

Melbourne & Metropolitan
Tramways Board

ELECTRIC SYSTEM

INSTRUCTIONS
TO DRIVERS IN
ELECTRIC CAR
OPERATION



1948

SAFETY FIRST
Melbourne & Metropolitan
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No 2154

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Instructions to Drivers in Electric Car Operation

Q. 1.—What does an Electric Tram Car Equipment consist of?

A.—It consists of:—

1. Trolley wheels, trolley poles and trolley bases.
2. Lightning arrester with choke coil.
3. Circuit breaker or line breaker with combined line breaker switch and fuse.
4. Controllers.
5. Rheostat (resistances).
6. Motors.
7. Compressor switch and fuse.
8. Air compressor governor.
9. Air compressor.
10. Reservoir.
11. Safety valve.
12. Brake cylinder.
13. Driver's operating valves.
14. Pressure gauges.
15. Brakes (air, electric and hand).
16. Sand gear.
17. Lamps, switches and fuses.
18. Foot gongs.
19. Lifeguards.

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- Q. 2.—What is the use of the circuit breaker?
- A.—(a) To open or close the main power circuit manually.
- (b) To cut the power off automatically in the case of defective motors, bad driving or short circuit in wiring, etc.
- Q. 3.—What is a line breaker?
- A.—It is an electrically-operated device fixed under the car, which closes and completes the main power circuit when the driver moves the controller handle from the "off" position towards the first power notch, and opens the main power circuit when the controller is moved towards the "off" position from any "on" position. It also opens the main power circuit automatically in cases of overload, that is, when there is an excessive current, due either to faulty operation of the controller (bad driving) or some defect of the electrical equipment.
- Q. 4.—What is the use of the line breaker control switch and fuse?
- A.—In the case of the control switch, to open and close the Line Breaker Control circuit manually; in the case of the fuse, to open the circuit automatically in the event of electrical trouble in the control circuit.
- Q. 5.—Name the circuits which are protected by a fuse.
- A.—(a) Line breaker control circuit.
- (b) Air compressor circuit.
- (c) Lighting circuit.
- Q. 6.—Name the vital points of the line breaker control circuit.
- A.—Line breaker switch and fuse. Ratchet switch segment and spring, S.1, S.2 and first earth fingers. With the exception of the first two items, all the others mentioned are mounted in the controller.

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- Q. 7.—What should a driver do when it is necessary to renew a fuse?
- A.—In all cases, put the switch controlling the supply of current to the "off" position.
- Q. 8.—What is a controller for?
- A.—The controller is for controlling the motion of the car, also for reversing its direction. It may also be used to operate the electric emergency brakes.
- Q. 9.—What is the use of the reverse key?
- A.—To reverse the direction of the car, and to lock the controller handle when the key is in the neutral position or removed. It is also used in the operation of electric brakes.
- Q.—10. What are the names of the groups of notches on the controller?
- A.—Series and parallel.
- Q. 11.—What is the difference between series and parallel?
- A.—When a car is operated in series, the motors divide the line pressure and the car attains half speed. When a car is operated in parallel, each motor receives the full line pressure and the car attains full speed.
- Q. 12.—What should a driver do when it is necessary to examine the inside of a controller, or cut out a defective motor or motors?
- A.—In all cases, put the circuit breaker or line breaker control switch to the "off" position, then before opening controller case, cut several notches to make sure there is no power. The controller contains special switches for the cutting out of a defective motor or motors. (For positions of

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these switches, see diagrams of controllers, pages 14 to 19.) On cars 750 and 751 these are situated on the end of the contactor box underneath the car. (Caution: If it is necessary to cut out motors in these cars, the pole should be removed from the overhead wire.)

- Q. 13.—Describe the use of the rheostat.
- A.—The rheostat is placed in circuit with the motors to regulate the motor current when starting and accelerating the car.
- Q. 14.—When starting or bringing car up to speed, how long would you pause on each rheostat notch?
- A.—Sufficiently long to maintain smooth acceleration. If a driver dwells too long on a rheostat notch, power is wasted, the rheostat gets overheated and a fire may be caused.
- Q. 15.—What is the result of moving the controller handle in the "on" position too quickly?
- A.—Excessive current flows through the main power circuit. This may cause the circuit breaker or line breaker to blow or the car wheels may spin.
- Q. 16.—Why is it necessary to pause on the full series running notch before cutting into parallel?
- A.—To prevent jolting the passengers on the transition stage (that is, changing from series to parallel).
- Q. 17.—Why should drivers not pause between notches?
- A.—To prevent severe arcing in the controller which would burn or blister the controller fingers and segments.

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- Q. 18.—Why is it imperative to cut quickly between the running notch in series and the first rheostat notch in parallel?
- A.—To prevent serious arcing in the controller and to maintain smooth acceleration.
- Q. 19.—How long should you operate the car on either the full series or the full parallel running notch?
- A.—Only as long as may be necessary to maintain the schedule.
- Q. 20.—How can power be saved?
- A.—(a) By accelerating as quickly as practicable, consistent with the smooth running of the car.
(b) By cutting off power as far as possible from a stopping place.
(c) By coasting as far as practicable.
(d) By releasing the brakes immediately power is applied.
(e) By cutting off power before applying the brakes.
- Q. 21.—What must a driver do if the controller becomes locked?
- A.—If the controller handle is locked in the operating position, knock out line breaker switch or circuit breaker and bring the car to a standstill by applying the brakes. The car may be pushed in the direction in which it was travelling, but must not be pushed in the opposite direction to that in which the reverse key is pointing. If the controller handle is locked in the "off" position, place reverse key in neutral and the car may be pushed in either direction. Advise Control as soon as possible by P.M.G. 'phone (FJ 3279, FJ 2488), or, if no P.M.G. 'phone is available, use track 'phone to nearest depot, stating nature of trouble, route, direction of travel and position.

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PROCEDURE TO BE ADOPTED WHEN A CAR IS BEING PUSHED.

- 1.—All passengers must leave the front (disabled) car.
- 2.—The driver of the disabled car must see that the reverse key is in the neutral position. When possible, keep air compressor switch "on" to allow the use of the air brake, otherwise the pole must be tied down securely, the air compressor switch put to the "off" position, and the hand brake used.
3. The signal to start (two bells) must be given from the rear car first, and repeated from the front car, but the driver of the rear car must not apply power to start until he receives the start signal (two bells) from the gong of the front car.
- 4.—Series speed must not be exceeded.
- 5.—The driver of the front (disabled) car must keep a sharp lookout and give the signal to stop (three bells) in case of emergency, and must also apply his own brakes promptly, using the hand brake if the air brake is out of action. He must also be ready, when on a grade, to apply his brakes quickly to stop the car, or to prevent it running backwards.
- 6.—The conductor of the front (disabled) car must take up a position at door of rear saloon to the driver's cabin and keep it open to give a clear view to the driver of rear car in case of necessity.
- 7.—At automatic points, the following procedure must be observed:—

The front (disabled) car must be stopped at the compulsory track stop mark.

Cars on the Straight: If the cars are to proceed on the straight, proceed normally, that is, both cars pass under the line contactor with power off.

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Cars taking the Curve: If cars are to proceed around the curve, the driver of the front (disabled) car must see that the points are set for the curve and indicate to the driver of the rear car accordingly, and the conductor must go to the rear of the car to hold down the trolley pole, so that it does not pass under the overhead contactor. On receipt of the signal to start, the driver of the rear car will then apply power and push the disabled car around the curve.

