

Trolley Vehicles

MINISTRY OF TRANSPORT

TROLLEY VEHICLES

MEMORANDUM

*on the Form, Construction, Dimensions
and Weight of Trolley Vehicles
and their Electrical
Equipment*

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MINISTRY OF TRANSPORT

TROLLEY VEHICLES

Memorandum on the Form, Construction, Dimensions and Weight of Trolley Vehicles and their Electrical Equipment

The Acts and Orders authorising the construction of trolley vehicle routes generally contain provisions to the effect that the trolley vehicles and the electrical equipment thereof used under the authority of the Act or Order shall be of such form, construction, weight and dimensions as the Minister of Transport may approve, and that no trolley vehicle shall be used which does not comply with the requirements of the Minister.

The procedure to be followed by trolley vehicle undertakers when applying under these provisions for the Minister's approval to the proposed design of trolley vehicles is set out in Appendix I of this memorandum.

The actual design of the vehicles approved by the Minister under these provisions varies to some extent according to the prevailing conditions on the routes on which the vehicles are proposed to be used, and the circumstances of the particular undertaking concerned, but the requirements usually made in connection with such approvals are set out in Appendix II of this memorandum.

In addition to the above-mentioned duty of approving the design of trolley vehicles, the Minister is also generally required by the Acts and Orders authorising trolley vehicle routes to make Regulations for regulating the use of electrical power, and for securing to the public all reasonable protection against danger arising from the use of mechanical or electrical power for the trolley vehicles. He is further empowered to make Byelaws for the purpose of such matters as regulating the use of bells or other warning apparatus fixed to the trolley vehicles; providing that the vehicles shall be brought to a stand at the intersection of cross streets and at such places and in such cases of horses being frightened or of impending danger as the Minister may deem proper for securing safety; regulating the entrance to and exit from and accommodation in the trolley vehicles; and providing for the protection of passengers from their machinery. These Regulations and Byelaws are included in separate codes made in respect of each undertaking,

and are printed and on sale as Statutory Rules and Orders. Model Codes of these Regulations and Byelaws showing the current form in which they are usually made can be obtained on application from the Ministry of Transport.

In addition to the above-mentioned provisions relating to the control of the design of trolley vehicles the relevant Acts and Orders usually provide that mechanical or electrical power shall not be used except with the consent of and according to a system approved by the Minister ; and that no trolley vehicle route shall be opened for public traffic until it has been inspected and certified to be fit for traffic by an Officer appointed by the Minister of Transport. A memorandum indicating the nature of the requirements made in connection with such certification of routes can be obtained on application from the Ministry of Transport.

APPENDIX I

PROCEDURE TO BE FOLLOWED IN MAKING APPLICATION TO THE MINISTER OF TRANSPORT FOR APPROVAL OF THE FORM, CONSTRUCTION, WEIGHT AND DIMENSIONS OF TROLLEY VEHICLES AND THEIR ELECTRICAL EQUIPMENT

- 1** Application for the necessary approval should be made by the undertakers concerned before the construction of the vehicles has commenced, and before any contracts for such construction have been entered into.
- 2** The application should state the number of vehicles in respect of which approval to the design is sought.
- 3** The application should be accompanied by drawings of the vehicles and specifications of the chassis and body respectively indicating in detail the proposed form, construction, dimensions and systems of braking of the vehicles.
- 4** The application should be accompanied by a statement showing the proposed unladen total weights and weights on each axle, the seating capacity, the tilting angle, and the extent to which it is proposed to equip the vehicles with safety glass on the windscreen and windows.

APPENDIX II

DETAILS OF APPROVED DESIGNS

(a) DEFINITIONS

1 "OVERALL LENGTH" means the length of a vehicle measured between parallel planes passing through the extreme projecting points of the vehicle, exclusive of any Post Office letter box.

"OVERALL WIDTH" means the width measured between vertical parallel planes passing through the extreme projecting points of the vehicle, exclusive of the driving mirror and of any direction indicator when in operation, and of so much of the distortion of any tyre as is caused by the weight of the vehicle.

