

3. *Uninsulated return to be of low resistance.*—Where the rails on which the cars run or any other conductor within 3 feet of such rails, and metallically connected therewith, form the whole or any part of the "return," such rails and conductor may be uninsulated, and all other "returns" or parts of the "return" shall be insulated from the earth, or, if uninsulated, must be of such sectional area that the difference of potential between the points of the uninsulated "return" furthest from and nearest to the generator shall not exceed seven volts, and a continuous record shall be kept of such difference of potential during the working of the tramway.

4. *Height of wire.*—Where any part of the "line" or "return" is erected overhead, and is used for conveying the current to the motor by means of a sliding or rolling contact attached to the car, such conductor and connexions thereto shall not, in any part thereof, be at a less height than 18 feet from the ground. All other overhead conductors, including feeders, shall be erected in accordance with the Regulations for aerial conductors.

5. *Guard Wires.*—Where telephone or telegraph wires cross any part of the "line" or "return" (erected overhead) used for conveying the current to the motor by means of a sliding or rolling contact attached to the car, a galvanized-steel guard wire must be erected at a distance of not less than 18 inches above and parallel to the "line" or "return," such guard wire in all cases to be insulated from the "line" and "return" (when insulated), and connected with earth.

6. *Uninsulated return connected with rails.*—When any uninsulated conductor laid between or within 3 feet of the rails forms any part of a "return" it shall be electrically connected to each length of rail by means of copper wires or strips having a sectional area of at least one-sixteenth of a square inch or by other metallic connexions of equal conductivity.

7. *Negative terminal connected to return and earth.*—When any part of a "return" is uninsulated it shall be connected with the negative terminal of the generator, and in such case the negative terminal of the generator shall also be directly connected, through the current indicator hereinafter mentioned, to two separate earth connexions, which shall be placed not less than 20 yards apart.

*Water-pipe may be used.*—Provided that in place of such two earth connexions the company may make one connexion to a main for water supply of not less than 3 inches internal diameter, with the consent of the owner thereof and of the person supplying the water, and provided that where, from the nature of the soil or for other reasons, the company can show, to the satisfaction of an inspecting officer of the constituted authorities, that the earth connexions herein specified cannot be constructed and maintained without undue expense, the provisions of this Regulation shall not apply.

*Efficient earth—Monthly test.*—The earth connexions referred to in this Regulation shall be constructed, laid, and maintained so as to secure electrical contact with the general mass of earth, and so that an electro-motive force not exceeding four volts shall suffice to produce a current of at least two amperes from one earth connexion to the other through the earth, and a test shall be made at least once in every month to ascertain whether this requirement is complied with.

*Distance from pipes.*—No portion of either earth connexion shall be placed within 6 feet of any pipe, except a water main, of not less than 3 inches internal diameter, metallically connected to the earth connexions with the consents hereinbefore specified.

*Storage batteries, &c.*—When storage batteries, motor generators, or other transforming devices are electrically connected to the line, or any part thereof, they shall be connected to the line, return, and earth in the same manner as the generator, and the same precautions taken to prevent leakage to earth.

8. *Uninsulated return—Conditions.*—When the return is partly or entirely uninsulated, the following conditions must be observed to prevent injurious leakage from such return to earth :—

- (a) Lay such return,
- (b) Avoid connexion of such return with any pipe or pipes,
- (c) Connect the several lengths of rails by suitable metallic bonding,
- (d) Adopt such means for reducing the difference of potential produced by the current (when the cars are running) between any one point and any other point of the uninsulated return,
- (e) Maintain the efficiency of the earth connexions specified in the preceding Regulations,

So that—

- (1) *Leakage to earth.*—The current passing from the earth connexions through the indicator to the generator shall not at any time exceed either two amperes per mile of single tramway line or 5 per cent. of the total current output of the station.
- (2) *Leakage to pipes.*—If at any time and at any place a test be 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 Leclanche cells connected in series if the direction of the current is from the return to the pipe, or by interposing one Leclanche cell if the direction of the current is from the pipe to the return.

In order to provide a continuous indication that the condition (1) is complied with, the company shall place in a conspicuous position a suitable, properly-connected, and correctly-marked current indicator, and shall keep it connected during the whole time that the line is charged.

The owner of any pipes in the vicinity of the uninsulated return may require the company to permit him, at reasonable times and intervals, to ascertain by test that the conditions specified in (2) are complied with as regards his pipe.

9. *Connexion with pipe, examination of.*—Every electrical connexion with any pipe shall be so arranged as to admit of easy examination, and shall be tested at least once in every three months.

10. *Line in half-mile sections.*—Every "line" and every insulated "return" or part of a "return," except feeders, shall be constructed in sections not exceeding one-half of a mile in length, and means shall be provided for isolating each such section for purposes of testing.

11. *Circuit, insulation of.*—The insulation of the "line" and of the "return" when insulated, and of all feeders and other conductors, shall be so maintained that the leakage current shall not exceed one-hundredth of an ampere per mile of tramway. The leakage current shall be ascertained daily before or after the hours of running, when the "line" is fully charged. If at that test the leakage be found to exceed one-hundredth of an ampere steps shall be taken to localize and remove the leak. Should the leakage current exceed one-half of an ampere per mile of tramway, the running of the cars shall be stopped unless the leak is localized and removed within 24 hours. Provided that, where both "line" and "return" are placed within a conduit, this Regulation shall not apply.