Q. 22.—If a car fails to start, how would you test the control circuit?

A.—See that the trolley pole is on the overhead wire and turn on lights. If they burn, this proves that the power is on and car wheels are not insulated from the rails by dirt or other matter. See that the line breaker switch is at the "on" position, open door to saloon of car and cut the first notch on controller and listen for dull thud of line breaker closing underneath the car. If line breaker does not close put line breaker switch to "off" position, renew fuse, close switch and again test for closing. If it still cannot be heard closing or the car does not start, put switch to "off" position, cut several notches to make certain that there is no power in controller. Open controller and examine ratchet switch spring (refer to diagram of controller for location) to see if it has become unhooked or broken. If unhooked, replace it. If spring is broken so that it cannot be rehooked, the spring from the controller at the other end of car may be used. Close controller. Put switch to "on" position and test again. If the line breaker still fails to come in, wait for following car, transfer passengers and get the car pushed to nearest depot or siding. Advise Control as soon as possible by P.M.G. 'phone (FJ 3279, FJ 2488), or, if no P.M.G. 'phone is

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available, use track 'phone to nearest depot, stating nature of trouble, route, direction of travel and position.

If it is necessary to push the car, refer to instructions dealing with procedure to be adopted when pushing a car as outlined at the end of Question 21.

Q. 23.—If the control circuit is operating, and car fails to start, how would you test the main circuit?

A.—If a car will not start on the first notch but will on some subsequent notch up to full series (indicating a broken resistor) the controller handle must not be operated beyond the full series position. If, however, the car will not start on any series notch, cut the first notch in parallel. If it then starts, the controller may be moved to the full parallel position, notch by notch. If these tests fail to start the car, open the circuit breaker or line breaker switch and advise Control as soon as possible by P.M.G. 'phone (FJ 3279, FJ 2488), or, if no P.M.G. 'phone is available, use track 'phone to nearest depot, stating nature of trouble, route, direction of travel and position. Wait for the following car to transfer passengers, and get the car pushed to the nearest depot or siding.

N.B.—When making any of the tests in Questions 22 and 23, it is essential to make certain that the track is clear for at least one car length ahead.

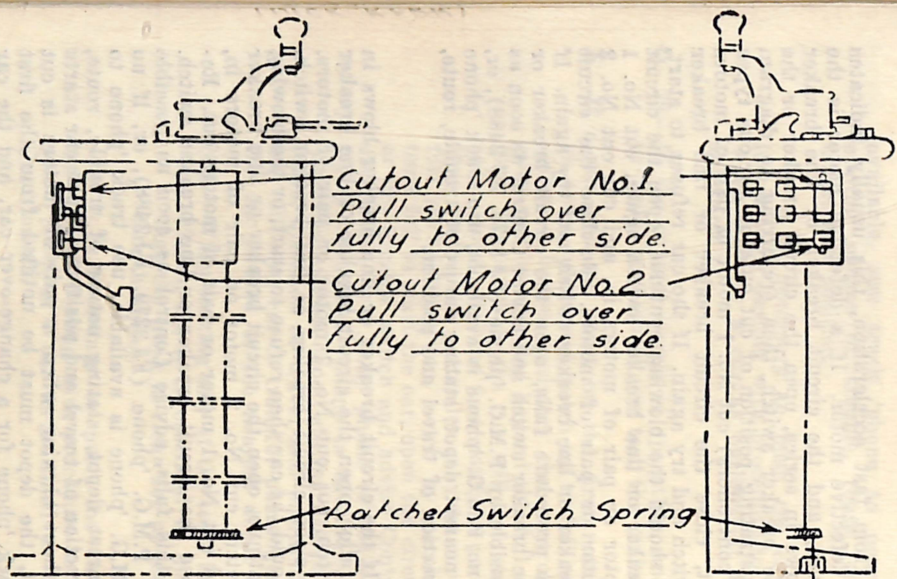
If it is necessary to push the car, refer to instructions dealing with procedure to be adopted when pushing a car as outlined at the end of Question 21.

Q. 24.—What must be done if the circuit breaker or line breaker continually blows?

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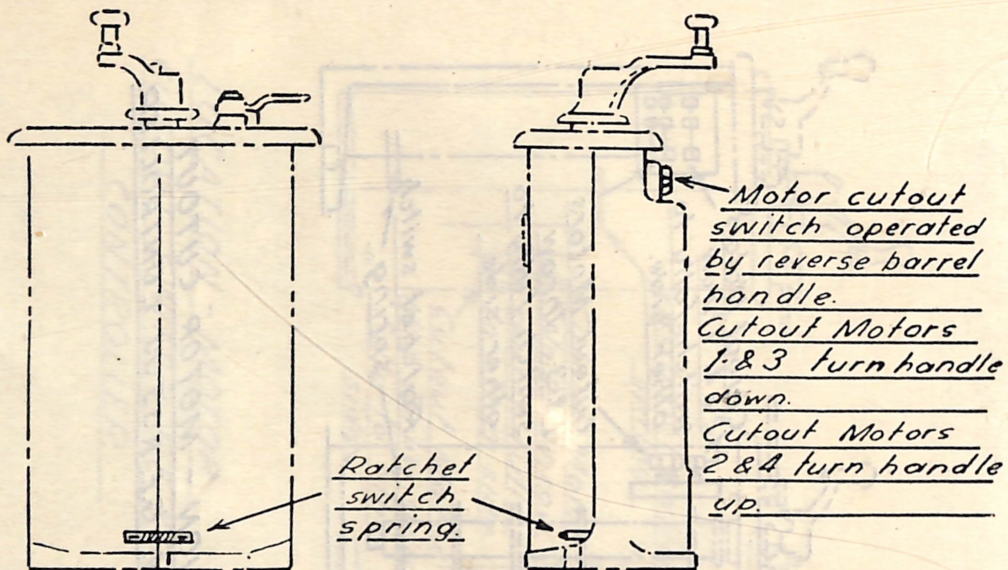
A.—Apart from fast acceleration, this usually indicates a defective motor. If a defective motor is the cause, and the circuit breaker or line breaker blows in series, open the circuit breaker or the line breaker switch, then (referring to diagram illustrating position of cut outs on various types of controllers) cut No. 1 motor or pair of motors out, close the circuit breaker or line breaker switch and try again. If the car refuses to start, or should the blowing continue, open the circuit breaker or line breaker switch again, cut No. 1 motor or pair of motors in, and cut out No. 2 motor or pair of motors. Re-close the circuit breaker or line breaker switch and try again. If the procedure fails, open the circuit breaker or line breaker switch and advise Control as soon as possible by P.M.G. 'phone (FJ 3279, FJ 2488), or, if no P.M.G. 'phone is available, use track 'phone to nearest depot, stating nature of trouble, route, direction of travel and position.

If the circuit breaker or line breaker blows in parallel, open the circuit breaker or line breaker switch, cut out No. 2 motor or pair of motors. Re-close circuit breaker or line breaker switch. Should the car then refuse to start, or the blowing continue, open the circuit breaker or line breaker switch, cut No. 2 motor or pair of motors in, and cut No. 1 motor or pair of motors out. Re-close the circuit breaker or line breaker switch. If this fails, advise Control as soon as possible by P.M.G. 'phone (FJ 3279, FJ 2488), or, if no P.M.G. 'phone is available, use track 'phone to nearest depot, stating nature of trouble, route, direction of travel and position. If the car starts without blowing when a pair of motors is cut out, the depot must be notified from the first track 'phone for a change-over car, and the car driven carefully to the change-over point. With a pair of motors cut out, do not rely on the electric brake.