"OVERHANG" means the distance measured horizontally and parallel to the longitudinal axis of the vehicle between two vertical planes at right angles to such axis passing through two points specified in paragraphs (i) and (ii) of this definition respectively.

(i) The rearmost point of the vehicle, exclusive of any Post Office letter box.

(ii) (a) in the case of a vehicle having only two axles, one of which is not a steering axle, through the centre point of that axle, and

(b) in the case of a vehicle having only three axles where the front axle is the only steering axle, through a point 4 inches in rear of the centre of a straight line joining the centre points of the rear and middle axles, and

(c) in any other case through a point situated on the longitudinal axis of the vehicles and such that a line drawn from it at right angles to that axis will pass through the centre of the minimum turning circle of the vehicle.

"GANGWAY" means the space provided for obtaining access from any entrance to the passenger seats or from any such seat to an exit, other than an emergency exit, but does not include a staircase or any space in front of a transverse seat which is required only for the use of passengers occupying that seat.

"SEATING CAPACITY" in relation to a vehicle means the seating capacity of that vehicle calculated in accordance with the provisions of Regulation 3 of the Hackney Motor Vehicles (Seating Capacity) Regulations, 1927.

"SAFETY GLASS" means glass so constructed or treated that if fractured it does not fly into fragments capable of causing severe cuts.

"WHEEL" means a wheel, the tyre of which when the vehicle is in motion on a road is in contact with the ground.

Any two wheels shall be regarded as one wheel if the distance between the centres of the areas of contact between such wheels and the road surface is less than 18 inches.

(b) GENERAL

2 GENERAL CONSTRUCTION. The vehicle including all body-work, upholstery and fittings, shall be soundly and properly constructed of suitable materials, well finished and in good and serviceable condition, and of such design that it is capable of withstanding the loads and stresses likely to be met with in operation.

3 OVERALL LENGTH. The overall length of a vehicle with four wheels shall not exceed 27 ft. 6 ins. for single-decked vehicles or 26 ft. for double-decked vehicles, and of a vehicle with more than four wheels shall not exceed 30 feet.

4 OVERALL WIDTH. The overall width of a vehicle shall not exceed 7 ft. 6 ins. provided that this dimension may be exceeded by 6 inches for trolley vehicles working on routes which have been approved by the Minister in writing for use by such wider vehicles.

5 HEIGHT. No vehicle shall exceed 15 ft. 10 ins. in height over the trolley base when unladen.

6 OVERHANG. The overhang shall not exceed 50 per cent. of the distance between the plane perpendicular to the longitudinal axis of the vehicle which passes through the centre or centres of the front wheel or wheels, and the foremost vertical plane from which the overhang is to be measured as defined above.

7 WEIGHT. The sum of all the weights transmitted to the road surface by all the wheels of a four-wheeled vehicle shall not exceed $12\frac{1}{2}$ tons, and of a six-wheeled vehicle shall not exceed $14\frac{1}{2}$ tons.

The weight transmitted to the road surface by any two wheels of a vehicle in line transversely shall not exceed 8 tons.

For the purpose of the above requirements, the weight transmitted to the road surface by a vehicle shall be taken to be the weight so transmitted by the vehicle when it is complete and fully equipped for service, and loaded with weights of 140 lbs. per person, placed in the correct relative positions for each passenger for whom a seat is provided and for the driver and conductor.

8 STABILITY. The stability of a double-decked vehicle shall be such that when loaded with weights of 140 lbs. per person placed in the correct relative positions to represent the driver and conductor and a full complement of passengers on the upper deck only,

if the surface on which the vehicle stands were tilted to either side to an angle of 25 degrees from the horizontal the point at which overturning occurs would not be passed.

The stability of a single-decked vehicle shall be such that under any conditions of load if the surface on which the vehicle stands were tilted to either side to an angle of 32 degrees from the horizontal the point at which overturning occurs would not be passed.

