-pressure of 12 lb. per square foot of diametral plane occurring simultaneously.

16. Overhead feeder cables shall not in any part thereof be at a less height than 18 ft. above the ground. Test wires and service telephone wires, where employed, shall similarly have a minimum clearance of 18 ft. The minimum height above the ground for any conductor shall be computed on the assumption that the conductor is subject to a temperature of 122 degrees Fahrenheit.

17. The best means available shall be adopted for preventing the occurrence of undue sparking at the rubbing or rolling contacts in any place.

#### *Track and Return Circuit.*

18. The rails forming the track shall be efficiently bonded or welded at the joints so that the resistance at the joint shall not exceed the resistance of 30 inches of the rail, and the rails and tracks shall be bonded across with the equivalent of 0.125 square inches copper every 240 ft. No metal pipe or conduit conveying gas or water, or which encloses electric lines or conductors, shall be laid within 2 ft. 6 in. of a track-rail, whether such pipe or conduit is laid before or after the track is laid. Where this precaution cannot be observed, notice shall be given to the Minister, who shall, after investigation, prescribe the conditions under which the work shall be carried out. It shall be incumbent upon the tramway authority to advise the Minister of any infringement of this regulation on the part of any local authority, company, person, or persons.

19. The track rails shall be connected to the negative bus-bar by means of an insulated conductor or conductors.

20. Conductors forming part of a return circuit may, if carried overhead, be bare, but shall be supported on suitable insulators, the insulation of which shall be efficiently maintained.

21. The difference of potential between any two points of a track shall not exceed seven volts, and a continuous record shall be taken of difference of potential between the supply end of a tramway track and the far end of each tramway route; provided that if the conditions are such that no injury is likely to occur, one or more records may be omitted by the consent of the Minister.

22. If at any time and at any place a test is made by connecting a galvanometer or other current-indicator to the uninsulated return and to any pipe in the vicinity, it shall always be possible to reverse the direction of any current indicated by interposing a battery of three Leclanché cells connected in series if the direction of the current is from the return to the pipe, or by interposing one Leclanché cell if the direction of the current is from the pipe to the return.

23. A suitable low-resistance indicating ammeter which can be connected in circuit between the negative bus-bar and the nearest main forming part of the reticulating system of the public water-supply shall be provided at the generating station. A switch or link, to be kept open except when in use for periodical tests, shall be inserted in the circuit and