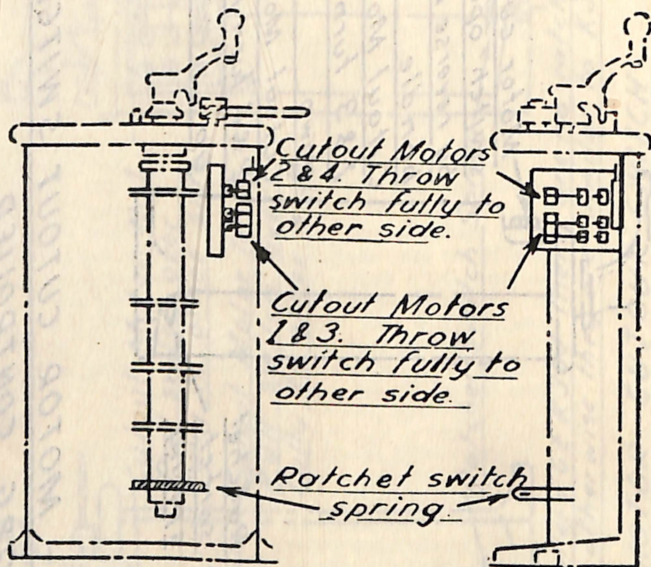


Note - In controllers G.E. K36J there are no ratchet switches otherwise they are similar to K36JR.

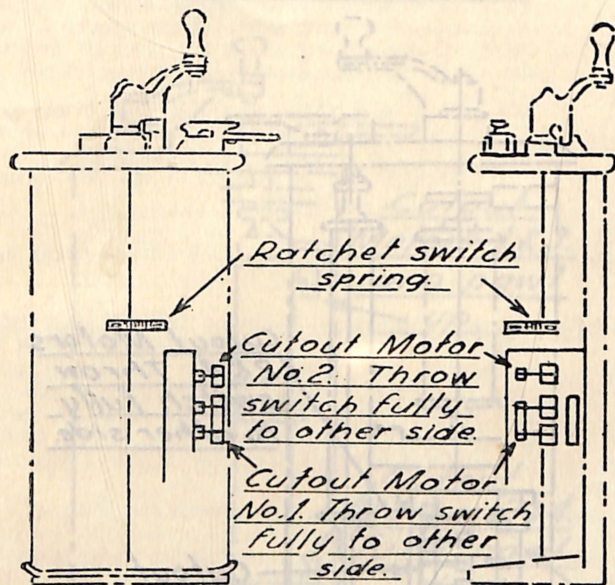
LOCATION - MOTOR CUTOUT SWITCH
G.E. K36JR CONTROLLER



LOCATION - MOTOR CUTOUT SWITCH
E.E. Q2G CONTROLLER.

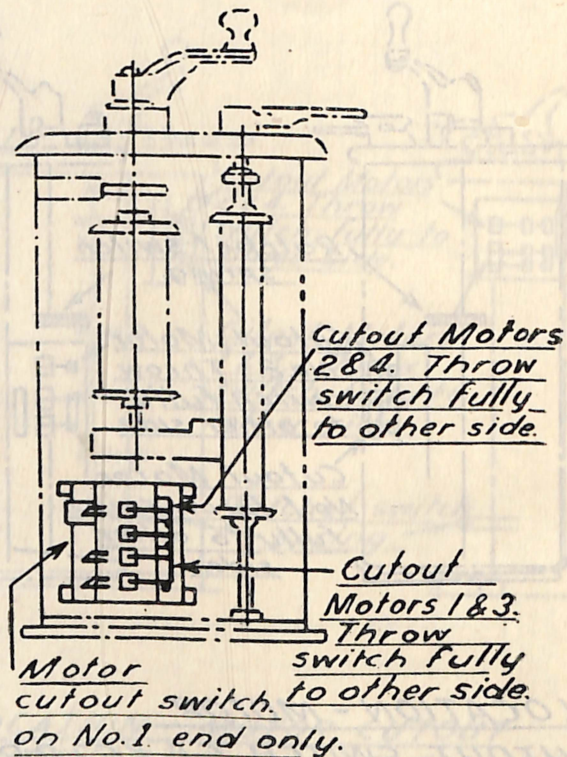


LOCATION - MOTOR CUTOUT SWITCH. G.E. K35 JJ CONTROLLER.



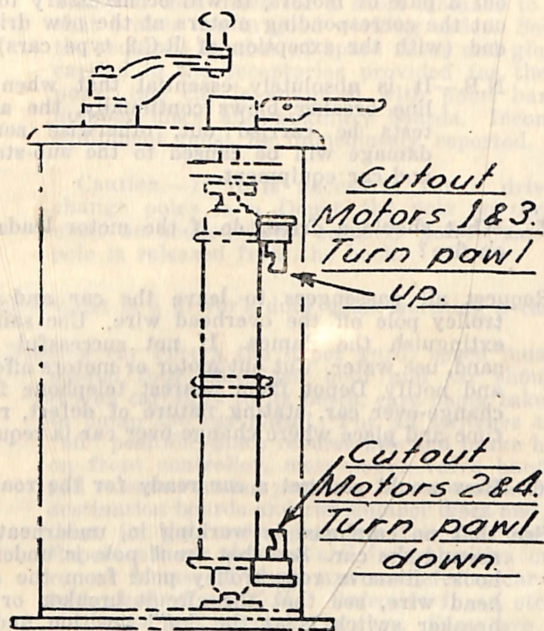
LOCATION - MOTOR CUTOUT SWITCH. G.E. K63 BR CONTROLLER.

Note - Ratchet switch
not accessible.



LOCATION - MOTOR
CUTOUT SWITCH M. & M. T. B.
R. C. 2. CONTROLLER.

Note - Ratchet switch
not accessible.



LOCATION - MOTOR
CUTOUT SWITCH.
E. E. Q2RC1 CONTROLLER.
E. E. Q2CK1 CONTROLLER.

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If it is necessary to change ends after cutting out a pair of motors, it will be necessary to cut out the corresponding motors at the new driving end (with the exception of R.C.2 type cars).

N.B.—It is absolutely essential that when the line breaker blows continually, the above tests be carried out, otherwise serious damage will be caused to the sub-station and car equipment.

Q. 25.—What should a driver do if the motor leads are on fire?

A.—Request all passengers to leave the car and take trolley pole off the overhead wire. Use sand to extinguish the flames. If not successful with sand, use water. Cut out motor or motors affected and notify Depot from nearest telephone for a change-over car, stating nature of defect, route, time and place where change-over car is required.

Q. 26.—How would you get a car ready for the road?

A.—See that no employee is working in, underneath or around the car. See that front pole is under the hook. Remove rear trolley pole from the overhead wire, see that the circuit breaker or line breaker switch is at the "off" position and try both controllers forward and reverse, then place reverse key in the neutral position. Replace rear trolley pole on overhead wire and put circuit breaker, line breaker and air compressor switches to the "on" position. Test lights, lifeguards and sand gear at both ends of car. Adjust destination and route number signs and see that the air compressor automatically ceases working when maximum pressure is reached and try for minimum pressure. Test air and hand brakes and make sure that hand brake is fully off at both ends. Examine car for signs of recent damage,

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sound gong to warn those working in the pits, etc., and then drive car a short distance to prove that brakes are in good working order. See that the required number of spare fuses and globes is carried in the receptacles provided for the purpose. See car is equipped with point bar, run number discs and auxiliary boards. Incomplete equipment must be immediately reported.

Caution.—If it is necessary for a driver to change poles in a Depot, the pole on the wire must be hooked down securely before the other pole is released from the hook.