When making stability tests the trolley booms shall be clear of conductor wires and secured in the roof hooks ; the height of any stop used to prevent a wheel of a vehicle from slipping sideways shall not be greater than two-thirds of the distance between the surface upon which the vehicle stands before it is tilted, and that part of the rim of that wheel which is then nearest to such surface when the vehicle is loaded in accordance with the above conditions.

9 TURNING CIRCLE. Every vehicle shall be so constructed as to be capable of turning in either direction in a circle not exceeding in diameter 60 feet in the case of a vehicle the overall length of which does not exceed 26 feet, and 66 feet in the case of a vehicle the overall length of which exceeds 26 feet. Such diameter shall be determined by reference to the extreme outer edge of the wheel track at ground level.

10 UNDERCLEARANCE. No part of any fully laden vehicle standing on level ground shall in front of or within the limits hereinafter specified, be nearer to the ground than 10 inches. The limits shall extend in length from the foremost part of the vehicle for a distance of 12 feet in the case of either a four-wheeled vehicle or a six-wheeled vehicle, and shall extend in width for a distance on either side of the centre line of the vehicle of not less than one-third of the distance between the centre lines of the tracks of the front wheels.

Special consideration would be given to the underclearance to be required for a vehicle fitted with an approved design of lifeguard.

11 SIDE OVERHANG. No part of a vehicle other than a Direction Indicator, when in operation, or a Mirror, shall project laterally more than 6 inches beyond the outer face of the outer tyre on the rearmost wheel on the same side of the vehicle.

12 HUB PROJECTION. No portion of any road wheel or any fittings thereof shall project more than $3\frac{1}{2}$ inches beyond the extreme outer face of the tyre when fully inflated.

13 TYRES. Every vehicle shall be equipped with pneumatic tyres.

14 WINGS. A vehicle shall be provided with wings or other similar means to catch, so far as practicable, mud or water thrown up by the rotation of the wheels, unless adequate protection is afforded by the body of the vehicle.

15 GUARD RAILS. If any two wheels on either side of a vehicle have a clear space of more than 2 feet between the nearest points, that space shall be effectively guarded to within 9 inches of the front wheel and 6 inches of the rear wheel, and to within 10 inches of the ground, when the vehicle is carrying no passengers and is standing on level ground.

The means of guarding the space shall be so constructed and fitted that, when necessary, by raising or otherwise, access can easily be obtained to any part of the space underneath the vehicle.

16 DISTRIBUTION OF WEIGHT. Every vehicle with more than four wheels shall be provided with such compensating arrangements as will ensure that all the wheels remain in contact with the road surface, and under the most adverse conditions will not be subjected to abnormal variations of load.

17 SPRINGS. Every vehicle shall be equipped with an efficient suspension system, so designed and constructed that there is no excessive body sway.

(c) MECHANICAL

18 BRAKES. Every vehicle shall be equipped with an efficient braking system or efficient braking systems, in either case having two means of operation, so designed and constructed that, notwithstanding the failure of any part (other than a fixed member or a brake shoe anchor pin) through or by means of which the force necessary to apply the brakes is transmitted, there shall still be available for application by the driver, to not less than half the number of the wheels of the vehicle, brakes sufficient under the most adverse conditions to bring the vehicle to rest within a reasonable distance.

One means of operation shall be by pedal and the application of one means of operation shall not affect or operate the pedal or hand lever of the other means of operation.

All the brakes which are operated by one means of operation shall be capable of being applied by direct mechanical action without the intervention of any hydraulic, electric or pneumatic device.

In the case of a vehicle fitted with a servo braking system, the brakes of such system shall not immediately be rendered ineffective by a failure of the means provided to develop the vacuum or pressure required for servo action.

In the case of vehicles fitted with air brakes, a suitable pressure gauge shall be provided, conveniently visible to the driver. [The provision of a low air pressure alarm, audible and/or visible, is considered a desirable addition].

All mechanical brakes shall act direct on the wheels of the vehicle and not through the transmission, but an electric brake of the rheostatic, regenerative, eddy current, or similar approved type may act through the transmission ; any such electric brake shall be additional to the braking system or systems required in the first paragraph above.

One of the braking systems shall be so designed and constructed that it can at all times be set so as effectively to prevent two at least of the wheels from revolving, when the vehicle is not being driven or is left unattended.

A brake drum shall be deemed to form part of the wheel and not of the braking system.

19 STEERING. The steering mechanism shall be so constructed or arranged that no overlock shall be possible, and that the wheels shall not in any circumstances foul any part of the vehicle.

The steering arms shall be polished, but shall not be painted or plated.

The ball and socket joints of steering gears, when such are used, shall not be pendant.

Dust excluding covers fitted to any joint or connection of the steering mechanisms shall be capable of being easily removed to facilitate inspection.

20 REVERSING. Every vehicle shall be capable of being so worked that it may travel either forwards or backwards.

21 LOCKING OF NUTS, ETC. All moving parts and all parts subject to severe vibration, connected by bolts or studs and nuts, shall be fastened by lock nuts, or by nuts and efficient spring or lock nut washers, or by castellated nuts and split pins, or by some other efficient device so as to prevent their working or coming loose.

Where brake and steering connections are secured with bolts or pins, the bolts or pins shall be threaded and effectively locked. All connections made with bolts or pins shall be such that when they are in any position other than horizontal, the head of the bolt or pin shall be uppermost.

(d) DRIVER'S CAB AND EQUIPMENT

22 DRIVER'S CAB AND SEAT. The driver's cab and seat shall be designed to give adequate leg room and head room, and the controls shall be so placed that they can be easily reached and quickly operated. The position of the hand brake lever when fully "on" shall be such that it does not incommode exit from or entrance to the cab. The accommodation for the driver shall be so arranged as to afford protection during inclement weather, and

where an entirely enclosed compartment is provided for the driver, this shall be adequately ventilated without the necessity of opening the front windscreen. Steps shall be taken to prevent light from the internal illumination of the vehicle from incommoding the driver.

The steering pillar shall be on the right or offside of the vehicle and the driver's seat shall be so placed as to permit him to give by hand the usual traffic signals on the offside of the vehicle.

There shall not be any seats for passengers in the driver's compartment or cab. No part of the underside of any top deck gangway shall project into the driver's cab.

Every vehicle shall be so designed and constructed that the driver can have a full view of the road and traffic ahead of the vehicle, including the best practicable view of the near side kerb immediately in front of the vehicle.

An efficient windscreen wiper shall be fitted to the front windscreen, and the windscreen shall be capable of being opened if necessary, in such a manner as to give the driver a clear view of the road ahead.

Alternative means of exit for the driver in emergency shall be provided, not located on the offside of the vehicle.

23 STANDARDISATION OF CONTROLS. All trolley vehicles belonging to one undertaking shall have the same layout in respect of the relative positions and method of operation of the main controls, viz. hand brake, foot brake and power controller.

Note. The standards most commonly adopted are right pedal, brake; left pedal, controller; and right hand, pull on hand brake; it is recommended that, in the absence of special reasons to the contrary, these standards should be followed.

24 WARNING INSTRUMENTS. Every vehicle shall carry an instrument capable of giving audible and sufficient warning of its approach and position; such instrument shall not consist of a bell or gong or a siren.

25 SPEEDOMETER AND BRAKE GAUGE. Every vehicle shall be fitted with a speedometer, and the speedometer and brake gauge, if any, shall be adequately illuminated at night.

26 REFLECTING MIRROR. Every vehicle shall be equipped with a reflecting mirror so constructed and fitted as to enable the driver to be aware of the presence in rear thereof of any other vehicle, the driver of which is desirous of passing the trolley vehicle.

[The provision of an additional mirror on the near side, to enable the driver to see passengers boarding or alighting is considered desirable].

27 FIRE EXTINGUISHER AND RUBBER GLOVES. Every vehicle shall be equipped with an efficient fire extinguisher, of approved type, and also a pair of rubber gloves.