Q. 27.—What is a driver's duty when berthing a car?

A.—When a car enters the depot yard, speed must not exceed four miles per hour and car should be driven carefully to its berth, care being taken not to bump the car ahead. Put all switches to the "off" position, place reverse key and brake handle on front controller, motorman's valve handle at full release running position. Remove all auxiliary destination boards and run number discs and place them in the racks provided for the purpose. Report all car defects and irregularities on car report forms. If there are no defects, car is to be booked off as "O.K." Defective fuses, etc., are not to be left in racks in cars. Same are to be turned in and a record thereof made on the defect sheet.

In the case of cars Nos. 750 and 751, place reverse key on front controller in the forward position and then back to neutral before putting switches to the "off" position.

Caution.—If it is necessary for a driver to change poles in a depot, the pole on the wire must be hooked down securely before the other pole is released from the hook.

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THE AIR SYSTEM.

Equal in importance to the equipment for propelling a car is the air system, which is provided for its efficient stopping once it is in motion.

The essential components of the air system are:—

- (a) The air compressor circuit, consisting of an independent circuit from trolley base to compressor motor switch, through a fuse, to automatic switch or governor then through compressor motor to the main ground wire.
- (b) The compressor switch to switch current on or off the compressor motor circuit, and a fuse to protect it.
- (c) The governor, which automatically starts the compressor motor when the air pressure falls below the predetermined minimum value of 60 lbs., and stops the motor when the predetermined maximum value of 70 lbs. is reached.
- (d) The air compressor, to compress the air used for the brakes, the sanding system, the windscreen wiper and, on later types of cars, for the sliding door mechanism.
- (e) The air reservoir, to contain the compressed air.
- (f) The brake cylinder, to operate the brake levers connected to the brake shoes.
- (g) The air pressure gauge, which indicates the pressure of air in the reservoir and the brake cylinder.
- (h) The motorman's valve, for the manual operation of the air brakes.
- (i) The door operating valve.

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Q. 28.—What should be done if the compressor motor does not start when the pressure of air drops below 60 lbs.?

A.—Stop car with the air brake, or, if the pressure of air is too low for the air brake to be effective, use hand brake. If car has been stopped with the air brake, release it and apply hand brake. See that the trolley pole is on the overhead wire and turn on lights. If they burn, open and close the air compressor switch to be sure it is making good contact. If the compressor still does not start, put compressor switch to "off" position, renew fuse and reclose switch. If the trouble persists, tap the governor case lightly with the point bar. If the compressor now starts, notify the nearest depot by track 'phone for a change-over. If the compressor does not start, proceed very cautiously, using hand brake, and notify depot for a change-over.

Q. 29.—What should a driver do if the air compressor governor fails to cut out?

A.—If the pressure as indicated in the gauge does not exceed 90 lbs., car must be operated as carefully as possible, but normal brakes are available (service brakes only). If the pressure rises above 90 lbs., put air compressor switch to the "off" position, reduce pressure by making several service applications up to 55 lbs. until pressure drops to below 90 lbs. and use brake sparingly until pressure drops to 60 lbs., then cut switch in again. Notify nearest depot for a change-over.

Note.—If it is necessary to change ends, pressure must be reduced to below 90 lbs. as described before putting the air brake handle to the emergency braking position. When the pressure exceeds 90 lbs., application of the air emergency brake is liable to lock the wheels and also seriously damage the brake rigging.

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Q. 30.—If the air pressure suddenly drops below the predetermined minimum of 60 lbs. and air can be heard escaping beneath the car what might be the cause?

A.—This is probably due to the tap of the drain cock being struck by some obstruction on the roadway. Stop car, using hand brake if the pressure of air is not sufficient to enable the air brake to be effective. Examine drain cock situated below the reservoir underneath the step of the car. If the tap has been knocked on, turn it off. If tap has been broken off, thus releasing all the air, switch off compressor and proceed carefully using the hand brake. Notify nearest depot for a change-over.

Q. 31.—What must be done if the wheels of the car become locked?

A.—See that the hand brake is fully released at both ends of car. The driver should attempt to unlock the wheels by proceeding to the other end of the car and cutting one or two notches, tending to drive the car in a forward direction from that end. Irrespective of whether the wheels become unlocked or not, advise Control as soon as possible by P.M.G. 'phone (FJ 3279, FJ 2488), or, if no P.M.G. 'phone is available, use track 'phone to nearest depot, stating nature of trouble, route direction of travel and position.

Q. 32.—What should be done if a pneumatically operated sliding door fails to operate?

A.—See that the door exit cock situated under brake valve at No. 1 end is at the "on" position, that is, in the upright position.

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TRAM CAR BRAKING SYSTEMS.

The various types of brakes used on cars in the Board's service are:—

1. AIR BRAKE.

The air brake is operated by means of one of two types of driver's operating valve:—

- (a) Westinghouse self-lapping brake valve (on all four-motor cars).
- (b) Manual lap valve (on two-motor cars).

Two distinct forms of air brake application are available on all cars:—

1. **Service:** used for all normal stops. The correct method of applying the service brake is as follows:—

Westinghouse Self-Lapping Brake Valve: Move the brake valve handle from the release position towards but not beyond the full service position, which is approximately two-thirds of the way between release and full on ("handle off" position), the extent of the movement depending on the brake cylinder pressure required. It is necessary to move the handle as far in the service position as circumstances warrant in the initial application, then as the speed of the car is reduced, gradually move the handle back towards release position reducing the air pressure to allow the car to come to an easy stop without a jolt. When car is stationary, increase pressure to approx. 35 lbs., which is ample to hold the car. The practice of applying full emergency is not necessary.

Note: Reduction of the speed of a car is obtained by reducing the rotational speed of the wheels and not by skidding them. The highest pressure application necessary should be made at the commencement of braking, that is when the wheels will be less likely to skid. As the speed

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of the car is reduced, so should the brake pressure be reduced in order that the car may be brought to an easy stop without a jolt. Much incorrect use of the Westinghouse Self-Lapping Valve is made by the driver moving the valve handle too slowly, resulting in the car approaching too close to the stopmark before sufficient brake pressure has been applied to check its speed. It is then necessary for the driver to make a still higher pressure application of the brake to avoid over-running the stopmark, which results in the wheels skidding or the car stopping with a jolt. This incorrect use of the Self-Lapping Brake Valve gives the driver an impression that the brakes are weak.

Fanning the brake valve handle is incorrect application, does not stop the car as quickly or steadily and only produces wear and tear on the valve.

If the use of sand is necessary on a greasy rail, it must be applied at the beginning of the application of the brake otherwise the wheels may have time to lock before the sand is applied, thus producing a flat.

If the wheels skid when making a service stop the brakes should be released immediately, sand applied and brakes re-applied.

Manual Lap Valve: Move the brake valve handle as far to the right as is necessary to obtain the air pressure required in the brake cylinder to make the stop, then return the handle to the "lap" position. As the car is stopping, release air slowly to avoid stopping with a jolt, but retain sufficient air pressure in the cylinder to hold the car.

2. **Emergency:** Known as the **First Emergency**. Available on both types of brake valve and all cars in service.

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Place controller handle to the "off" position. Apply sand. Apply air brake "full on" by moving the brake valve handle quickly to the extreme right. This applies the full reservoir pressure to the brake cylinder. With the Westinghouse Self-Lapping Air Brake Valve the handle must be pushed past the full service position to the extreme right, that is, "Handle off" position. Sand must be applied before air is applied full on.

Under no circumstances, except in the operation of automatic points on a down grade, are the brakes to be applied while power is on.