(e) BODY

28 GENERAL. The body shall be securely fixed to the chassis. Every trap door in the floor of the vehicle shall be strong and so fitted or fastened that it cannot become dislodged by vibration. Any lifting device provided shall be properly sunk.

29 ENTRANCES AND EXITS. Every entrance and exit shall be at least 21 inches in width, and if fitted with a door shall be so arranged that a clear space of no less dimension shall be available without obstruction when the door is open.

Where the same entrance is used for both the upper and lower deck of a vehicle no part of the entrance (exclusive of any stanchions) measured along the near side of the vehicle shall be less than 36 inches in width.

A grab handle shall be fitted to each entrance or exit, other than an emergency exit, to assist passengers in boarding or alighting from the vehicle.

30 EMERGENCY EXITS. Provision shall be made to enable passengers to emerge from a vehicle which may have been overturned and is lying on its near side, without it being necessary to break glass windows. This may be done (a) by providing a width of not less than 18 inches open access to the rear platform from the rear end of the vehicle (in continuation of the normal access to the platform from the near side) or (b) by an emergency window opening in the rear of the vehicle, or (c) by other approved means. In the case of (b) it shall be possible to open the window from both inside and outside.

In the case of vehicles with an enclosed rear platform an emergency exit door shall be provided, at the rear or on the offside of the vehicle, of a minimum width of 21 inches, capable of being readily opened from both inside and outside the vehicle, and so placed that passengers shall be able to step directly from the passage leading to the exit to the outside of the vehicle.

[Generally, the provision of an opening window at the rear of the upper deck of a double-decked vehicle is regarded as desirable, in view also of the facility this can be made to offer for access to the roof and trolley booms].

31 DOORS. Every entrance and exit door shall be capable of being opened by one operation of the locking mechanism.

Door handles or levers to door catches shall be so designed and fitted that they are not liable to be dislodged or to be operated accidentally. Where any entrances are provided with doors which are intended to remain open when the vehicle is in motion, suitable fastenings shall be provided to hold such doors securely open.

All doors shall be so designed as to be readily opened from both inside and outside of the vehicle. In the case of vehicles provided

with a front exit, with air operated doors, controlled by the driver, emergency handles shall be provided inside and outside the vehicle, whereby the air pressure can be released and the doors left free for manual opening.

All doors shall open so as not to obstruct clear access to any entrance or exit, either from inside or from outside the vehicle.

32 STEPS, PLATFORMS AND STAIRS. The top of the tread of the lowest step of any entrance or exit (other than an emergency exit) from a vehicle shall not be more than 17 inches nor less than 10 inches above the ground when the vehicle is empty. All steps shall be fitted with non-slip treads. Fixed steps shall be not less than 9 inches wide, and shall not cause projection laterally beyond the body of the vehicle unless they are so protected by the front wings (or otherwise) that they are not liable to injure pedestrians.

In the case of a double-decked vehicle :

(a) The risers of steps leading from the lower to the upper deck shall be closed.

No unguarded aperture shall be left at the top landing board.

(b) All steps leading from the lower to the upper deck shall be fitted with non-slip treads.

(c) The horizontal distance from the nearest point of the riser of the top step to the vertical line passing through the nearest point of the seat opposite to the top tread of the staircase, excluding any grab rail which does not project more than 3 inches from the back of the seat, shall not be less than 26 inches.

(d) The outer stringer of an outside staircase shall be so constructed, or a band shall be so placed, as to act as a screen to persons ascending or descending, and the height of the outer guard rail shall not be less than 3 ft. 3 ins. above the front of the tread of each step.

33 GANGWAYS. There shall be unobstructed accessibility to every seat.

The width of every gangway shall be not less than 12 inches up to a height of 2ft. 6 ins. from the floor level, and above that height the width of every gangway shall be not less than 14 inches.

In the case of a single-deck vehicle and the lower deck of a double-deck vehicle, the height inside measured at the centre line of the gangway from the top of the floor battens to the lower edge of the hoop sticks or other such projections, shall be not less than 5 ft. 10 ins.