2. ELECTRIC BRAKES.

These are known as the 2nd, 3rd and 4th emergency brakes. The numbers are not indicative of the order in which they are to be used, nor is it to be assumed that all these brakes are available on the various types of cars.

The electric brake is operated in varying ways according to the type of car and equipment. On all four-motor cars the electric brake is known as the **Fourth Emergency Brake** which is applied as follows:—Place controller handle to the "off" position, apply sand and place the reverse key in the opposite direction to that in which the car is travelling.

Caution: The reverse key must not be removed from this emergency position until the car comes to a dead stop, otherwise serious damage to the equipment will result.

Second and Third Emergency: Applicable only to two-motor equipment, that is, maximum traction and single truck cars. These brakes are applied as follows:—

Place controller handle to the "off" position, apply sand. Place reverse key in reverse position. Bring controller handle smartly round to the full parallel position. During the notching to the full parallel position, the circuit breaker or line breaker will open. Before this opening

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takes place the second emergency brake will be in operation, that is, power will have been applied to the motors tending to drive the car in the opposite direction. After the opening of the circuit breaker or line breaker the third emergency will automatically come into action to stop the car when the controller is on any parallel notch.

Caution: The controller handle must not be brought around from the emergency parallel position until the car comes to a dead stop.

With any defect in the electrical equipment of a car or with a motor cut out, the electric brake must not be relied upon. Under such circumstances the car must be driven carefully and stopped with the air or hand brake.

Sand must be applied simultaneously with the application of any emergency brake to avoid skidding.

In the event of using any of the electric emergency brakes it should be noted that the braking effect ceases when the tram stops and, to hold the car, the air brake or hand brake must be used.

3. HAND BRAKE.

The method of using the hand brake is as follows:—

The pawl should be held into the ratchet with the right foot and the chain slack taken up. The handle must be brought to a position from which it can be conveniently pushed downwards and short, downward applications made until the car has stopped. The brake wheel should never be allowed to spin when being released, as this may injure the driver.

Note: The hand brake must be used if the air brake is out of action, therefore drivers must see that they are efficient in its use.

In an emergency (all brakes failing at the driver's end) the conductor should be directed to apply the hand brake at the rear end of car.

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SPECIAL INSTRUCTIONS TO DRIVERS OPERATING CARS EQUIPPED WITH PNEUMATIC SAFETY CAR EQUIPMENT, AIR BRAKE, HAND BRAKE AND ELECTRIC BRAKE.

Q. 33.—How would you get a car equipped with safety car control equipment ready for the road?

A.—See that no employee is working underneath, in or around the car. Remove trolley pole from the overhead wire, see that the circuit breaker or line breaker switch is at the "off" position, try both controllers by bringing handle around to the full parallel position and off again. place controller handle on front controller and reverse key in neutral position, replace trolley pole on overhead wire, put circuit breaker or line breaker and air compressor switches to the "on" position, put motorman's valve handle to the "full release, doors closed running position." Test lifeguards, lights, hand brakes and sand gear. See that the required number of spare fuses and globes is carried in the receptacles provided for the purpose and that car is equipped with point bar, run number discs and auxiliary boards. Adjust destination signs, examine car for signs of recent damage. Place hand on controller handle and hold it down until brakes are released (this is known as "balancing"), then try for minimum pressure. Sound gong to warn those working in the pits, etc. Drive car a short distance and apply brakes to ascertain that they are in good working order.

With the following exceptions, the procedure to be followed in the operation of cars equipped with pneumatic safety car equipment is similar to that outlined in pages 37 to 43 of the Manual, where general instructions are laid down.

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- Q. 34.—What would you do if a car equipped with safety car control equipment would not start when the controller handle is operated notch by notch to the series running notch?
- A.—See that the car is properly “balanced” (that is, by placing the hand on the controller handle and holding it down until the brakes are released) and then proceed to test the circuit as in Question 23 on page 12 of Manual.
- Q. 35.—What happens when the car is in motion and the driver takes his hand off the controller handle without placing his foot on the foot valve and pressing it down, or having made a straight air brake application of approximately 35 lbs. cylinder pressure?
- A.—The power is cut off at the circuit breaker or line breaker, an emergency application of the air brake is applied, sand is distributed on the rails, car is brought to a standstill, and both door and step are arranged for hand operation.
- Q. 36.—What happens when the car is in motion and the driver takes his foot off the foot valve without having first put his hand on the controller handle and pressed it down, or having made a straight air brake application of approximately 35 lbs. brake cylinder pressure?
- A.—The power is cut off at the circuit breaker or line breaker, an emergency application of the air brake is applied, sand is distributed on the rails, car is brought to a standstill, and both door and step are arranged for hand operation.
- Q. 37.—What should a driver do if he has to leave his car?

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- A.—Apply hand brake, release air brake, and make sure that the hand brake is holding the car, then place motorman's valve handle to brakes applied (door open) position, knock out circuit breaker or line breaker switch, and take the reverse key with him. Do not trust to the air brake holding the car. If a conductor is on the car, instruct him to remain there to comply with the rule that driver and conductor must not leave the car at the same time.
- Q. 38.—If the power drum jams on an operating position, and the controller handle cannot be put to the “off” position on a car equipped with safety car control equipment, what should be done?

A.—Immediately take hand off controller handle or foot off foot valve—this will cut off power. Apply brakes, distribute sand on rails and stop car.

To release the brakes: If car is equipped with circuit breaker, hold the controller handle down until the pointer on air gauge is showing 50 lb. pressure, and all the air from the brake cylinder is released to atmosphere.

If car is equipped with line breaker, knock out line breaker switch, then hold controller handle down until both air gauge pointers are showing equal pressure and all the air from the brake cylinder is released to atmosphere.

After releasing air from brake cylinder, put motorman's valve handle to “doors open, brakes applied” position, then take hand off controller handle, open controller, look for the cause and, if possible, remove it. If still unable to get the controller handle to the “off” position, notify Control by P.M.G. 'phone (FJ 3279, FJ 2488) as

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soon as possible, or, if no P.M.G. 'phone is available, use track 'phone to nearest depot stating route, time and place where change-over is to be made.

Q. 39.—If a power drum jams on an operating position and the controller handle cannot be put to the "off" position and the pneumatic equipment out of order, such as the air reservoir empty, etc., what should be done?

A.—Immediately knock out the circuit breaker or line breaker switch and stop car with the hand brake. Notify Control by P.M.G. 'phone (FJ 3279, FJ 2488) as soon as possible, or, if no P.M.G. 'phone is available, use track 'phone to nearest depot, stating route, time and place where change-over is to be made.

Q. 40.—What is a driver's duty before signing off?

A.—Knock out all switches, place reverse key and controller handle on the controller at end of car nearest the depot exit. Put motorman's valve handle to brakes applied (doors open) position. Remove run number discs and auxiliary destination boards and place them in the racks provided for the purpose. Report all car defects and irregularities on car report forms. Defective fuses, etc., must not be left in racks in cars. Same are to be turned in and a record thereof made on the defect sheet.

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BRAKING SYSTEM—SAFETY CARS.

The various types of brakes used on the safety cars are as follows:—

1. AIR BRAKE.

(a) **Service: Manual Lap Valve.**—Move the handle as far to the right as is necessary to obtain the maximum air pressure required in the brake cylinder in time to make the stop, then return handle to lap position. As car is stopping, release air slowly to avoid stopping with a jolt, then return to lap position with sufficient air pressure to hold the car.

If the use of sand is necessary on a greasy rail, it should be applied at the beginning of the application of the brake, otherwise the wheels may have time to lock before the sand is applied, resulting in a flat wheel.

(b) **Emergency: First Emergency.**—Place controller handle to the "off" position. Apply sand. Apply air brake full on, and immediately take hand off controller handle or foot off foot valve.

2. ELECTRIC BRAKES.

(a) **Second and Third Emergency:** These brakes are applied as follows:—

Place controller handle to the "off" position, apply sand; place reverse key in the reverse position and bring controller handle around smartly to the full parallel position. During the notching to the full parallel position, the circuit breaker or line breaker will open. Before this opening takes place the second emergency brake will be in operation, that is, power will have been applied to the motors tending to drive the car in the opposite direction. After the opening of the circuit breaker or line breaker the third emergency will automatically come into action to stop the car when the controller is on any parallel notch.

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Caution.—The controller handle must not be brought around from the emergency parallel position until the car comes to a dead stop.

With any defect in the electrical equipment of a car or with a motor cut out, the electric brake must not be relied upon. Under such circumstances the car must be driven carefully and stopped with the air or hand brake.

Sand must be applied simultaneously with the application of any emergency brake to avoid skidding.

In the event of using any of the electric emergency brakes it should be noted that the braking effect ceases when the tram stops, and, to hold the car, the air brake or hand brake must be used.

3. HAND BRAKE.

The method of using the hand brake is as follows:—

The pawl should be held into the ratchet with the right foot and the chain slack taken up. The handle must be brought to a position from which it can be conveniently pushed downwards and short, downward applications made until the car has stopped. The brake wheel should never be allowed to spin when being released, as this may injure the driver.

Note: The hand brake must be used if the air brake is out of action, therefore drivers must see that they are efficient in its use.

In an emergency (all brakes failing at the driver's end) the conductor should be directed to apply the hand brake at the rear end of car.

Q. 41.—How would you release brakes after an emergency application?

A.—(1) On cars equipped with line breaker, put the motorman's valve handle to full release, doors closed position. Place hand on the controller handle and hold it down until both air gauge

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pointers indicate equal pressure on the air gauge and all the air has been released from the brake cylinder to atmosphere.

(2) On cars equipped with circuit breaker, put the motorman's valve handle to full release, doors closed position. Place hand on controller handle and hold it down until the air gauge pointer indicates 50 lb. pressure and all the air has been released from the brake cylinder to atmosphere. On cars 217 and 218 put circuit breaker to "on" position.

Q. 42.—What should a driver do if the air brake fails to release owing to any part of the pneumatic safety car equipment being out of order?

A.—Apply hand brake, put air compressor switch to "off" position, empty reservoir by turning on the drain cock under the reservoir, release hand brake and operate car on hand brake. Doors and steps can then be operated by hand. Ring depot for change-over car.

Q. 43.—What should a driver do, if, whilst the car is in service, the pressure of air drops below the minimum operating pressure of 60 lbs. in the reservoir on a car equipped with safety car control equipment?

A.—Stop car with air brake, or, if pressure of air is too low for air brake to be effective, release air brake and apply hand brake. If car has been stopped with the air brake, when car is stationary, apply hand brake. See that the trolley pole is on the overhead wire and turn on lights. If they burn, open and close the air compressor switch to be sure it is making good contact. If O.K. put air compressor switch to "off" position and renew fuse, also tap governor case lightly with the point bar. If these tests fail, ring depot for a change-over car, stating route, time and place where change-over is required. Use hand brake and operate step and doors by hand.

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Note: If the air reservoir is empty, the pneumatic safety car equipment and air brake will not function and when operating the car the hand brake must be used. If an emergency brake is required to stop the car, the second and third emergency brakes will function when operated.

Q. 44.—What should be done if the air compressor governor fails to cut off?

A.—If the pressure as indicated in the gauge does not exceed 90 lbs., car must be operated as carefully as possible, but normal brakes are available (service brakes only). If the pressure rises above 90 lbs., put air compressor switch to the "off" position, reduce pressure by making several service applications up to 55 lbs. until pressure drops to below 90 lbs. and use brake sparingly until pressure drops to 60 lbs. then cut switch in again. Notify nearest depot for change-over.

Q. 45.—How would you distribute sand on the rails?

A.—By pressing down the motorman's valve handle.

Q. 46.—Name the positions of the brake valve.

A. (1)—Full release, or running position (doors closed).

(2)—Lap handle "off" position (doors closed).

(3)—Service application position (doors closed).

(4)—Brakes applied position (doors open).

(5)—Emergency position (doors balanced).

LIGHTING SYSTEM.

Q. 47.—What should a driver do in the case of all the lights failing, assuming the power is on as indicated by the otherwise normal operation of the car?

A.—Remove pole from overhead wire and renew fuse. Examine switch for "on" position. If trouble cannot be rectified proceed cautiously to depot using gong frequently.

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GENERAL.

Q. 48.—What is a driver's first consideration and duty?

A.—The safety of the public.

Q. 49.—What should you do when passengers are getting on or off the car?

A.—See that all is clear before starting.

Q. 50.—What should be done when passing a stationary car?

A.—Cut off power, reduce speed and sound gong, and be prepared to stop quickly in case of emergency.

Q. 51.—What precautions are necessary when there is water on the track?

A.—When water does not exceed two inches in depth the car must not be operated beyond series speed. If the water exceeds two inches but does not exceed ten inches in depth, proceed at walking pace. Power may be used if necessary. Care must be taken in case the rails are filled with silt, etc. If car is stranded in water, remove pole from overhead wire. A car should not be driven into water if depth is expected to exceed ten inches. In all cases when running through water the foot must be kept on the lifeguard pedal to prevent the lifeguard being tripped by the force of water.

Q. 52.—What should be done if anything abnormal is observed in connection with the overhead, track, roadway, etc.?

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A.—Advise Control as soon as possible by P.M.G. 'phone (FJ 3279, FJ 2488), or, if P.M.G. 'phone is not available, use track 'phone to nearest depot advising nature of defect, route and location.

Q. 53.—What should be done if a trolley pole becomes badly damaged and unusable?

A.—Tie down securely and use leading pole in the trailing position, proceeding carefully.

Q. 54.—What precautions must be adopted to prevent the pole from leaving the overhead wire?

A.—The speed of the car must be reduced when proceeding around curves, through junctions, special work and crossovers, and under bridges.

Q. 55.—If pole leaves the overhead wire when car is running, what should be done?

A.—Place controller handle to the "off" position, and, having regard to the safety and comfort of passengers, stop car as quickly as practicable.

Note: (a) Under no circumstances must a section insulator be bridged by both poles of a car or both poles allowed to touch the wire at railway crossings.

(b) If a car stops with the trolley pole on a section insulator, remove pole from the insulator before letting the other pole touch the wire.

Q. 56.—When passing under overhead crossings, section insulators or frogs, in which position must the controller handle be?

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A.—Controller handle must be in the "off" position, but several notches may be cut on smartly after passing according to speed at which car is travelling.

Note: When travelling under line contactors of automatic point controllers and traffic signals, the speed of the car should not exceed **three miles per hour.**

Q. 57.—What should be done when passing a slow down disc?

A.—Speed of car must be reduced to ten miles per hour.

Q. 58.—What should be done when the trolley wire breaks and falls on the roadway?

A.—Stop the car within a safe distance of the point where the wire is down. Immediately warn all passengers, public and vehicles to keep away from the wire. The conductor must be asked to notify Control immediately by P.M.G. 'phone (FJ 3279, FJ 2488), or, if no P.M.G. 'phone is available, use track 'phone to nearest depot, stating nature of trouble, route, direction of travel and position.