The height inside the top deck of a double-decked vehicle measured at the centre line of the gangway from the top of the floor battens to the lower edge of the hoop sticks or other such projections shall be not less than 5 ft. 8 ins.

34 SEATS. The supports of all seats shall be firmly fixed in position and at least 16 inches measured in a straight line along the front of each seat shall be allowed for each passenger.

Every seat shall have a backrest so closed or otherwise constructed as to prevent as far as possible the pockets of passengers being picked.

No part of the backrests of any seat placed lengthwise shall be less than 54 inches from the corresponding part of the backrest of the seat facing it.

Transverse seats shall be so fitted that :

1. There is a clearspace of at least 26 inches in front of the whole length of the top of the backrest of every seat, any handles or guards which do not project more than 4 inches from the backrest being disregarded when measuring the clear space herein referred to, and
2. There is a clear space of at least 19 inches between any part of the front edge of a seat and any part of any other seat which faces it.

The expression "backrest" includes any part of a vehicle which is available for passengers to lean against.

Seats over a wheel arch shall not be placed in such position as to cause discomfort to passengers.

Where any transverse seat is so placed that a passenger seated upon it is liable to be thrown forward through an entrance or down a stairway, an effective screen or guard shall be placed so as to provide protection for any passenger occupying the seat.

The shortest distance between the edge of any step well and a vertical plane passing through the front edge of a seat shall not be less than 9 inches.

Glass windows or panels facing any transverse seats which are liable to be broken by passengers being thrown against them, shall, unless they are of safety glass, be adequately guarded.

35 SAFETY GLASS. All glass fitted to windscreens, and to windows facing to the front on the outside of any vehicle, except glass fitted to the upper deck of a double-decked vehicle, shall be safety glass.

For the purpose of this Requirement any windscreen or window at the front of the vehicle the inner surface of which is at an angle exceeding 30 degrees to the longitudinal axis of the vehicle shall be deemed to face to the front.

36 VENTILATION. There shall be adequate ventilation for passengers without the necessity for opening any main window or windscreen.

37 INTERIOR LIGHTING. Adequate artificial lighting shall be provided for the illumination of each deck. At least one lamp shall be provided as near as is practicable to the top of every staircase leading to an upper deck.

38 COMMUNICATION. Efficient means shall be provided to enable passengers on any deck to signal to the driver.

39 MARKING ON VEHICLES. The weight of the vehicle unladen shall be painted or otherwise plainly marked upon some conspicuous part on the left or near side of the vehicle.

40 OPEN TOP DOUBLE-DECK VEHICLES. In the application of these requirements to open top double-decked vehicles, special consideration of the design will be necessary in each case.

41 FRONT AND REAR LAMPS. Front and rear lamps shall conform to the provisions laid down for Public Service Vehicles in the Road Transport Lighting Act, 1927, and any Regulations made thereunder.

(f) ELECTRICAL

42 TROLLEY BOOMS AND HEADS. Trolley booms and heads shall be so designed and secured as to minimise danger arising from the following causes :

- (a) Dewiring of trolley heads.
- (b) Dewired trolley heads catching in any part of the overhead equipment or guard wiring.
- (c) Pulling out or breakage of trolley boom or standard.
- (d) Swinging of trolley boom after trolley head is dewired.
- (e) Falling of detached trolley head.

43 ELECTRICAL CONDUCTORS. All electrical conductors fixed upon the vehicle in connection with the current collectors shall be formed of flexible cables protected by adequate insulation of the highest quality, and additionally protected wherever they are adjacent to any metal so as to avoid risk of the metal becoming charged.

Conductors located on the underside of the chassis and in other positions exposed to water and dirt, shall in addition be provided with physical protection such as flexible metallic tubing, rubber hose pipe or other equivalent material.

44 EMERGENCY CUT-OFF SWITCH. An emergency cut-off switch shall be provided and fixed so as to be conveniently reached by the driver in case of any failure of action of the controller switch. This shall be so located that any flash resulting from its operation is kept well away from the driver's eyes.

45 MASTER CONTROLLERS. The casings of master controllers and similar apparatus in the cab which may be touched by a driver shall either be constructed of insulating material or be bonded to the chassis.

46 AIR COMPRESSORS. Any air compressor or vacuum exhauster driven by a High Tension Motor shall be carried on an insulating

mounting, and an insulated coupling shall be provided in the pipe leading to the compressor or exhauster, so arranged that the insulation is not likely to be bridged by condensed moisture.

The switch controlling the compressor circuit shall be so linked with the switch of the master control circuit that it shall be impossible for a driver to neglect to energise his compressor circuit before starting his vehicle.

47 SKATE CABLE. If a detachable skate cable is fitted the connecting plug shall be provided with an insulating handle or guard so that no risk of shock is incurred when inserting the plug.

48 INSULATION OF GRAB HANDLES AND STEPS. The handles and entrance steps used by passengers and by the driver on entering or leaving a vehicle shall either be constructed of some non-conducting substance or be covered with a suitable insulating material.

49 RADIO INTERFERENCE SUPPRESSION. The electrical equipment shall be so designed as to reduce to a minimum interference with Wireless Broadcasting reception in buildings adjacent to the routes operated and shall conform to the requirements of British Standard Specification No. 827, Radio Interference Suppression for Trolley Buses and Tramways.

50 LOW TENSION ELECTRICAL EQUIPMENT. All vehicles shall be fitted with a Low Tension generator and battery adequate for either :

- (a) The external lights required by regulations (vide para. 41 above) and at least one light in each of upper and lower saloons, together with any small electrically operated accessories, such as screen wipers and horns ; or
- (b) All internal and external lights and any small electrically operated accessories.

The term " Low Tension " shall imply a voltage not exceeding 40 volts, which voltage may only be exceeded by prior consent of the Minister, *e.g.* if required for Fluorescent Lighting. In the case of vehicles fitted with emergency battery traction the battery may be in two halves, each not exceeding 40 volts, which may be connected in series when required for traction purposes.

The electrical circuits of any Low Tension generator shall be efficiently insulated from the High Tension Motor by which it is driven ; in the case of a motor generator set, the whole set shall be carried on an insulating mounting.

51 ELECTRIC HEATING. Special approval will be necessary in any case when it is desired to provide Electric Heaters fed from the traction supply. Generally it will be required that such heaters should be mounted on an insulating mounting and protected from contact by a passenger or from damp, by suitable perforated screens. The circuit feeding them to be controlled by a separate double pole switch and double pole fuses.

52 TESTING EQUIPMENT. Convenient socket receptacles or other devices shall be provided to facilitate the efficient operation of the daily leakage test.

Note. The daily leakage test of trolley vehicles, as at present prescribed in the Regulations issued for each Undertaking, is as follows :

“ The insulation of the electrical conductors from the metal work of each trolley vehicle shall be tested and the leakage current recorded daily before the vehicle is used for passenger traffic with a testing pressure not less than 500 volts. The arrangements for this test shall be such as to ensure that the whole of the high tension circuits of the vehicle, including any compressor or similar motor circuit, are subjected to the test pressure. If a high resistance instrument is used for the test, the scale shall be suitable calibrated to ensure that the resistance of the instrument itself does not affect the accuracy of the indication of the true leakage from conductors to chassis. No trolley vehicle shall be taken out for use if the leakage current exceeds 3 milliamperes.”

53 METAL FRAMED BODIES. In the case of vehicles with metal framed bodies the following additional protective arrangements are required :

Low Tension Lighting shall be provided throughout.

Grab handles and stanchions which may be handled by passengers or driver while stepping on or off the vehicle shall, in addition to having an insulating covering, be secured to the body by an insulating mounting.

Dry spot insulation shall be provided in the creepage path of the trolley base or trolley booms.

Special attention shall be given to the provision of adequate insulation between the resistances and the chassis or body, and also to the insulation of the platform step used by passengers when entering or leaving the vehicle.

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