Q. 59.—What precautions should a driver take to prevent damage being done to trolley pole guides.

A.—The trolley pole must be allowed to enter the guide gently by not allowing the pole to shoot up and hit it.

Note: Care must be taken when leaving a terminus or shunting point to make sure that the rear trolley pole only is on the trolley wire. Failure to do this can cause serious damage to the car and overhead equipment.

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Q. 60.—What special care and procedure is necessary when repairs to the overhead wire or fittings are in progress?

A.—When overhead repair work at fittings or breaks renders it necessary for cars to coast under same with poles pulled down, or to proceed with caution with poles up, the action to be taken is indicated in the following manner:—

Where a red flag by day or a red lamp by night is displayed, drivers must coast under the spot with the trolley pole pulled down clear of the overhead.

In such cases, drivers are to warn their conductors to go to the rear of their cars and hold the trolley pole down until clear of the section affected.

Where a green flag by day or a green lamp by night is displayed, drivers must proceed with caution under the overhead at the point indicated.

Q. 61.—What should be done if the wheels spin when starting?

A.—Shut off power, use sand, re-apply power gradually.

Q. 62.—What should a driver do if he notices anything unusual about the running of his car?

A.—He must report the trouble to an Inspector or city mechanic as soon as possible. If an Inspector is not met with on the road within a reasonable time, the depot must be notified without delay.

Q. 63.—What precautions must be taken when a car is parked at a siding or if you have to leave a car standing?

A.—In all cases, the line breaker control switch or the circuit-breaker must first be put to the "off" position.

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On four-motor bogie cars, apply hand brake, release air brake and make sure that the hand brake is holding the car. Leave hand brake on then re-apply air brake. The air compressor switch is to remain at "on" position. Reverse key and air brake handle must be removed and placed on canopy alongside destination box.

On two-motor bogie cars, apply hand brake, release air brake and make sure that the hand brake is holding the car. Leave hand brake on, then re-apply air brake. In addition, if a grade is apparent, place the reverse key in the opposite direction to that in which the car would travel in the event of the brakes failing, and bring the controller handle to the full parallel position.

On single truck cars, release air brake, apply hand brake but do not re-apply air brake. In addition, if a grade is apparent, place the reverse key in the opposite direction to that in which the car would travel in the event of the brakes failing and bring controller handle to the full parallel position.

In all cases, with the exception of one-man cars or cars parked at a siding, the conductor should be instructed to remain on the car to comply with the rule which provides that the driver and conductor shall not leave the car unattended.

Q. 64.—What would you do if a car became insulated from the rails by dirt, sand, etc.?

A.—Under such circumstances, all metal parts of the car are alive, therefore it is imperative that no contact be made between the car and the roadway by passengers or crew until pole has been removed. Warn all passengers to remain seated

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until pole has been removed from the overhead wire. To do this, conductor or driver must leave the car through the smoker entrance by jumping to the roadway. Remove pole from overhead wire and then request passengers to leave the car and wait on the footpath. Put light switch to the "on" position. Jam point bar between the back of the rear wheels and rail. Replace pole and, if lights come on, enter the car and drive a few yards on to clean rail. Request passengers to re-enter car. If this fails, remove pole again, wait for following car and get pushed on to clean part of rail. The driver must remain on the car while it is being pushed in order to operate the brakes if necessary. No passengers should be permitted to board or alight until the wheels are again making good contact and there is no risk of any kind to the passengers. The dirty track should be reported by advising Control by P.M.G. 'phone (FJ 3279, FJ 2488) as soon as possible, or, if no P.M.G. 'phone is available, use track 'phone to nearest depot, stating nature of trouble, route, direction of travel and position.

Q. 65.—What should be done when a car is badly derailed and the electric contact between the wheels and the rails is broken?

A.—Under such circumstances all metal parts of the car are alive, therefore it is imperative that no contact be made between the car and the roadway by passengers or crew until pole has been removed. Warn all passengers to remain seated until pole has been removed from the overhead wire. To do this, conductor or driver must leave the car through the smoker entrance by jumping to the roadway. Remove pole from overhead wire and then request passengers to leave the car and wait on the footpath. Notify Control as soon as possible by P.M.G. 'phone (FJ 3279, FJ 2488), or, if

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no P.M.G. 'phone is available, use track 'phone to nearest depot stating nature of trouble, route, direction of travel and position.

Q. 66.—What would you do if the car becomes permanently alive or if passengers complain of receiving shocks from any metal part of the car?

A.—The trolley pole must at once be removed from the overhead wire and, after this is done, all passengers must be requested to leave the car and arrangements made to carry them to their destinations by the following cars. Advise nearest depot by track 'phone for change-over. Passengers should on no account be carried on any car from which they are likely to receive electric shocks.

Q. 67.—What would you do in the event of the power failing in the overhead wire?

A.—If the power failure exceeds three minutes notify Control by P.M.G. 'phone (FJ 3279, FJ 2488), or, if no P.M.G. 'phone is available, use track 'phone to nearest depot stating route and position. Remove pole from the overhead wire and replace pole after one minute. This procedure permits the substation equipment to function to restore power under certain circumstances. Apply hand brake and release air brake so as to maintain pressure of air in the reservoir until power is on again.

Q. 68.—What should a driver do at each terminus?

A.—Make a brief inspection for hot bearings, broken brake shoes or any loose parts. Make sure that trolley pole or poles are in correct position.

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DONT'S FOR ELECTRIC CAR DRIVERS.

1. DON'T NEGLECT to read and observe the rules and instructions contained in the Board's Book of Rules and Regulations. Also inspect local notice boards each day for new notices and instructions.
2. DON'T NEGLECT public safety. Give your passengers safe transportation. Safety when boarding, safety when riding and safety when alighting.
3. DON'T NEGLECT comfort of passengers.
4. DON'T NEGLECT courtesy to other road users.
5. DON'T NEGLECT to exercise special care when approaching junctions, compulsory stops, and when descending grades, and be always on the alert so that the car can be stopped quickly in case of emergency.
6. DON'T NEGLECT to observe the speed regulations. Excessive speed is dangerous and causes damage to overhead equipment, trolley poles, rolling stock and permanent way. Reduce speed to a maximum of 10 m.p.h. at all points, crossings, curves and slow down discs. Also reduce speed when passing stationary cars, or when passing schools during the hours children are entering or leaving.
7. DON'T NEGLECT to sound gong once before starting the car.
8. DON'T NEGLECT to study the car equipment. Make an inspection of your car at all termini for defective brake blocks, hot bearings, etc.

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9. DON'T NEGLECT to keep a safe distance behind the car ahead (at least three pole lengths from the car ahead when travelling at more than half speed).
10. DON'T NEGLECT to stop at all compulsory stops. (Other road users expect you to stop.)
11. DON'T NEGLECT to keep in mind, especially at night, the exact positions of all loops, turnouts, curves, junctions, cut off and slow down discs.
12. DON'T NEGLECT to obey traffic signals, both manual and automatic.
13. DON'T NEGLECT to watch the air pressure gauge.
14. DON'T NEGLECT to have your sand punch in position on the front end of car, and to apply sand for all emergency stops, and, if necessary, when starting and stopping on greasy rails.
15. DON'T NEGLECT to remember that checking the speed of a car is obtained by checking the rotation of the wheels, not by skidding them.
16. DON'T NEGLECT to apply the hand and electric brakes before leaving a car standing on a grade in charge of the conductor. (See Page 41.)
17. DON'T NEGLECT to adjust the destination sign and route number only while the car is stationary.
18. DON'T NEGLECT to have headlight and canopy lights (if fitted) burning on front end of car and make sure rear canopy light is off.

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19. **DON'T NEGLECT** to save power wherever practicable. Cut off power as far as possible from stopping places and stop car by a steady application of the air brake. Release brakes immediately power is applied. Cut off power when car is running down grades, or where the necessary speed can be maintained without it. Cut off power when passing under section insulators and frogs.
20. **DON'T NEGLECT** to have the trolley pole trailing while car is in motion.
21. **DON'T NEGLECT** to see that the leading trolley pole on bogie cars is down and under the hook and rope securely tied before leaving the depot or terminus.
22. **DON'T NEGLECT** to exercise special care if, at any time, it should be necessary to get on the roof of a car. Be careful not to make contact with any steel framework of the car while handling trolley pole.
23. **DON'T NEGLECT** to have the reverse key in the neutral position before placing the trolley pole on the overhead wire or putting circuit breaker or line breaker control switch to the "on" position.
24. **DON'T NEGLECT** to put to the "off" position the switch controlling any circuit you are going to examine.
25. **DON'T NEGLECT** to put the circuit breaker or line breaker control switch to the "off" position before attempting to cut out a motor or motors, or examine the inside of a controller.

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26. **DON'T NEGLECT** when shunting at a turnout or crossover to stop the car well clear of the points, so that you can see that they are correctly set before starting on return journey. (Failure to do this will derail the car).
27. **DON'T NEGLECT** to notify the emergency mechanic or Inspector if you suspect something wrong with your car.
28. **DON'T** allow your car to enter points until you are sure they are correctly set.
29. **DON'T** attempt to start your car unless you are satisfied that the signal is for you.
30. **DON'T** suddenly start away again after bringing your car to what is almost a stop without receiving the signal to do so. Complete the stop and get the correct signal.
31. **DON'T** start your car on receiving one bell. "TWO BELLS" are the starting signal. See that you get them.
32. **DON'T** wait till you are close up to a vehicle before you warn the driver of your approach.
33. **DON'T** make emergency stops unnecessarily.
34. **DON'T** fail to give plenty of clearance to other cars passing on loops, crossovers, double track turnouts, or in depot yards.
35. **DON'T** look behind when your car is in motion.
36. **DON'T** enter up journals or read papers while car is in motion.
37. **DON'T** look in the rear view mirror when the car is in motion.
38. **DON'T** approach within one car's length of a defective car.

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39. DON'T under any circumstances approach within 100 feet of any emergency or overhead waggon on the track. Stop car and wait until the all clear signal is received from the linesman.
40. DON'T slam pole on to trolley guides at shunting points or termini.
41. DON'T open the "off" side doors on sliding door cars until car is stationary at the terminal point where the poles are to be changed.
42. DON'T allow one pole to touch any part of the metal frame of the depot building whilst the other pole is on the overhead wire. This will cause a short circuit which will blow the circuit breaker in the yard and cut off power. It can also cause serious damage to sub-station equipment.

NOTCHING DON'TS—

- Don't move your hand from the controller handle while on power notches.
- Don't run on resistance notches longer than necessary.
- Don't notch backward. Cut right off and again feed up to running point.
- Don't slip notches when starting.
- Don't notch up so quickly as to blow circuit breaker or line breaker.
- Don't cut on more power when the car wheels spin. They will only spin faster. Cut off and slowly apply power again, with a little sand.
- Don't cut into parallel until the maximum acceleration has been gained on series notches.
- Don't cut into parallel when the distance to be run is short.
- Don't dwell between series and first parallel notch.
- Don't cut into parallel when starting car on down grade.

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TRAFFIC REGULATIONS

"TRAFFIC CODE"

POINTS TO REMEMBER.

- ALWAYS be on the lookout for intending passengers waiting on the footpath at stopping places where safety zones are not provided.
- ALWAYS obey signals of traffic constables, or traffic lights at intersections, junctions, etc.
- ALWAYS stop at full (compulsory) track marks.
- ALWAYS observe half (provisional) track marks as required.
- ALWAYS remember when driving on badly lighted roads or during fogs to reduce speed so that a stop may be easily made in case of emergency.
- ALWAYS when approaching the intersection of another major street stop before entering such intersection.
- ALWAYS when approaching the intersection of a minor street proceed at such a rate of speed that you will be able to stop immediately in case of sudden danger.
- ALWAYS endeavour to arrive at bundy clocks and connecting points with other routes on proper table time.
- ALWAYS signal drivers of other vehicles to proceed after passengers have boarded or alighted and all is clear when trams are required to stand for periods longer than the average at bundy clocks, junctions, intersections, crossovers, etc.

SAFETY FIRST

ALWAYS when crossing line of traffic while running out of or into depot give clear and distinct warning to other road users, and operate car at a slow speed so that it can be stopped immediately in case of emergency.

ALWAYS allow tramway breakdown cars, ambulances, fire brigade, police cars, etc., to pass by, slowing down if necessary.

ALWAYS REMEMBER that if urgent assistance is required, ring Control by P.M.G. 'phone (FJ 3279, FJ 2488) or track 'phone if P.M.G. 'phone is not available.



REFERENCE INDEX FOR THE QUICK SOLUTION OF EQUIPMENT DEFECTS

Defect In	Relevant Matter
Air System	Pressure too low—Page 23, Q. 28. Pressure too high—Page 23, Q. 29.
Brakes	Wheels locked—Page 24, Q. 31.
Controller	Locked "on" or "off" position—Page 9, Q. 21. Locked "on" or "off" position (Safety Cars)—Pages 31 and 32, Qs. 38 and 39. Inspection of, for failure of car to start—Pages 11 and 12, Qs. 22 and 23. Inspection of, for failure of car to start (Safety Cars)—Page 30, Q. 34. Procedure to adopt when cutting out defective motor—Pages 12 and 13, Q. 24.
Control Circuit ..	Testing of control circuit—Page 11, Q. 22.
Car (Alive)	Procedure to adopt if alive due to dirty track—Page 41, Q. 64. Procedure to adopt if alive due to derailment—Page 42, Q. 65. Procedure to adopt if alive due to defect in wiring, etc.—Page 43, Q. 66.
Circuit Breaker ..	Continually blowing—Pages 12 and 13, Q. 24.
Doors (Pneumatic)	Reference—Page 24, Q. 32.

**REFERENCE INDEX FOR THE QUICK SOLUTION OF
EQUIPMENT DEFECTS—(Continued)**

Defect In	Relevant Matter
Line Breaker	Testing of Line Breaker Control Circuit—Page 11, Q. 22. Continually blowing—Pages 12 and 13, Q. 24.
Lighting System . Motors	Failure of lights—Page 36, Q. 47. Procedure to adopt when cutting out defective motors—Pages 12 and 13, Q. 24.
Main Power Circuit	Leads on Fire—Page 20, Q. 25. Symptom of, and testing procedure Pages 12 and 13, Qs. 23 and 24.
Overhead	Procedure to adopt when noted— Pages 37, 38 and 39, Qs. 52 and 58.
Power (failure) . .	Procedure to adopt—Page 43, Q. 67.
Rheostat	Relevant information—Page 12, Q. 23.
Trolley Pole	Procedure to adopt, Page 38, Q. 53.
Track (Per. Way)	Procedure to adopt—Page 37, Qs. 51 and 52.
Wheels	Locked—Page 24, Q. 31.

PROCEDURE TO ADOPT IF CAR IS DERAILED—
Page 42, Q. 65.

PROCEDURE TO ADOPT IN CASES OF EMERGENCY
—Ring Control by P.M.G. 'phone (FJ 3279, FJ 2488), or
if P.M.G. 'phone is not readily available, use track
'phone.



